Faculty of Engineering & Technology

Syllabus

For

Bachelor of Technology (B. Tech.)

in

Electrical Engineering

(Program Code: ET0141)

(2019-20)

(Approved by the Academic Council vide Resolution No. 34.26 dated 20.06.2019)

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1. **Program Educational Objectives (PEOs):** The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Bachelor of Technology is to produce engineers who later take the responsibility of engineering professionals and researchers with following qualities:

- **PEO1.** Apply basic knowledge of mathematics, principles of physics and chemistry, and interdisciplinary engineering for the design and development.
- **PEO2.** Demonstrate the application of exploration practices and engineering principles through development of innovative tools that are beneficial in production.
- **PEO3.** Exhibit skills of design and construct machineries based on requirement and need of Technology operations.
- **PEO4.** Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication, and ability to work in teams.
- **PEO5.** To have successful career as engineering professional or a researcher through lifelong learning in the field of Bachelor of Technology.

2. **Graduation Attributes (GAs):** The graduate attributes in B. Tech. are the summation of the expected course learning outcomes mentioned in the end of each course. Some of them are stated below.

GA1: Discipline-specific Knowledge: Capability of demonstrating comprehensive knowledge of B. Tech. program and understanding of core branch so that it forms a foundation for a graduate program of study.

GA2: Critical Thinking & Analytical Reasoning: Ability to employ critical thinking in understanding the concepts relevant to the various branches of engineering. Ability to analyze the results and apply them in various problems appearing in different streams.

GA3: Problem Solving:

Capability to solve problems by using research-based knowledge and research methods including innovative thinking, design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

GA4: Research-related skills:

To develop a sense of inquiry and capability for asking relevant and intelligent questions, problem identification, synthesizing and articulating; ability to recognize and establish cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

GA5: Usage of Modern Tools (Information/digital literacy):

To create, select, and apply appropriate techniques, resources, and modern science and IT tools including prediction and modeling to complex science activities with an understanding of the limitations.

GA6: Social Responsibilities:

Ability to work with contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

GA7: Self-directed learning with environment:

Ability to work independently and doin-depth study of various problems and requirements of society with natural available resources which leads to sustainable development.

GA8. Moral and ethical awareness/reasoning:

Ability to identify unethical behavior such as falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects of their program.

GA9. Leadership Readiness/Qualities:

Capability for mapping out the tasks in a team or an organization, self-motivating and inspiring team members to engage with the team objectives/vision; and using management skills to follow the mapped path to the destination in a smooth and efficient way.

GA10: Communication skills:

a. Ability to communicate various concepts of technical education effectively using practical approach and their geometrical visualizations.
b. Ability to use courses as a precise language of communication in other branches of human knowledge.
c. Ability to resolve unsolved problems and requirements of industries and societies.
d. Ability to show the importance of their technical knowledge as precursor to various scientific developments since the beginning of the civilization.

GA11: Project Management and Finance:

Ability to 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

GA12: Lifelong learning:

Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

3. **Program Outcomes (POs):** Students graduating with the B. Tech. degree should be able to acquire with following POs

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 team work**: 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. **Lifelong 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.

Mapping of Graduate Attributes (GAs) and Program Outcomes (POs):

PO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	■											
PO2		■										
PO3			■									
PO4				■								
PO5					■							
PO6						■						
PO7							■					
PO8								■				
PO9									■			
PO10										■		
PO11											■	
PO12												■

4. Program Specific Outcomes (PSOs) :

PSO1: Professionally empowering the student as technical manpower in industry or an entrepreneur for production analytics and innovation.

PSO2: Able to excel in various technological challenges and contribute for self-reliant society.

5. Course-Wise Learning Objectives, Structures and Outcomes (CLOSOs)

BACHELOR OF TECHNOLOGY

Semester - I

THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	T	P	IA	EA	Total	**Credits**
BTBSC 101	Engineering Mathematics-I	3	1	-	30	70	100	4
BTBSC 102	Engineering Physics	3	1	-	30	70	100	4
BTHSMC 103	Communication Skills	2	-	-	30	70	100	2
BTESC 104	Programming for Problem Solving	2	-	-	30	70	100	2
BTESC 105A/ BTESC 105B	Basic Electrical Engineering/ Basic Civil Engineering	2	-	-	30	70	100	2
PRACTICALS/ VIVA VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTBSC 106	Engineering Physics Lab	-	-	2	30	20	50	1
BTHSMC 107	Language Lab	-	-	2	30	20	50	1
BTESC 108	Computer Programming Lab	-	-	2	30	20	50	1
BTESC109A/ BTESC109B	Basic Electrical Engineering Lab/ Basic Civil Engineering Lab	-	-	2	30	20	50	1
BTESC 110	Computer Aided Engineering Graphics	-	-	2	30	20	50	1
BTSODECA111	Social Outreach, Discipline & Extra Curricular Activities	-	-	-	-	-	50	1
	Total	**12**	**2**	**10**	**300**	**450**	**800**	**20**

Semester – II

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	L	T	P	IA	EA	Total	**Credits**
BTBSC 201	Engineering Mathematics-II	3	1	-	30	70	100	4
BTBSC 202	Engineering Chemistry	3	1	-	30	70	100	4
BTHSMC 203	Human Values	2	-	-	30	70	100	2
BTESC 204	Basic Mechanical Engineering	2	-	-	30	70	100	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	2	-	-	30	70	100	2
BTHSMC 206	Advanced English	2	-	-	30	70	100	2
PRACTICALS/ VIVA VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTBSC 207	Engineering Chemistry Lab	-	-	2	30	20	50	1
BTHSMC 208	Human Values Activities	-	-	2	30	20	50	1
BTESC 209	Manufacturing Practices Workshop	-	-	2	30	20	50	1
BTESC210A/ BTESC 210B	Basic Electrical Engineering Lab/ Basic Civil Engineering Lab	-	-	2	30	20	50	1
BTESC 211	Computer Aided Machine Drawing	-	-	2	30	20	50	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities	-	-	-	-	-	50	1
	Total	**14**	**2**	**12**	**330**	**520**	**900**	**22**

ELECTRICAL ENGINEERING								
THIRD SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEBSC301	Advance Mathematics	3	-	-	30	70	100	3
BTEEHSMC302	Managerial Economics and Financial Accounting	2	-	-	30	70	100	2
BTEEESC303	Power generation Process	3	-	-	30	70	100	3
BTEEPCC304	Electrical Circuit Analysis	3	-	-	30	70	100	3
BTEEPCC305	Analog Electronics	3	-	-	30	70	100	3
BTEEPCC306	Electrical Machine-I	3	-	-	30	70	100	3
BTEEPCC307	Electromagnetic Field	3	-	-	30	70	100	3
	Sub Total	**20**	**0**	**0**	**210**	**490**	**700**	**20**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC308	Analog Electronics Lab	-	-	2	30	20	50	1
BTEEPCC309	Electrical Machine-I Lab	-	-	2	30	20	50	1
BTEEPCC310	Electrical Circuit Design Lab	-	-	2	30	20	50	1
BTEEPSIT311	Industrial Training / Seminar	-	-	2	-	-	50	1

BTEESODECA312	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
Sub Total		0	**0**	**8**	**90**	**60**	**250**	**5**
TOTAL OF III SEMESTER		**20**	**0**	**8**	**300**	**550**	**950**	**25**

FOURTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEBSC401	Biology	2	-	-	30	70	100	2
BTEEHSMC402	Technical Communication	2	-	-	30	70	100	2
BTEE ESC 403	Electronic Measurement & Instrumentation	3	-	-	30	70	100	3
BTEE PCC 404	Electrical Machine-II	3	-	-	30	70	100	3
BTEE PCC 405	Power Electronics	3	-	-	30	70	100	3
BTEE PCC 406	Signals & Systems	3	-	-	30	70	100	3
BTEE PCC 407	Digital Electronics	3	-	-	30	70	100	3
Sub Total		**19**	**0**	**0**	**210**	**490**	**700**	**19**
PRACTICALS/VIVA-VOCE					**Sessional**	**Practical**	**Total**	**Credits**
BTEE PCC 408	Electrical Machine-II Lab	-	-	2	30	20	50	1
BTEE PCC 409	Power Electronics Lab	-	-	2	30	20	50	1
BTEE PCC 410	Digital Electronics Lab	-	-	2	30	20	50	1
BTEE PCC 411	Measurement Lab	-	-	2	30	20	50	1
BTEESODECA412	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
Sub Total		**0**	**0**	**8**	**120**	**80**	**250**	**5**
TOTAL OF IV SEMEESTER		**19**	**0**	**8**	**330**	**570**	**950**	**24**

FIFTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEESC501	Electrical Materials	3	-	-	30	70	100	3
BTEEPCC502	Power System – I	3	-	-	30	70	100	3
BTEEPCC503	Control System	3	-	-	30	70	100	3
BTEEPCC504	Microprocessor	3	-	-	30	70	100	3
BTEEPCC505	Electrical Machine Design	3	-	-	30	70	100	3
Professional Elective I (any one)								
BTEEPEC506A	Restructured Power System	3	-	-	30	70	100	3
BTEEPEC506B	Electromagnetic Wave							
BTEEPEC506C	Digital Control System							
	Sub Total	18	**0**	**0**	**180**	**420**	**600**	**18**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC507	Power System-I Lab	-	-	2	30	20	50	1
BTEEPCC508	Control System Lab	-	-	2	30	20	50	1
BTEEPCC509	Microprocessor Lab	-	-	2	30	20	50	1
BTEEPCC510	System Programming Lab	-	-	2	30	20	50	1
BTEEPSIT511	Industrial Training			2	60	40	100	2
BTEESODECA512	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	--	50	1
	Sub Total	0	**0**	**10**	**180**	**120**	**350**	**7**
	TOTAL OF V SEMESTER	**18**	**0**	**10**	**360**	**540**	**950**	**25**

SIX SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEESC601	Computer Architecture	3	-	-	30	70	100	3
BTEEPCC602	Power System-II	3	-	-	30	70	100	3
BTEEPCC603	Power System Protection	3	-	-	30	70	100	3
BTEEPCC604	Electrical Energy Conversion and Auditing	3	-	-	30	70	100	3
BTEEPCC605	Electric Drives	3	-	-	30	70	100	3
Professional Elective I (any one)								
BTEEPEC606A	Power System Planning	3	-	-	30	70	100	3
BTEEPEC606B	Digital Signal Processing							
BTEEPEC606C	Electrical and Hybrid Vehicles							
	Sub Total	18	**0**	**0**	**180**	**420**	**600**	**18**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC607	Power System-II Lab	-	-	2	30	20	50	1
BTEEPCC608	Electric Drives Lab	-	-	2	30	20	50	1
BTEEPCC609	Power System Protection Lab	-	-	2	30	20	50	1
BTEEPCC610	Modelling and Simulation Lab	-	-	2	30	20	50	1
BTEESODECA611	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	--	50	1
	Sub Total	0	**0**	**8**	**120**	**80**	**250**	5
	TOTAL OF VI SEMESTER	**18**	**0**	**8**	**300**	**500**	**850**	**23**

SEVENTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Professional Elective I (any one)								
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEPEC701A	Wind & Solar Energy Systems.	3	-	-	30	70	100	3
BTEEPEC701B	Power Quality and FACTS							
BTEEPEC701C	Control System Design							
Open Elective I (any one)								
BTEEOEC702A	Principle of Electronic Communication	3	-	-	30	70	100	3
BTEEOEC702B	Water Pollution Control Engineering							
BTEEOEC702C	Micro and Smart System Technology							
	Sub Total	6	**0**	**0**	**60**	**140**	**200**	**6**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC703	Embedded System Lab	-	-	4	60	40	100	2
BTEEPCC704	Advanced Control System Lab	-	-	4	60	40	100	2
BTEEPSIT705	Industrial Training	1	-	0	30	20	50	1
BTEEPSIT706	Seminar	2	-	0	30	20	50	1
BTEESODECA707	Social Outreach, Discipline & Extra Curricular Activates			0	-	-	50	1
Sub Total		3	**0**	**8**	**180**	**120**	**350**	**7**
TOTAL OF VII SEMESTER		**9**	**0**	**8**	**240**	**260**	**550**	**13**

EIGHT SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Professional Elective I (any one)								
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEPEC801A	HVDC Transmission System	3	-	-	30	70	100	3
BTEEPEC801B	Line Commutated & Active Rectifiers							
BTEEPEC801C	Advanced Electric Drives.							
Open Elective I (any one)								
BTEEOEC802A	Electrical & Electronic Ceramics	3	-	-	30	70	100	3
BTEEOEC802B	Robotics and Control							
BTEEOEC802C	Composite Materials							
Sub Total		6	**0**	**0**	**60**	**140**	**200**	**6**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC803	Energy System Lab	-	-	4	60	40	100	2
BTEEPSIT804	Project	3	-	-	120	80	200	4
BTEESODECA805	Social Outreach, Discipline & Extra Curricular Activates	-		-	-	--	50	1
Sub Total		3	**0**	**4**	**180**	**120**	**350**	7
TOTAL OF VIII SEMESTER		**9**	**0**	**4**	**240**	**260**	**600**	**13**

BTBSC101: Engineering Mathematics-I

Course Objectives:

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- To understand Fourier series representation of Periodic signals and to introduce with Fourier Series.

Unit I: ***Calculus:***

Improper integrals (Beta and Gamma functions) and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit II: Sequences and Series:

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

Unit III: Fourier Series:

Periodic functions, Fourier series, Euler's formula, Change of intervals, Half range sine and cosine series, Parseval's theorem.

Unit IV: Multivariable Calculus (Differentiation):

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Unit V: Multivariable Calculus (Integration):

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to), Applications: areas and volumes, Centre of mass and Gravity constant and variable densities); Triple integrals (Cartesian), Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, surface integrals, Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edit ion, John Wiley & Sons, 2006. F201

3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the calculation and Applications of definite integrals.

CO2: Solve problems related to Sequences and Series.

CO3: Interpret the concept of s series as the sum of a sequence and able to solve problems related to Fourier series.

CO4: Interpret the concept of s series as the sum of a sequence and use the sequence of partial sums to determine divergence of a series.

CO5: Understand the calculation and Applications of Multivariable integrals.

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	H	M
CO2	L3	-	M	H	M	-	-	-	-	-	M	-	L	M	L
CO3	L4	H	L	M	L	-	-	-	-	-	-	-	L	H	M
CO4	L4	H	L	M	L	-	-	-	-	-	-	-	L	H	M
CO5	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC102: Engineering Physics

Course Objective:

- To understand the concepts of interference, Diffraction and Polarization.
- To know about wave particle duality.
- To know applications of Optical fibre.
- To know applications of Lasers in Science, engineering and medicine.
- To know classification of Solid.

Unit I: Wave Optics

Newton's Rings, Michelson's Interferometer, Fraunhofer Diffraction from a Single Slit. Diffraction grating: Construction, theory and spectrum, Resolving power and Rayleigh criterion for limit of resolution, Resolving power of diffraction grating, X-Ray diffraction and Bragg's Law.

Unit II: Quantum Mechanics

Introduction to quantum Mechanics, Wave-particle duality, Matter waves, Wave function and basic postulates, Time dependent and time independent Schrodinger's Wave Equation, Physical interpretation of wave function and its properties, Applications of the Schrodinger's Equation: Particle in one dimensional and three dimensional boxes.

Unit III: Coherence and Optical Fibers

Spatial and temporal coherence: Coherence length; Coherence time and 'Q' factor for light, Visibility as a measure of Coherence and spectral purity, Optical fiber as optical wave guide, Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Unit IV: Laser

Einstein's Theory of laser action; Einstein's coefficients; Properties of Laser beam, Amplification of light by population inversion, Components of laser, Construction and working of He-Ne and semiconductor lasers, Applications of Lasers in Science, engineering and medicine.

Unit V: Material Science & Semiconductor Physics

Bonding in solids: covalent and metallic bonding, Energy bands in solids: Classification of solids as Insulators, Semiconductors and Conductors, Intrinsic and extrinsic semiconductors, Fermi dirac distribution function and Fermi energy, Conductivity in semiconductors, Hall Effect: Theory, Hall Coefficient and applications.

References:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).

3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Enhance the basic skills required to understand, develop, and design various engineering applications involving Wave Optics.

CO2: Understand Quantum Mechanics and apply them to diverse engineering problems.

CO3: Analyze the nature of light propagation in guided medium for engineering applications and study in Coherence and Optical Fibers.

CO4: Describe different Laser problems.

CO5: Describe Material Science & Semiconductor Physics.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom’s Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	H	-	H	-	M	-	-	-	-	L	H	M
CO2	L3	H	H	H	H	-	M	-	-	-	-	-	-	M	M
CO3	L4	M	L	M	-	L	-	L	-	-	-	-	-	H	H
CO4	L2	H	M	H	H	M	-	M	L	-	L	-	L	H	M
CO5	L2	H	M	H	H	M	-	M	L	-	L	-	L	M	H

H- High, M- Moderate, L- Low, ‘-’ for No correlation

BTHSMC103: Communication Skills

Course Objective:

- To improve communication skills with Basic English.
- To know different types of communication.
- To develop basic skills needed for writing short stories and poems.

Detailed contents :

Unit I: Communication

Meaning, Importance and Cycle of Communication. Media and Typesof Communication. Verbal and Non-Verbal Communication.Barriers to communication. Formal and Informal Channels ofCommunication (Corporate Communication). Divisions of HumanCommunication and Methods to improve InterpersonalCommunication. Qualities of good communication.

Unit II: Grammar

Passive Voice. Reported Speech. Conditional Sentences. Modal Verbs. Linking Words (Conjunctions)

Unit III: Composition

Job Application and Curriculum-Vitae Writing. Business LetterWriting. Paragraph Writing. Report Writing.

Unit IV: Short Stories

"Luncheon" by Somerset Maugham."How Much Land Does a ManNeed?" by Count Leo Tolstoy. "The Night Train at Deoli" by RuskinBond.

Unit V: Poems

"No Men are Foreign" by James Kirkup. "If" by Rudyard Kipling."Where the Mind is without Fear" by Rabindranath Tagore.

Text / Reference Books Suggested Readings:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand Communication and Types of Communication.

CO2: Know Grammar of Passive Voice, Reported Speech.

CO3: Understand different ways of writing Job Application and Curriculum-Vitae.

CO4: Describe different Short Stories for effective Learning.

CO5: Describe different poems for improving communication skills.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	M	-	-	-	H	-	M	M	L
CO2	L1	-	-	-	-	-	H	-	-	-	H	-	L	M	M
CO3	L2	-	-	-	-	-	M	-	-	M	H	-	M	M	L
CO4	L2	-	-	-	-	-	M	-	-	-	H	-	L	M	M
CO5	L2	-	-	-	-	-	M	-	-	-	H	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC104: Programming for Problem Solving

Course Objective:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Syllabus

UNIT I:Fundamentals of Computer:

Stored program architecture of computers, Storage device- Primarymemory, and Secondary storage, Random, Direct, Sequential access methods.

UNIT II:

Concepts of High-level, Assembly and Low-level languages,Representing algorithms through flowchart and pseudo code.

UNIT III:Number system:

Data representations, Concepts of radix and representation ofnumbers in radix r with special cases of r=2, 8, 10 and 16 withconversion from radix r1 to r2, r's and (r-1)'s complement, Binaryaddition, Binary subtraction, Representation of alphabets.

UNIT IV:C Programming:

Problem specification, flow chart, data types, assignment statements,input output statements, developing simple C programs, Ifstatement, for loops, while loops, do-while loops, switch statement,break statement, continue statement.

UNIT V:Development of C programs using

Arrays, functions, parameter passing,recursion, Programming in C using these statements, Structures,files, pointers and multi file handling.

Text / Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes:

At the end of the course, the student will be able to:

CO1: know and understand the conventions of Fundamentals of Computer.

CO2: represent algorithms through flowchart and pseudo code.

CO3: learn Number system and apply these skills in developing new products.

CO4: understand and learn C Programming.

CO5: Comprehend the Development of C programs using- Arrays, functions.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	H	M	-	M	L	-	-	-	-	-	L	H	M
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L3	H	L	M	L	M	L	-	-	-	L	-	L	H	H
CO4	L2	M	H	L	M	H	-	-	-	-	M	-	M	H	M
CO5	L2	M	H	H	M	H	-	-	-	-	M	-	M	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 105A : Basic Electrical Engineering

Course Objective:

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Detailed contents

UNIT I:DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

UNIT II:AC Circuits:

Representation of sinusoidal waveforms, peak and r.m.s values,phasor representation, real power, reactive power, apparent power,power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance.Three phase balanced circuits, voltage and current relations in starand delta connections.

UNIT III:Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

UNIT IV:Electrical Machines:

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

UNIT V:Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC105B: Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Detailed contents:

Unit I: Introduction to objective, scope and outcome the subject

Unit II: Introduction

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: Surveying Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying, Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling : Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

TEXTBOOKS:

1. Gopi, S., Basic Civil Engineering, Pearson Publishers
2. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
3. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
4. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
3. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
4. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Illustrate the fundamental aspects of Civil Engineering.

CO2: Understand the scope of civil engineering.

CO3: Explain the concepts of surveying for making horizontal and vertical measurements.

CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC106: Engineering Physics Lab

Course Objective:

- To understand the concepts of interference.
- To know about wavelength of light.
- To know about depletion layer and band gap of semiconductor.
- To know dispersion of light through prism.
- To know principle of Hall Effect.

LIST OF EXPERIMENTS :

1. To determine the wave length of monochromatic light with the help of Michelson's interferometer.
2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4. Determination of band gap using a P-N junction diode.
5. To determine the height of given object with the help of sextant.
6. To determine the dispersive power of material of a prism with the help of spectrometer.
7. To study the charge and discharge of a condenser and hence determine the same constant both current and voltage graphs are to be plotted.
8. To determine the coherence length and coherence time of laser using He – Ne laser.
9. To measure the numerical aperture of an optical fibre.
10. To study the Hall Effect and determine the Hall Voltage and Hall coefficients.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the usage of common Ammeter, voltmeter and Multimeter.

CO2: Formulate and solve complex AC, DC circuits.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Identify the type of electrical machine used for that particular application.

CO5: Understand the usage of optical instruments.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	H	-	M	-	-	H	-	L	H	L
CO2	L6	H	H	-	H	-	M	-	-	-	-	-	-	M	M
CO3	L2	M	L	-	-	L	-	L	-	-	L	-	-	M	L
CO4	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M
CO5	L2	H	M	-	H	M	-	M	L	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTHSMC107: Language Lab

Course Objective:

- To understand concepts of basic English language fundamentals.
- To understand the communication skills.
- To develop Dialogue Writing and Listening comprehension.

Detailed Syllabus

1. Phonetic Symbols and Transcriptions.
2. Extempore.
3. Group Discussion.
4. Dialogue Writing.
5. Listening comprehension.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: understand the Phonetic Symbols and Transcriptions.

CO2: Understand the skills required in Extempore.

CO3: improve their communication skills for Group Discussion.

CO4: improve their technical communication skills.

CO5: Understand Dialogue Writing and Listening skills.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	H	M	-	-	-	H	-	M	H	M
CO2	L2	M	-	-	-	-	M	-	-	H	H	-	L	M	L
CO3	L6	M	-	-	-	-	M	-	-	H	H	-	M	M	L
CO4	L6	M	-	-	-	M	M	-	-	-	H	-	M	M	M
CO5	L2	M	-	-	-	M	M	-	-	M	H	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 108: Computer Programming Lab

Course Objective(s):

- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

LIST OF EXPERIMENTS :

1. To learn about the C Library, Preprocessor directive, Input-outputstatement.
2. Programs to learn data type, variables, If-else statement
3. Programs to understand nested if-else statement and switch statement
4. Programs to learn iterative statements like while and do-while loops
5. Programs to understand for loops for iterative statements
6. Programs to learn about array and string operations
7. Programs to understand sorting and searching using array
8. Programs to learn functions and recursive functions
9. Programs to understand Structure and Union operation
10. Programs to learn Pointer operations
11. Programs to understand File handling operations
12. Programs to input data through Command line argument

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Learn about the C Library, Preprocessor directive, Input-output statement.

CO2: Learn data type, variables, and conditional statement.

CO3: Learn about array and string operations.

CO4: Understand File handling operations.

CO5: learn programs related to C Programming and apply them to solve real world problems.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	-	-	M	L	-	-	-	L	-	L	M	L
CO2	L2	H	H	M	L	M	L	-	-	-	L	-	L	M	M
CO3	L2	H	L	M	L	M	L	-	-	-	L	-	L	H	M
CO4	L2	M	H	L	M	H	L	L	-	-	L	-	M	H	M
CO5	L3	M	H	H	M	H	M	L	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 109A: Basic Electrical Engineering Lab

Course Objectives:

- To understand training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood and other metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate or brush arrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC109B: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Conduct survey and collect field data.

CO2: Review field notes from survey data.

CO3: Interpret survey data and compute areas and volumes.

CO4: Describe Total station and measurement

CO5: Describe various water fittings and find out the various fluids properties

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC110: Computer Aided Engineering Graphics

Course Objectives:

- To Increase ability to communicate with people
- To Learn to sketch and take object dimensions.
- To Learn to take data and transform it into graphic drawings.

Introduction: Principles of drawing, lines, type of lines, usage of Drawinginstruments, lettering, Conic sections including parabola, hyperbola, RectangularHyperbola (General method only); Scales-Plain, Diagonal and Vernier Scales.

Projections of Point & Lines: Position of Point, Notation System, SystematicApproach for projections of points, front view & Top view of point, Position ofstraight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs,Line inclined to one RP and parallel to the other, Line inclined to Both the RPs,Traces of a line (One drawing sheet, one assignment in sketch book).

Projection of Planes: Positions of planes, Terms used in projections of planes,plane parallel to RP, plane inclined to one RP and perpendicular to the other RP,plane perpendicular to Both the RPs, plane Inclined to Both the RPs, True shape ofthe plane, Distance of a point from plane, Angle between two planes.

Projections of Regular Solids: frustum and truncated solids, those inclined toboth the Planes-Auxiliary Views.

Section of Solids: Theory of sectioning, section of prisms and cubes, section ofpyramids and Tetrahedron section of Cylinders, section of cones, section ofspheres (One drawing sheet, one assignment in sketch book)

Overview of Computer Graphics : Covering theory of CAD software [such as: Themenu System, Toolbars (standard, Object Properties, Draw, Modify andDimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialogboxes and windows, Shortcut menus (Button Bars), Command Line (whereapplicable), The Status Bar, Different methods of zoom as used in CAD, Select anderase objects.: Isometric Views of lines, Planes, Simple and compound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know and understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Know the Theory of sectioning and Section of Solids.

CO4: Comprehend the theory of projection.

CO5: Improve their drawing skill in the form of Computer Graphics.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	L	-	-	L	M	-	L	L	M
CO2	L4	H	M	L	M	L	L	-	-	-	M	-	L	L	M
CO3	L1	H	M	L	M	L	L	-	-	L	M	-	L	L	L
CO4	L2	H	H	M	H	L	L	-	-	L	H	-	M	M	M
CO5	L2	H	M	M	M	L	L	-	-	L	M	-	M	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSSODECA 111: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

Semester - II

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	L	T	P	IA	EA	Total	**Credits**
BTBSC 201	Engineering Mathematics-II	3	1	-	30	70	100	4
BTBSC 202	Engineering Chemistry	3	1	-	30	70	100	4
BTHSMC 203	Human Values	2	-	-	30	70	100	2
BTESC 204	Basic Mechanical Engineering	2	-	-	30	70	100	2
BTESC205A/ BTESC205B	Basic Electrical Engineering/ Basic Civil Engineering	2	-	-	30	70	100	2
BTHSMC 206	Advanced English	2	-	-	30	70	100	2
PRACTICALS/ VIVA VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTBSC 207	Engineering Chemistry Lab	-	-	2	30	20	50	1
BTHSMC 208	Human Values Activities	-	-	2	30	20	50	1
BTESC 209	Manufacturing Practices Workshop	-	-	2	30	20	50	1
BTESC210A/ BTESC 210B	Basic Electrical Engineering Lab/ Basic Civil Engineering Lab	-	-	2	30	20	50	1
BTESC 211	Computer Aided Machine Drawing	-	-	2	30	20	50	1
BTSODECA212	Social Outreach, Discipline & Extra Curricular Activities	-	-	-	-	-	50	1
	Total	**14**	**2**	**12**	**330**	**520**	**900**	**22**

BTBSC201 : Engineering Mathematics-II

Course Objective:

- To provide detailed of **matrices** which is applied for solving system of linear equations and useful in various fields of technology.
- To understand the course is an introduction to ordinary differential equations.
- To understand the collection of methods and techniques used to find solutions to several types of differential equations, including first order scalar equations.

Unit I: Matrices:

Rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Unit II: First order ordinary differential equations:

Linear and Bernoulli's equations, Exact equations, Equations not of first degree: equations solvable for *p*, equations solvable for *y*, equations solvable for *x* and Clairaut's type.

Unit III: Ordinary differential equations of higher orders:

Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations, Second order linear differential equations with variable coefficients: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters, Cauchy- Euler equation; Power series solutions including Legendre differential equation and Bessel differential equations.

Unit IV: Partial Differential Equations – First order: Order and Degree, Formation; Linear Partial differential equations ofFirst order, Lagrange's Form, Non Linear Partial Differential equationsof first order, Charpit's method, Standard forms.

Unit V: Partial Differential Equations– Higher order : Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdit ion, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the matrices, Rank of a matrix, rank-nullity theorem; System of linear equations.

CO2: Identify, analyze and subsequently solve physical situations whose behavior can be described by First order and First degree ordinary differential.

CO3: Determine solutions to second order linear differential equations with variable coefficients.

CO4: Solve Engineering problems using different methods and techniques.

CO5: Evaluate the first order and second order partial differential equations

Mapping between Objectives and Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	M	L	M	-	-	-	-	L	M	-	M	M	M
CO2	L4	M	M	H	M	-	-	-	-	L	M	-	M	M	M
CO3	L4	H	M	M	M	-	-	-	-	-	M	-	L	M	L
CO4	L6	H	M	M	M	L	-	-	-	-	M	-	L	L	M
CO5	L5	H	M	L	M	L	-	-	-	L	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC202 : Engineering Chemistry

Course Objective:

- To acquire the knowledge about impurities in water, their determination and purification.
- To learn about different types of fuel and lubricant and their applications.
- To gain the basic knowledge, applications and control methods of corrosion.
- To get the knowledge of preparation and significance of explosives, cement, refractories and glass.
- To get the knowledge of organic reaction mechanism and their uses with different types of drugs

Detailed contents:

Unit I: Water

Common impurities, hardness, determination of hardness by complexometric (EDTA method), Degree of hardness, Units of hardness Municipal water supply: Requisite of drinking water, Purification of water; sedimentation, filtration, disinfection, breakpoint chlorination. Boiler troubles: Scale and Sludge formation, Internal treatment methods, Priming and Foaming, Boiler corrosion and Caustic embrittlement Water softening; Lime-Soda process, Zeolite (Permutit) process, Demineralization process. Numerical problems based on Hardness, EDTA, Lime-Soda and Zeolite process.

Unit II: Organic Fuels

Solid fuels: Coal, Classification of Coal, Proximate and Ultimate analyses of coal and its significance, Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter. Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method. Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking, Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas, Determination of calorific value of gaseous fuels by Junker's calorimeter Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit III: Corrosion and its control

Definition and significance of corrosion, Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion. Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit IV: Engineering Materials

Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. Glass: Definition, Manufacturing by tank furnace, significance of annealing, Types and properties of soft glass, hard glass, borosilicate glass, glass wool, safety glass Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Unit V: Organic reaction mechanism and introduction of drugs

Organic reaction mechanism: Substitution; SN1, SN2, Elecrophilic aromatic substitution in benzene, free radical halogenations of alkanes, Elimination; elimination in alkyl halides, dehydration of alcohols, Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones, Rearrangement; Carbocation and free radical rearrangements Drugs : Introduction, Synthesis, properties and uses of Aspirin, Paracetamol

Suggested Text / Reference Books

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. "Engineering Chemistry" Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain " Engineering Chemistry" Dhanpat Rai publishing company
5. Dara S. S. , " A Text Book of Engineering Chemistry" S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: gain knowledge about impurities in water, their determination and purification.

CO2: understand organic fuels and various emerging new areas of organic chemistry.

CO3: learn about Corrosion and its control.

CO4: Get knowledge about the chemistry of some Engineering Materials like Portland Cement.

CO5: understand and study Organic reaction mechanisms.

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	L2	H	-	M	-	-	-	-	-	-	M	-	H	M	M
CO2	L2	M	-	-	-	L	-	-	-	-	L	-	M	M	M
CO3	L1	M	-	-	-	-	-	-	-	-	L	-	M	M	L
CO4	L2	M	-	-	-	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	-	-	-	-	-	-	-	-	-	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTHSMC203: Human Values

Course Objective:

- To Know the basic guidelines, content and Process for Value Education
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Detailed contents:

Unit I: Course Introduction - Need, Basic Guidelines, Content andProcess for Value Education

Understanding the need, basic guidelines, Self Exploration – itscontent and process; 'Natural Acceptance' and Experiential Validation,Continuous Happiness and Prosperity- Human Aspirations, Rightunderstanding, Relationship and Physical Facilities,UnderstandingHappiness and Prosperity correctly- A critical appraisal of the currentscenario.Method to fulfill the above human aspirations: understanding andliving in harmony at various levels

Unit II: Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' andthe material 'Body'Understanding the needs of Self ('I') and 'Body' - Sukh and SuvidhaUnderstanding the Body as an instrument of 'I',Understanding thecharacteristics and activities of 'I' and harmony in 'I' Understandingthe harmony of I with the Body: Sanyam and Swasthya; correctappraisal of Physical needs, meaning of Prosperity in detail, Programsto ensure Sanyam and Swasthya.

Unit III: Understanding Harmony in the Family and Society- Harmony inHuman-Human Relationship

Understanding harmony in the Family, Understanding values inhuman-human relationship; meaning of Nyaya and program for itsfulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect(Samman) , meaning of Vishwas; Difference between intention and competence, meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, harmony in the society , Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals ,Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family.

Unit IV: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in allpervasive Space. Holistic perception of harmony at all levels of existence

Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values

Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management

models. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers. Case studies related to values in professional life and individual life.

Suggested Text / Reference Books

1. Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
2. Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2ndedition, 2015.
3. Mathur, U C CorporateGovernance and business ethics,MacMillan India Ltd, 2009.
4. Baxi, C V: CorporateGovernance, Excel Books, 2009
5. Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, 1998.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: understand and analyze Basic Guidelines, Content and Process for Value Education.

CO2: understand Harmony in the Human Being - Harmony in Myself.

CO3: Understand Harmony in the Family and Society- Harmony in Human-Human Relationship.

CO4: understand Harmony in the Nature and Existence – Whole existence as Coexistence.

CO5: Understand of Harmony on Professional Ethics. Natural acceptance of human values.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	-	L	M	H	L	M	-	L	M	L
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	M
CO5	L2	L	-	-	-	-	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 204: Basic Mechanical Engineering

Course Objectives:

- To Increase ability to understand machine working
- To Learn to understand fundamentals of mechanical systems
- To Learn to make different mechanical aspects of engineering

Unit I: Fundamentals:

Introduction to mechanical engineering, concepts of thermalengineering, mechanical machine design, industrial engineering andmanufacturing technology.Steam Boilers classification and types of steam boilers and steamturbines. Introduction and Classification of power plants.

Unit II: Pumps and IC Engines:

Applications and working of Reciprocating and Centrifugal pumps.Introduction, Classification of IC Engines, Main Components of ICEngines, Working of IC Engines and its components.

Unit III: Refrigeration and Air Conditioning:

Introduction, classification and types of refrigeration systems andair-conditioning. Applications of refrigeration and Air-conditioning.

Unit IV: Transmission of Power:

Introduction and types of Belt and Rope Drives, Gears.

Unit V:

Primary Manufacturing Processes:Metal Casting Process: Introduction to Casting Process, Patterns,Molding, Furnaces. Metal Forming Processes: Introduction toForging, Rolling, Extrusion, Drawing. Metal Joining Processes:Introduction to various types of Welding, Gas Cutting, Brazing, andSoldering.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: know and understand the Fundamentals of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.

CO2: understand the Refrigeration and Air Conditioning.

CO3: understand the Applications and working of Reciprocating and Centrifugal pumps.

CO4: know the Transmission of Power through Belt and Rope Drives, Gears.

CO5: understand of Primary Manufacturing Processes.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	L	-	-	-	-	M	-	L	M	M
CO2	L2	H	M	L	M	L	-	L	-	-	M	-	L	M	M
CO3	L2	H	L	L	L	M	-	-	-	-	L	-	L	M	M
CO4	L2	H	L	L	L	L	-	L	-	-	L	-	L	M	M
CO5	L2	M	L	L	L	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC205A : Basic Electrical Engineering

Course Objective:

- To Understand the basic concept of Electrical engineering instruments for engineering applications.
- To Understand the basic electrical engineering parameters and their importance.
- To Understand the concept of various laws and principles associated with electrical systems.
- To Develop the knowledge to apply concepts in the field of electrical engineering, projects and research.

Detailed contents

UNIT I:DC Circuits:

Electrical circuit elements (R, L and C), voltage and current sources,Kirchhoff current and voltage laws, Series-Parallel circuits, Nodevoltage method, Mesh current method, Superposition, Thevenin's,Norton's and Maximum power transfer theorems.

UNIT II:AC Circuits:

Representation of sinusoidal waveforms, peak and r.m.s values,phasor representation, real power, reactive power, apparent power,power factor. Analysis of single-phase AC circuits consisting of R, L,C, RL, RC and RLC combinations (series and parallel), resonance.Three phase balanced circuits, voltage and current relations in starand delta connections.

UNIT III:Transformers:

Ideal and practical transformer, EMF equation, equivalent circuit,losses in transformers, regulation and efficiency.

UNIT IV:Electrical Machines:

Generation of rotating magnetic fields, Construction and working ofa three-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of induction motor, singlephaseinduction motor. Construction, working, torque-speedcharacteristic and speed control of separately excited DC motor.Construction and working of synchronous generators.

UNIT V:Power Converters:

Semiconductor PN junction diode and transistor (BJT).Characteristics of SCR, power transistor and IGBT. Basic circuits ofsingle phase rectifier with R load, Single phase Inverter, DC-DCconverter.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply basic skills for designing various instruments for engineering applications.

CO2: Determine error in laboratory measurements and techniques used to minimize such error.

CO3: Gain knowledge regarding the various laws and principles associated with electrical systems.

CO4: Understand electrical machines and apply them for practical problems.

CO5: Understand the concepts in the field of electrical engineering, projects and research.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	L	M	H	M	L	-	-	-	-	M	-	M	M	M
CO3	L1	M	H	H	H	-	-	-	-	-	H	-	M	M	M
CO4	L2	H	L	M	L	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	H	H	H	-	-	-	-	-	H	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 205B : Basic Civil Engineering

Course Objective:

- To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
- To provide students the significance of the Civil Engineering Profession in satisfying societal needs.

Detailed contents:

Unit I: Introduction to objective, scope and outcome the subject

Unit II: Introduction

Scope and Specialization of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Unit III: Surveying Object, Principles & Types of Surveying; Site Plans, Plans& Maps; Scales & Unit of different Measurements. Linear Measurements: Instruments used. Linear Measurement by Tape, Ranging out Survey Lines and overcoming Obstructions; Measurements on sloping ground; Tape corrections, conventional symbols. Angular Measurements: Instruments used; Introduction to Compass Surveying,Bearings and Longitude & Latitude of a Line, Introduction to total station. Levelling: Instrument used, Object of leveling, Methods of leveling in brief, and Contour maps.

Unit IV: Buildings

Selection of site for Buildings, Layout of Building Plan, Types of buildings, Plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation. Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit V: Transportation

Introduction to Transportation Engineering; Traffic and Road Safety: Types and Characteristics of Various Modes of Transportation; Various Road Traffic Signs, Causes of Accidents and Road Safety Measures.

TEXTBOOKS:

5. Gopi, S., Basic Civil Engineering, Pearson Publishers
6. Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house
7. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
8. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

References Books:

5. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England
6. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England
7. McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
8. Minu, S., Basic Civil Engineering, Karunya Publications

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Illustrate the fundamental aspects of Civil Engineering.

CO2: Understand the scope of civil engineering.

CO3: Explain the concepts of surveying for making horizontal and vertical measurements.

CO4: Describe plan and set out of a building, also illustrate the uses of various building materials and explains the method of construction of different components of a building.

CO5: Understand the modes of Traffic and Road Safety and Road Safety Measures

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	-	-	-	-	M	L	-	-	-	-	M	M	M
CO2	L2	H	M	M	L	-	M	L	-	-	L	-	L	M	M
CO3	L2	M	H	M	L	H	-	H	-	-	L	-	L	L	L
CO4	L2	M	H	M	L	H	-	H	-	-	L	-	L	M	M
CO5	L2	M	M	L	H	M	L	-	H	-	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTHSMC206: Advanced English

Course Objective:

- To Develop basic communication concept for social environment.
- To Improve conversation skills to increase confidence and proficiency.
- To understand the concept of English in 'real life' situations.
- To apply grammar knowledge for growing according to environment.

Detailed contents

Unit-I (Grammar)

1. Modal
2. Preposition
3. Conjunction

Unit-II (Composition)

1. Resume writing
2. Report writing
3. Advertisement

Unit-III (Personality)

1. Define Personality
2. Types of Personality
3. How to develop one's personality

Unit-IV (Elements of Communication)

1. Meaning
2. Barriers to communication
3. Functions / Objectives of Communication

Unit-V (Poems)

1. 'No men are foreign' – by James Kirk up
2. 'Death, Be not Proud' – by John Donne

Course Outcomes:

At the end of the course, the student will be able to:

CO 1: Understand Communicate in a variety of social, travel and work-related situations
CO 2: Understand conversation skills and Widen vocabulary skills
CO 3: Apply proficiency in all major skills
CO 4: Apply Practice English in 'real life' situations
CO 5: Learn how to apply grammar knowledge

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	-	-	-	-	L	M	-	-	-	H	-	M	M	M
CO2	L2	-	-	-	-	-	H	-	-	-	H	-	-	M	M
CO3	L3	-	-	-	-	L	-	-	-	M	H	-	M	M	L
CO4	L3	-	-	-	-	L	H	-	-	-	H	-	-	H	L
CO5	L1	-	-	-	-	-	H	-	-	-	H	-	-	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTBSC 207: Engineering Chemistry Lab

Course Objective:

- To understand the method for the determination of hardness in water and purification process.
- To understand about different types of volumetric analysis.
- To learn about properties of lubricant oil.
- To Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

1. Determination the hardness of water by EDTA method
2. Determination of residual chlorine in water
3. Determination of dissolved oxygen in water
4. Determination of the strength of Ferrous Ammonium sulphate solution with the help of K2Cr2O7 solution by using diphenyl amine indicator
5. Determination of the strength of CuSO4 solution iodometrically by using hypo solution
6. Determination of the strength of NaOH and Na2CO3 in a given alkali mixture
7. Proximate analysis of Coal
8. Determination of the flash & fire point and cloud & pour point of lubricating oil
9. Determination of the kinematic viscosity of lubricating oil by Redwood viscometer no. 1 at different temperature
10. Synthesis of Aspirin/ Paracetamol

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the method for the determination of hardness in water and purification process.

CO2: understand about different types of volumetric analysis.

CO3: learn about properties of lubricant oil.

CO4: Synthesize a small drug molecule and analyse a salt sample

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L2	H	M	-	M	-	-	L	-	-	M	-	-	M	L
CO2	L1	L	H	M	H	-	-	L	-	-	H	-	-	M	M
CO3	L1	M	L	H	L	L	-	M	-	-	L	-	L	M	M
CO4	L3	L	L	H	L	L	-	L	-	-	L	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTHSM208 : Human Values Activities

Course Objective:

- **To Understand the** basic guidelines, content and process for value education.
- To develop understanding different Harmony concept.
- To understand professional ethics and natural acceptance of human values.

Detailed contents

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmadeproblems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions). Explore the following:
   (i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
   (ii) What is 'naturally Acceptable' to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it?
2. Out of the three basic requirements for fulfillment of your aspirations – right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

List down all your important desires. Observe whether the desire is related to Self (I) the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable

b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.
3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body – in terms of nurturing, protection and right utilization of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy?

2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy?

4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy?

2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat yourself or on differentiations based on body, physical facilities or belieds.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.

PS 10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought
b. Behavior
c. Work and
d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Analyze Basic Guidelines, Content and Process for Value Education.

CO2: Understanding Harmony in the Human Being - Harmony in Myself.

CO3: Understand Harmony in the Family and Society- Harmony in Human-Human Relationship. Recollect and narrate an incident in your life.

CO4: Understand Harmony in the Nature and Existence – Whole existence as Coexistence. Summarize the core massage of this course grasped by you.

CO5: List ac and Implicate the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	-	-	-	-	L	L	M	H	L	M	-	L	M	L
CO2	L2	-	-	-	-	-	L	M	M	M	M	-	L	M	M
CO3	L2	-	-	-	-	L	L	M	H	L	M	-	L	M	M
CO4	L2	-	-	-	-	L	L	L	M	M	L	L	H	M	L
CO5	L1	-	-	-	-	L	M	M	H	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 209: Manufacturing Practices Workshop

Course Objectives:

- To discuss the modules include training on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

Carpentry Shop

1. T – Lap joint
2. Bridle joint

Foundry Shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding Shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice

9. Job on lathe with one step turning and chamfering operations

Fitting and Sheet Metal Shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal
12. To cut a square notch using hacksaw and to drill a hole and tapping

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe cast different parts through Carpentry.

CO2: Define control manufacturing via computers.

CO3: Understanding use power tools and fitting tools.

CO4: Knowledge of various welding operations

CO5: Understanding different metallic and non-metallic objects.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	H	M
CO2	L2	H	M	L	M	M	-	-	-	-	M	-	L	M	L
CO3	L2	H	M	L	M	M	-	-	-	-	M	-	L	H	M
CO4	L2	H	M	L	M	M	-	L	-	L	M	-	L	H	M
CO5	L2	H	M	L	M	M	-	L	-	L	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC210A Basic Electrical Engineering Lab

Course Objectives:

- To understandtraining on different trades like Fitting, Carpentry and Casting
- To learn various joints are made using wood andother metal pieces.
- To develop machining skills in students.

List of Experiments

1. Basic safety precautions. Introduction and use of measuring instruments –voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitorsand inductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope. Loading of a transformer: measurement of primary andsecondary voltages and currents, and power.
3. Three-phase transformers: Star and Delta connections. Voltage and Currentrelationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents).Phase-shifts between the primary and secondary side.
4. Demonstration of cut-out sections of machines: dc machine (commutate orbrusharrangement), induction machine (squirrel cage rotor), synchronous(field winging - slip ring arrangement) and single-phase induction
5. Torque Speed Characteristic of separately excited dc motor.
6. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d)Components of LT switchgear.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Adapt knowledge regarding the various laws and principles associated with electrical systems.

CO2: Adapt knowledge regarding electrical machines and apply them for practical problems.

CO3: Understand various types' Electrical Equipments.

CO4: Understanding digital measuring equipments.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	M	-	-	-	-	M	-	L	H	M
CO2	L3	L	M	H	M	M	-	-	-	-	M	-	M	M	M
CO3	L2	M	H	H	H	M	-	-	-	-	H	-	M	H	H
CO4	L2	H	L	M	L	M	-	-	-	-	L	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 210B: Basic Civil Engineering Lab

Course Objective(s):

- To Introduce The Various Activities Regarding Measurement And Leveling
- To Water Supply Procedure And Various Discharge And Pressure Measuring Apparatuses

LIST OF EXPERIMENTS:

1. Linear Measurement by Tape:
   a) Ranging and Fixing of Survey Station along straight line and across obstacles.
   b) Laying perpendicular offset along the survey line
2. Compass Survey: Measurement of bearing of linesusing Surveyor's and Prismatic compass
3. Levelling: Using Tilting/ Dumpy/ Automatic Level
   a) To determine the reduced levels in closed circuit.
   b) To carry out profile levelling and plot longitudinal and cross sections for road by Height of Instrument and Rise & Fall Method.
4. To study and take measurements using various electronic surveying instruments like EDM, Total Station etc.
5. To determine pH, hardness and turbidity of the given sample of water.
6. To study various water supply Fittings.
7. To determine the pH and total solids of the given sample of sewage.
8. To study various Sanitary Fittings.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Conduct survey and collect field data.

CO2: Review field notes from survey data.

CO3: Interpret survey data and compute areas and volumes.

CO4: Describe Total station and measurement

CO5: Describe various water fittings and find out the various fluids properties

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom's Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	L	L	L	H	M	L	-	L	L	-	M	H	M
CO2	L2	H	M	M	M	-	M	L	-	L	M	-	L	M	L
CO3	L4	M	H	M	H	H	M	H	-	L	H	-	L	L	H
CO4	L2	M	H	M	H	H	M	H	-	L	H	-	L	-	M
CO5	L2	M	M	L	H	M	M	-	-	L	H	-	H	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTESC 211: Computer Aided Machine Drawing

Course Objective:

- To design, develop and analyze simple linear and non linear computer based drawing.
- To identify and apply the suitable knowledge of computers to understand the shape and size of Drawing Objects.

Syllabus

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules ofdimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet)Introduction to orthographic prdcojection, concept of first angle and third angleprojection, drawing of simple machine elements in first angle projection, missingview problems covering Principles of Orthographic Projections.

Sectional views of mechanical components: (1 drawing sheet) Introduction,cutting plane line, type of sectional views-full section, half section, partial orbroken section, revolved section, removed section, offset section, sectioningconventions-spokes, web rib, shaft, pipes, different types of holes, conventions ofsection lines for different metals and materials.

Fasteners and other mechanical components: (Free hand sketch) Temporaryand permanent fasteners, thread nomenclature and forms, thread series,designation, representation of threads, bolted joints, locking arrangement of nuts,screws, washers, foundation bolts etc., keys, types of keys, cotter and knucklejoints. Riveted joints, rivets and riveting, type of rivets, types of riveted joints etc.Bearing: Ball, roller, needle, foot step bearing. Coupling: Protected type, flange, andpin type flexible coupling. Other components: Welded joints, belts and pulleys,pipes and pipe joints, valves etc.

Overview of Computer Graphics: (2 drawing sheets) Covering theory of CADsoftware such as: The menu System, Toolbars (Standard, Object Properties, Draw,Modify and Dimension), Drawing Area (Background, Crosshairs, CoordinateSystem), Dialog boxes and windows, Shortcut menus (Button Bars), CommandLine (Where applicable), The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.: Isometric Views of Lines, Planes, Simple andcompound Solids.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the conventions and the method of engineering drawing.

CO2: Interpret engineering drawings using fundamentals of different views to construct basic and intermediate geometry.

CO3: Adapt theory of sectioning and Section of Solids.

CO4: Classify the theory of projection.

CO5: Understand drawing skill in the form of Computer Graphics.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	L	-	-	-	L	L	-	L	L	M
CO2	L4	H	L	H	L	L	-	-	-	-	L	-	L	L	L
LCO3	L3	H	H	H	H	L	-	-	-	-	H	-	L	L	M
CO4	L4	H	M	H	M	L	-	-	-	L	M	-	L	M	L
CO5	L2	H	M	H	M	L	-	-	-	L	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTCSSODECA 212: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PSO1	PSO2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

ELECTRICAL ENGINEERING								
THIRD SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEBSC301	Advance Mathematics	3	-	-	30	70	100	3
BTEEHSMC302	Managerial Economics and Financial Accounting	2	-	-	30	70	100	2
BTEEESC303	Power generation Process	3	-	-	30	70	100	3
BTEEPCC304	Electrical Circuit Analysis	3	-	-	30	70	100	3
BTEEPCC305	Analog Electronics	3	-	-	30	70	100	3
BTEEPCC306	Electrical Machine-I	3	-	-	30	70	100	3
BTEEPCC307	Electromagnetic Field	3	-	-	30	70	100	3
	Sub Total	**20**	**0**	**0**	**210**	**490**	**700**	**20**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC308	Analog Electronics Lab	-	-	2	30	20	50	1
BTEEPCC309	Electrical Machine-I Lab	-	-	2	30	20	50	1
BTEEPCC310	Electrical Circuit Design Lab	-	-	2	30	20	50	1
BTEEPSIT311	Industrial Training / Seminar	-	-	2	-	-	50	1
BTEESODECA312	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
Sub Total		0	**0**	**8**	**90**	**60**	**250**	**5**
TOTAL OF III SEMESTER		**20**	**0**	**8**	**300**	**550**	**950**	**25**

BTEEBSC301: Advance Mathematics

Course Objective:

- To provide students with an introduction to the field of numerical analysis
- To Derive appropriate numerical methods to solve interpolation based problems
- To determine properties of Fourier Transform which may be solved by application of special functions?
- To determine properties of Laplace Transform which may be solved by application of special functions

Syllabus

UNIT-1

Numerical Methods: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae.

UNIT-2

Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.

UNIT -3

Transform Calculus:Laplace Transform: Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem.

UNIT-4

Fourier Transform: Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem. Z-Transform: Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.

UNIT-5

Complex Variable: Differentiation, Cauchy-Riemann equations, analytic functions,harmonic functions, finding harmonic conjugate; elementary analyticfunctions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Text Books

1. Advanced Engineering Mathematics, Chandrika Prasad & Reena Garg, Khanna Book Publishing Co. (P) Ltd., Delhi (ISBN: 9789386173522)

2. Engineering Mathematics for first year, Veerarajan T., Tata McGraw-Hill

Reference Books

1. Higher Engineering Mathematics, Ramana B.V., Tata McGraw

2. Differential Calculus Shanti Narayan & Dr. P.K. Mittal, S.Chand Publishing

3. Advanced Engineering Mathematics (ISBN:9788120336094), Sashtry, PHI

Course Outcomes:

At the end of the course, the student will be able to:

CO1: understand the theoretical and practical aspects of the use of numerical Calculation.

CO2: derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

CO3: understand integral calculus and special functions of various engineering problem and to known the application of some basic mathematical methods via all these special functions

CO4: classify and explain the functions of different types of differential equations.

CO5: Solve a linear system of equations using an appropriate numerical method

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	M	M	-	-	-	-	M	-	L	M	M
CO2	L3	H	M	H	M	M	-	-	-	_	M	-	M	M	M
CO3	L5	H	H	H	M	M	-	-	-	-	M	-	M	H	M
CO4	L4	H	H	M	L	H	-	-	-	-	L	-	M	H	M
CO5	L3	M	M	L	M	H	-	-	-	-	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEHSMC302: Managerial Economics and Financial Accounting

Course Objective:-

- To discuss economics deals with the application of the economic concepts, theories, tools, and methodologies to solve practical problems in a business.
- To the managerial economics is the combination of economics theory and managerial theory.
- To helps the manager in decision-making and acts as a link between practice and theory.

Syllabus

UNIT -1

Basic economic concepts-Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economicproblems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.

UNIT -2

Demand and Supply analysis-Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting – purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.

UNIT- 3

Production and Cost analysis-Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation

UNIT -4

Market structure and pricing theory-Perfect competition, Monopoly, Monopolistic competition, Oligopoly.

UNIT- 5

Financial statement analysis-Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.

Text Books

1. Managerial Economics and Financial Accounting, M. KASI REDDY, S. SARASWATHI, PHI Learning Pvt. Ltd

2. Managerial Economics and Financial Accounting, Prof. B.K. Garg,Dr. Surabhi Garg, Dr.Kusumlata Bhardwaj , Ashirwad Publication, ISBN- 9788193796207

Reference Books:

1. Managerial Economics, R.L.Varshney & K.L Maheswari",. 5th Edition, S.Chand Publishers,
2. Managerial Economics And Financial Analysis, Kumar, P. Vijaya & Rao

Course Outcomes:

At the end of the course, the student will be able to:

CO1 - Acquire conceptual knowledge of basics of accounting

CO2 - Recommend events that need to be recorded in the accounting records and develop the skill of recording financial transactions and preparation of reports in accordance with GAAP

CO3 -Describe the role of accounting information and its limitations

CO4- Discuss the accounting process and preparation of final accounts of sole trader

CO5-Identify and analyze the reasons for the difference between cash book and pass book balances

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	H	H	M	H	L	-	-	-	-	-	L	H	M
CO2	L5	H	M	L	M	M	M	-	-	-	-	-	M	M	M
CO3	L1,L2	H	H	H	H	M	M	-	-	-	-	-	M	H	M
CO4	L2	H	H	H	M	H	H	-	-	-	-	-	M	H	M
CO5	L4	M	H	H	M	H	H	-	-	-	-	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEESC303: Power Generation Process

Course Objective:

- To introduce the concepts and phenomenon of different sources of Power Generation
- To familiarize the students with the Tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.
- To This course is a beginners fundamental of Power systems course.
- To emphasis on the economic aspects of Generating and Distributing Electric Power

Syllabus

Unit 1

Conventional Energy Generation Methods

Thermal Power plants: Basic schemes and working principle. (ii)Gas Power Plants: open cycle and closed cycle gas turbineplants, combined gas & steam plants-basic schemes.Hydro Power Plants: Classification of hydroelectric plants. Basicschemes of hydroelectric and pumped storage plants. (iv) NuclearPower Plants: Nuclear fission and nuclear fusion. Fissile andfertile materials. Basic plant schemes with boiling water reactor,heavy water reactor and fast breeder reactor. Efficiencies ofvarious power plants.

Unit 2

New Energy Sources

Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming).Renewable and nonrenewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.

Unit 3

Loads and Load Curves

Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization. Power Factor Improvement-Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers

Unit 4

Power Plant Economics

Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation.

Unit 5

Tariff

Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three part tariff. Spot (time differentiated) pricing. Selection of Power Plants, Comparative study of thermal, hydro, nuclear and gas powerplants. Base load and peak load plants. Size and types ofgenerating units, types of reserve and size of plant. Selection andlocation of power plants.

Text Books

1. Electrical Power Generation, Transmission and distribution, Singh, PHI
2. Electrical Power Generation, Tanmoy Deb, Khanna Publishers
3. HVDC Power Transmission System, K. R. Padiyar, Wiley

Reference Books

1. Analysis of Engineering Cycles" by R W Haywood. ...
2. Boiler Control Systems" by D Lindsay.
3. Least Cost Electrical Utility / Planning" by H G Stoll

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the Layout of Various Generating Power Stations.

CO2: Design Electrical Layout of Various Generating Stations

CO3: Discuss various power sources for generation of power Merit/Demerits.

CO4: Calculate usage of electrical power

CO5: Describe the power / Energy demand in the form of graph

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	-	M	-	-	M	-	M	M	-	M	M	M
CO2	L6	H	M	M	M	-	-	M	-	H	L	-	M	H	L
CO3	L2	M	L	-	L	-	-	L	-	M	M	-	M	H	M
CO4	L3	M	M	M	M	M	-	-	-	-	M	-	-	M	M
CO5	L2	M	M	M	M	M	-	-	-	M	M	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC304: Electrical Circuit Analysis

Course Objective:

- To provide a methodical approach to problem solving.
- To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.
- To understand the concept of graphical solution to electrical network
- To understand frequency response in electrical circuits
- To analyze different types of two-port network using network parameters, with different types of connections

Syllabus

UNIT- I

Network Theorems

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem,Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

UNIT- II

Solution of First and Second order networks

Solution of first and second order differential equations for Series and parallel R-L, R-C, RL- C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

UNIT- III

Sinusoidal steady state analysis

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis,effective or RMS values, average power and complex power.Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNIT -IV

Electrical Circuit Analysis Using Laplace Transforms

Review of Laplace Transform, Analysis of electrical circuits using laplace transform for standard inputs, convolution integral,inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros, Frequency response (magnitude and phase plots), series and parallel resonances.

UNIT- V

Two Port Network and Network Functions

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Text Books

1. Networks and Systems, Asfaq Hussain, Khanna Publishing House, Delhi
2. Networks and systems, D. Roy Choudhary, New Age International Publishers
3. Problems and Solutions of Electrical Circuit Analysis, R.K. Mehta & A.K. Mal, CBS Publishers

Reference Books

1. Fundamentals of Electric Circuits , Charles K Alexander and Matthew N O Sadiku.
2. Electric Circuits Fundamentals, Thomas L Floyd

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss the concepts of trigonometry, complex algebra, and matrix algebra using modern engineering tools necessary for electrical engineering practices.

CO2: Apply network theorems for the analysis of electrical circuits.

CO3: Evaluate the transient and steady-state response of electrical circuits.

CO4: Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).

CO5: Discuss two port circuit behaviors.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	H	L	-	-	-	M	M	-	M	M	L
CO2	L3,L4	M	M	M	H	-	-	-	-	-	M	-	M	H	L
CO3	L5	H	M	M	M	-	-	-	-	M	L	-	-	H	M
CO4	L4	M	M	M	H	-	-	-	-	-	M	-	M	M	M
CO5	L2	H	M	L	M	-	-	-	-	M	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC305: Analog Electronics

Course Objective:

- To expose the students semiconductor device, performance characteristics and their application.
- To expose different signal processing technique and characteristics.
- To analyze and design idealized active linear circuits containing OPAMPs

UNIT -I
Diode circuits
P-N junction diode, I-V characteristics of a diode; review of half wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit.

UNIT- II
BJT circuits
Structure and I-V characteristics of a BJT; BJT as a switch. BJTas an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

UNIT- III
MOSFET circuits

MOSFET structure and I-V characteristics. MOSFET as a switch.MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

UNIT -IV
Differential, multi-stage and operational amplifiers
Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias Current, input offset current, slew rate, gain bandwidth product)

UNIT- V
Linear applications of op-amp
Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Nonlinear applications of op-amp: Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators, Precision rectifier, peak detector. Monoshot

Text Books

1. Analog Electronics, L.K.Maheshwari, Laxmi Publications
2. Analog Electronics, A.K. Maini, Khanna Publishing House

3. Analog Electronics, I.G.Nagrath, PHI

Reference Books

1. Design of analog CMOS Integrated Circuits" by Behzad Razavi
2. Analog Integrated Circuit Design" by Chan Carusone, David Johns, Kenneth Martin

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the characteristics of transistors

CO2: Design and analyse various rectifier and amplifier circuits.

CO3: Construct sinusoidal and non-sinusoidal oscillators.

CO4: Describe the functioning of OP-AMP and design OP-AMP based circuits.

CO5: Illustrate working principle of different electronic circuit and their application in real life.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	-	-	-	-	-	-	M	-	H	M	L
CO2	L4	H	M	H	M	-	-	-	-	M	L	-	M	H	L
CO3	L6	M	M	L	M	-	-	-	-	M	M	-	M	H	M
CO4	L1,L2	M	M	M	M	-	-	-	-	-	L	-	M	M	M
CO5	L3	M	-	-	-	-	-	-	-	-	-	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC306: Electrical Machine-I

Course Objective:

- To prepare the students to have a basic knowledge of transformers, motors& alternator.
- To prepare the students to have a basic knowledge of magnetic field
- To Design the magnetic circuits.

Syllabus

UNIT- I

Magnetic fields and magnetic circuits Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil -through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

UNIT- II

Electromagnetic force and torque B-H curve of magnetic materials; flux-linkage v/s current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

UNIT- III

DC machines Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT- IV

DC machine - motoring and generation Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines.

UNIT -V

Transformers Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase. transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer,

Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Text Books

1. Electrical Machines-I, GC Garg, (ISBN: 978-93-86173-447), Khanna Book Publishing, Delhi
2. Electrical Machines, Kothari & Nagrath, TMH

Reference books:

1. Electrical Machines, Mehta & Mehta, S.Chand Publications
2. Electrical Machines, Indrayudh Bandyopadhyay and Prithwiraj Purkait

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know about the concepts of magnetic circuits.
CO2: Understand the operation of dc machines.
CO3: Analyze the operation of different dc machine configurations.
CO4: Understand the design of single phase and three phase transformers circuits.
CO5: Understand the testing and applications of dc machines.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	-	-	-	-	-	M	M	-	H	H	L
CO2	L2	M	M	M	-	-	-	-	-	-	-	-	M	M	L
CO3	L4	H	M	M	H	-	-	-	-	-	L	-	M	M	L
CO4	L6	M	L	M	M	-	-	-	-	H	-	-	M	H	M
CO5	L2	H	M	M	H	-	-	-	-	M	L	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC307: Electromagnetic Field

Course Objective:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

Syllabus

UNIT I

Review of Vector Calculus Vector algebra- addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

UNIT II

Static Electric Field Coulomb’s law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT III

Conductors, Dielectrics and Capacitance Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson’s equation, Laplace’s equation, Solution of Laplace and Poisson’s equation, Application of Laplace’s and Poisson’s equations.

UNIT IV

Static Magnetic Fields

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Magnetic Forces, Materials and Inductance Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

UNIT V

Time Varying Fields and Maxwell’s Equations

Faraday’s law for Electromagnetic induction, Displacement current, Point form of Maxwell’s equation, Integral form of Maxwell’s equations, Motional Electromotive forces. Boundary Conditions. Electromagnetic WavesDerivation of Wave Equation, Uniform Plane Waves,

Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text Books

1.Electromagnetic Theory, Prabir K. Basu & Hrishikesh Dhasmana, AneBooks

2. Elements of electromagnetics-Sadiku :Oxford university press

References Books

1. Fundamentals of Electromagnetic Theory, Khunita, PHI

2.Electromagnetic Fields & Waves, R.L. Yadava, Khanna Publishing House

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know the basic laws of electromagnetism.

CO2: Obtain the electric and magnetic fields for simple configurations under static conditions.

CO3: Evaluate time varying electric and magnetic fields.

CO4: Understand Maxwell's equation in different forms and different media.

CO5: Describe the propagation of EM waves.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	M	-	-	-	-	-	M	-	M	H	L
CO2	L4	H	M	M	H	-	-	-	-	M	H	-	M	H	L
CO3	L5	M	M	H	H	-	-	-	-	M	M	-	M	M	L
CO4	L2	L	H	M	H	-	-	-	-	-	M	-	M	H	M
CO5	L1,L2	M	M	M	M	-	-	-	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC308: Analog Electronics Lab

Course Objective(s):

- To design various BJT and FET Voltage and Power amplifiers.
- To design various BJT Feedback amplifiers, BJT Oscillators, voltage amplifier.

List Of Experiments

1) Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1 kHz with and without negative feedback.

2) Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.

3) Plot and study the characteristics of small signal amplifier using FET.

4) Study of push pull amplifier. Measure variation of output power & distortion with load.

5) Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency.

6) Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.

7) Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts.

8) To plot the characteristics of UJT and UJT as relaxation.

Course Outcomes:

At the end of the course, the student will be able to

CO1. Apply the concepts of amplifiers in the design of Public Addressing System.

CO2. Develop Sinusoidal wave forms of given specifications.

CO3. Solve stable system using feedback concepts.

CO4. Define the working multi vibrators using transistor.

CO5. Discuss amplifier circuits using BJT s And FET's and observes the amplitude and frequency responses of common amplifier circuits.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	M	M	M	M	-	-	-	-	M	L	-	M	H	L
CO2	L6	M	M	L	H	-	-	-	-	M	M	-	L	M	L
CO3	L3	M	M	M	H	-	-	-	-	M	M	-	M	M	M
CO4	L1	H	L	M	M	-	-	-	-	-	L	-	M	H	M
CO5	L2	M	M	H	H	-	-	-	-	M	M	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC309: Electrical Machine-I Lab

Course Objective(s):

- To provide hands on experience of conducting various tests on dc machines and obtaining their performance indices using standard analytical as well as graphical methods.
- To provide hands on experience of conducting various tests on transformers and obtaining their performance indices using standard analytical as well as graphical methods.

List Of Experiments

1) To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
2) To perform sumpner's test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
3) To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
4) To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit.
5) To perform the parallel operation of the transformer to obtain data to study the load sharing.
6) Separation of no load losses in single phase transformer.
7) To study conversion of three-phase supply to two-phase supply using Scott- Connection.
8) Speed control of D.C. shunt motor by field current control method & plot the curve for speed verses field current.
9) Speed control of D.C. shunt motor by armature voltage control method & plot the curve for speed verses armature voltage.
10) To determine the efficiency at full load of a D.C shunt machine considering it as a motor by performing Swinburne's test.
11) To perform Hopkinson's test on two similar DC shunt machines and hence obtain their efficiencies at various loads.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Know the relevant information to supplement to the Electric Machine- I course.

CO2. Set up testing strategies and select proper instruments to evaluate performance characteristics of electrical machines.

CO3. Discuss Estimate constraints, uncertainties and risks of the system (social, environmental, business, safety issues etc.). Combine an understanding of the established principles, theories, concepts and terminology relevant to electrical machines with practical laboratory experimentation.

CO4. Compute professional quality textual and graphical presentations of laboratory data and computational results, in corporating accepted data analysis and synthesis methods, mathematical software, and word - processing tools.

CO5. Students will demonstrate the ability to interact effectively on a social and interpersonal level with fellow students, and will demonstrate the ability to divide up and share task responsibilities to complete assignments.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	-	-	-	-	-	M	M	-	H	H	L
CO2	L2	M	M	M	-	-	-	-	-	-	-	-	M	H	M
CO3	L4	H	M	M	H	-	-	-	-	-	L	-	M	M	L
CO4	L6	M	L	M	M	-	-	-	-	H	-	-	M	H	M
CO5	L2	H	M	M	H	-	-	-	-	M	L	-	H	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC310: Electrical Circuit Design Lab

Course Objective(s):

- To gain hands on experience in designing electronic circuits.
- To Construct waveform generation circuits

List Of Experiments

1) Introduction to Datasheet Reading.

2) Introduction to Soldering - Desoldering process and tools.

3) Simulate characteristic of BJT and UJT. Validate on Bread Board or PCB.

4) Simulate Bridge Rectifier Circuit and validate on Bread Board or PCB.

a) Half Bridge. b) Full Bridge.

5) Simulate Regulated Power Supply and validate on Bread Board or PCB. a) Positive Regulation (03 Volt to 15 Volt). b) Negative Regulation (03 Volt to 15 Volt). c) 25 Volt, 1–10 A Power Supply.

6) Simulate Multivibrator circuit using IC 555 and BJT separately. Validate on Bread Board or PCB. a) Astable Mode. b) Bistable Mode. c) Monostable Mode.

7) Introduction to Sensors to measure real time quantities and their implementation in different processes. (Proximity, Accelerometer, Pressure, Photo-detector, Ultrasonic Transducer, Smoke, Temperature, IR, Color, Humidity, etc.).

8) Hardware implementation of temperature control circuit using Thermistor.

9) Simulate Frequency divider circuit and validate it on Bread Board or PCB.

10) Hardware implementation of 6/12 V DC Motor Speed Control (Bidirectional)

11) Simulate Buck, Boost, Buck-Boost circuit and validate on Bread Board or PCB.

12) Simulate Battery Voltage Level Indicator Circuit and validate on Bread Board or PCB.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Observe Circuits Design on PCB and Breadboard.

CO2. Calculate satisfactory laboratory record data.

CO3. Design of electronic circuits using MATLAB.

CO4. Analyse the characteristics of Multivibrators.

CO5. Describe the characteristics of Converters.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	-	H	-	-	-	-	M	L	-	M	M	L
CO2	L3,L4	M	L	M	M	-	M	-	-	H	M	-	M	H	M
CO3	L6	H	M	M	H	M	-	-	-	H	M	-	M	H	L
CO4	L4	H	L	M	M	-	M	-	-	H	L	-	L	M	M
CO5	L1,L2	H	M	-	H	M	-	-	-	M	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPSIT 311: Industrial Training

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P011	PO 12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 312: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

IV SEMESTER

FOURTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEBSC401	Biology	2	-	-	30	70	100	2
BTEEHSMC402	Technical Communication	2	-	-	30	70	100	2
BTEE ESC 403	Electronic Measurement & Instrumentation	3	-	-	30	70	100	3
BTEE PCC 404	Electrical Machine-II	3	-	-	30	70	100	3
BTEE PCC 405	Power Electronics	3	-	-	30	70	100	3
BTEE PCC 406	Signals & Systems	3	-	-	30	70	100	3
BTEE PCC 407	Digital Electronics	3	-	-	30	70	100	3
Sub Total		**19**	**0**	**0**	**210**	**490**	**700**	**19**
PRACTICALS/VIVA-VOCE					**Sessional**	**Practical**	**Total**	**Credits**
BTEE PCC 408	Electrical Machine-II Lab	-	-	2	30	20	50	1
BTEE PCC 409	Power Electronics Lab	-	-	2	30	20	50	1
BTEE PCC 410	Digital Electronics Lab	-	-	2	30	20	50	1
BTEE PCC 411	Measurement Lab	-	-	2	30	20	50	1
BTEESODECA412	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
Sub Total		**0**	**0**	**8**	**120**	**80**	**250**	**5**
TOTAL OF IV SEMEESTER		**19**	**0**	**8**	**330**	**570**	**950**	**24**

BTEEBSC401: Biology

Course Objective:

- To provide students with a broad conceptual background in the biological sciences.
- To provide students with a various classifications of biology.
- To Gain knowledge of various types of enzymes.
- To Gain knowledge about genetics.

Syllabus

UNIT-1

Introduction:Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

UNIT-2.

Classification:Purpose: To convey that classification*per se*is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity-Unicellular or multi cellular (b) ultras tructure prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion-aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

UNIT-3

Genetics:Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. Biomolecules:Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

UNIT-4

Enzymes:Purpose: To convey that without catalysis life would not haveexisted on earth.

Enzymology: How to monitor enzyme catalysed reactions.How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic

Information Transfer:Purpose: The molecular basis of coding anddecoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- fromsingle stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation andrecombination.Macromolecular analysis:Purpose: To analyse biological processes at the

reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

UNIT-5

Metabolism:Purpose: The fundamental principles of energy transactionsare the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and

Exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.

Microbiology:Concept of single celled organisms. Concept of species andstrains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Text book

1.Biology for Engineers (ISBN: 9781121439931), TMH

2. Biology For Engineers" by Dr Tanu Allen Dr Sohini Singh.

Reference Books:

1. Essential Mathematical Biology (Springer Undergraduate Mathematics Series)" by Nicholas Britton.

2. Biology for Engineers" by Arthur T Johnson.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Describe how biological observations of 18th Century that lead to major discoveries.

CO2: Convey that classifying*per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological

CO3: Show the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.

CO4: Classify enzymes and distinguish between different mechanisms of enzyme action.
CO5: Identify DNA as a genetic material in the molecular basis of information transfer.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1,L 2	M	M	M	M	-	-	-	-	-	M	-	M	M	L
CO2	L2	M	M	L	M	-	-	-	-	-	M	-	L	M	L
CO3	L3	M	M	L	M	-	-	-	-	-	L	-	M	M	M
CO4	L4	M	M	L	M	-	-	M	-	-	L	-	L	M	L
CO5	L2	M	M	L	M	-	-	-	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEHSMC402: Technical Communication

Course Objectives: -

- To understand the characteristics of technical writing and the importance of purpose, audience, and genre for written communication in technical fields.
- To articulate complex engineering ideas appropriate for targeted audiences.
- To plan, drafting, revising, editing, and critiquing technical and professional documents through individual and collaborative writing.
- To write effective technical and business documents that are grammatically and stylistically correct. e. Preparing and delivering professional technical presentations through applying principles of effective oral communication and slide design.

Syllabus

UNIT-1

Introduction to Technical Communication- Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

UNIT- 2

Comprehension of Technical Materials/Texts and Information Design & development- Reading of technical texts, Reading andcomprehending instructions and technical manuals, Interpreting andsummarizing technical texts, Note-making. Introduction of differentkinds of technical documents, Information collection, factors affectinginformation and document design, Strategies for organization,Information design and writing for print and online media.

UNIT -3

Technical Writing, Grammar and Editing- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, and Minutes of Meetings.

UNIT-4

Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals,

UNIT-5

Advanced Technical Writing- Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

Text Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, M004
M. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, M003. (ISBN 031M406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, and M003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, M004.

Reference Books

1. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, M004. (ISBN: 078M8357-4)
2. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi M00M.
3. Xebec, Presentation Book, TMH New Delhi, M000. (ISBN 040MM13)

COURSE OUTCOME:-

At the end of the course, students will be able to:

CO1:- Examine an effective technical report, displaying the ability to employ appropriate rhetorical strategies and language features to make claims, present arguments, cite and comment on relevant literature, and interpret and comment on research results.

CO2: - Observe an effective technical abstract, displaying the ability to select important pieces of information and synthesize them into an accurate preview of the report.

CO3:- Describe an effective oral presentation, displaying the ability to engage the audience by employing a suitable delivery style, appropriate language, and quality visual aids.

CO4: A Practice of Create awareness, conviction & commitment to values for improving the quality of life through education, and for advancing social and human well being.

CO5: Understand the students as citizens so that the norms and values of human rights and duties education programme are realized.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	M	M	L	H	-	-	-	-	M	M	-	H	M	L
CO2	L2	-	M	M	M	-	M	-	-	M	L	-	M	M	L
CO3	L1	-	M	M	H	-	H	-	-	M	M	-	M	M	M
CO4	L3	-	-	-	-	-	M	-	-	-	-	-	L	L	L
CO5	L2	-	M	L	M	-	M	-	-	M	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEESC403: Electronic Measurement and Instrumentation

Course Objective:

- To introduce students to monitor, analyze and control any physical system
- To understand students how different types of meters work and their construction
- To provide knowledge to design and create novel products and solutions for real life problems
- To introduce students a knowledge to use modern tools necessary for electrical projects.

Syllabus

UNIT-1

Measuring Instruments:Moving coil, moving iron, electrodynamics and induction instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, single-phase power and single-phase energy. Errors in wattmeter and energy meter and their compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading.

UNIT-2

Polyphase Metering:Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two- wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers. Ratio and phase angle errors and their minimization. Effect of variation of power factor, secondary burden and frequency on errors. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.

UNIT-3

Potentiometers:Construction, operation and standardization of DC potentiometers– slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and voltmeter and ammeter calibrations. Volt ratio boxes. Construction, operation and standardization of AC potentiometer in-phase and quadrature potentiometers. Applications of AC potentiometers.

UNIT-4

Measurement of Resistances:Classification of resistance. Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard- wire method. Measurement of earth resistance.

UNIT-5

AC Bridges:Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self- inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge for capacitance measurement.

Wien's bridge for capacitance and frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components. Wagner earth device

Text Books

1. Electronic Instrumentation and Measurements" by David A Bell.
2. Electronic Measurements and Instrumentation" by Sedha R S
3. Modern Electronic Instrumentation and Measurement Techniques" by Helfrick.

Reference Books

1. A Course in Electronic Measurements and Instrumentation" by A K Sawhney
2. Electrical and Electronics Measurements and Instrumentation" by Rajput R K

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors.

CO2: Analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements

CO3: Apply innovative ideas to improve the existing technology in the field of measurements in terms of accuracy, cost, and durability and user friendliness

CO4: Design a system, component or process to meet desired needs in electrical engineering.

CO5: Define measure strain, displacement, Velocity, Angular Velocity, temperature, Pressure, Vacuum, and Flow

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	M	H	-	-	-	-	M	M	-	M	H	L
CO2	L4	H	M	M	H	-	-	-	-	M	L	-	H	H	M
CO3	L3	M	M	M	M	-	-	-	-	H	M	-	M	H	L
CO4	L6	H	M	H	M	-	-	-	-	M	L	-	M	M	M
CO5	L1	M	M	M	M	-	-	-	-	M	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC404: Electrical Machine-II

Course Objective:

1. To understand the concepts of rotating magnetic fields.

2. To understand the operation of ac machines.

3. To analyze performance characteristics of ac machines.

Syllabus

UNIT-1

Fundamentals of AC machine windings:-Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor.

UNIT-2

Pulsating and revolving magnetic fields:-Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

UNIT-3

Induction Machines:-Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self- excitation. Doubly-Fed Induction Machines.

UNIT-4

Single-phase induction motors:-Constructional features,double revolving field theory, equivalentcircuit, determination of parameters. Split-phase starting methodsand applications.

UNIT-5

Synchronous machines:-Constructional features, cylindrical rotor synchronous machine generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division

Text Books

1. Electrical Machinery by PS Bimbhra
2. Electrical Machines, Kothari & Nagrath, TMH
3. Generalized Theory of Electrical Machines by PS Bimbhra

Reference Books:

1. Special Electrical Machines" by Janardanan E G
2. Electrical Machines" by S K Bhattacharya
3. Principles of Electric Machines and Power Electronics" by P C Sen

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know the constructional details and principle of operation of alternators.
CO2: Discuss the working of synchronous machines as generators and motors.
CO3: Examine and applications of synchronous machines.
CO4: Describe the Constructional details and principle of operation of three phase and single phase induction motors.
CO5: Conclude about the starting and speed control of induction motors

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	H	-	-	-	-	-	M	-	M	H	L
CO2	L2	H	M	M	H	-	-	-	-	M	L	-	M	H	M
CO3	L4	M	L	M	M	-	-	-	-	M	M	-	L	H	M
CO4	L2	H	M	M	M	-	-	-	-	M	L	-	M	H	M
CO5	L5	M	M	L	M	-	-	-	-	M	M	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC405: Power Electronics

Course Objective:

- To understand the basics concept of Power Electronics.
- To provide the details of power semiconductor switches (Construction, Characteristics and operation).
- To understand the construction & working of various types of converters.
- To analyze the converters and design the components of them, under various load types.

Syllabus

UNIT-1

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

UNIT-2

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

UNIT-3

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

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

UNIT-4

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

UNIT-5

Three-phase voltage source inverter:-Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation

Text Books

1. Modern Power Electronics, P.C. Sen., Chand & Co.
2. Power Electronics, V.R.Moorthi, Oxford University Press
3. Power Electronics, Muhammad H. Rashid, Pearson

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Define The differences between signal level and power level devices.

CO2: Analyze controlled rectifier circuits.

CO3: Define the operation of DC-DC choppers.

CO4: Discuss working principle of voltage source inverters.

CO5: Calculate the control of various converters function.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	L	-	-	-	-	-	M	-	M	M	M
CO2	L4	H	M	M	M	-	-	-	-	M	L	-	L	M	L
CO3	L1	H	M	M	L	-	-	-	-	-	H	-	M	H	M
CO4	L2	M	L	L	M	-	-	-	-	-	L	-	M	H	L
CO5	L3,L4	H	M	M	M	-	-	-	-	M	M	-	L	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC406: Signals and Systems

Course Objective:

- To Acquire knowledge about the interconnection of elements in a system, classification of signals and basic operations on signals.
- To Acquire knowledge about the time domain analysis of first order systems and representation of total response in various formats

Syllabus

UNIT-1

Introduction to Signals and Systems:Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

UNIT-2

Behavior of continuous and discrete-time LTI systems:Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi- input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT-3

Fourier, Laplace and z- Transforms:Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT).

UNIT-4

Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT-5

Sampling and Reconstruction:The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems

Text Books

1. Signals and Systems, A. Anand Kumar, Phi
2. Signals and Systems, Rishabh Anand, Khanna Book Publishing Co., Delhi
3. Signals and Systems, Tarun Rawat, Oxford University Press
4.. Signals and Systems, J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, TMH

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the concepts of continuous time and discrete time systems.
CO2: Analyze systems in complex frequency domain.
CO3: Discuss sampling theorem and its implications.
CO4: Describe the block diagram representation and structures for system realization
CO5: Solve the Problem using Fourier series, Fourier transform and Laplace transform

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	M	M	-	M	M	M
CO2	L4	M	H	M	H	-	-	-	-	M	L	-	H	H	L
CO3	L2	H	M	M	M	-	-	-	-	M	M	-	M	H	L
CO4	L1,L2	H	M	M	L	-	-	-	-	M	L	-	M	H	M
CO5	L3	H	H	M	M	-	-	-	-	-	M	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC407: Digital Electronics

Course Objective:

- To Develop competence in Combinational Logic Problem formulation and Logic Optimisation
- To Develop design capability in the field of combinational logic using gates and state-of-the art MUX, ROM, PLA and PAL units

Syllabus

UNIT-1

Fundamentals of Digital Systems and logic families:Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary,signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT-2

Combinational Digital Circuits:Standard representation for logic functions, K- map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT-3

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT-4

A/D And D/A Converters:Digital to analog converters: weightedresistor/converter, R-2R Ladder D/A converter, specifications for D/Aconverters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter,

dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT-5

Semiconductor memories and Programmable logic devices:-Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA)

Text Books

1. Digital Electronics, A. Anand Kumar, PHI
2. Modern Digital Electronics, R.P. Jain, TMH
3. Digital Electronics, Rishabh Anand, Khanna Publishing House

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand working of logic families and logic gates.

CO2: Discuss Combinational and Sequential logic circuits.

CO3: Analyze the process of Analog to Digital conversion and Digital to Analog conversion.

CO4: Develop PLDs to implement the given logical problem.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	-	-	-	-	-	M	M	-	H	H	M
CO2	L2	M	M	M	-	-	-	-	-	M	L	-	H	H	L
CO3	L4	H	H	M	M	-	-	-	-	M	M	-	M	M	M
CO4	L3	M	M	M	M	-	-	-	-	H	L	-	M	H	M
														M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC408: Electrical Machine-II Lab

Course Objective(s):

- To Acquire knowledge about the constructional details and principle of operation of alternators. Acquire knowledge about the
- To Acquire knowledge about constructional details and principle of operation of three phase and single phase induction motors.

List of Experiments

1) To study various types of starters used for 3 phase induction motor.

2) To connect two 3-phase induction motor in cascade and study their speed control.

3) To perform load test on 3-phase induction motor and calculate torque, output power, input power, efficiency, input power factor and slip for various load settings.

4) To perform no load and blocked rotor test on a 3-phase induction motor and determine the parameters of its equivalent circuits.

5) Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slips (iv) p. f. (v) Efficiency.

6) Speed control of 3- Φ Induction Motor

7) To plot the O.C.C. & S.C.C. of an alternator.

8) To determine Zs , Xd and Xq by slip test, Zero power factor (ZPF)/ Potier reactance method.

9) To determine the voltage regulation of a 3-phase alternator by direct loading.

10) To determine the voltage regulation of a 3-phase alternator by synchronous impedance method.

11) To study effect of variation of field current upon the stator current and power factor of synchronous motor andPlot V-Curve and inverted V-Curve of synchronous motor for different values of loads.

12) To synchronize an alternator across the infinite bus and control load sharing.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss the working of synchronous machines as generators and motors.

CO2. Describe testing and applications of synchronous machines.

CO3. Determine the starting and speed control of induction motors.

CO4. Know the constructional details and principle operation of alternators.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	H	-	-	-	-	M	M	-	M	H	L
CO2	L3	H	M	M	H	M	-	-	-	M	M	-	M	M	M
CO3	L5	M	L	M	M	M	-	-	-	L	L	-	H	H	L
CO4	L1	H	M	M	H	-	-	-	-	M	M	-	M	H	L
														M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC409: Power Electronics Lab

Course Objective(s):

- To provide the details of power semiconductor switches (Construction, Characteristics and operation).
- To understand the differences between signal level and power level devices.

List Of Experiments

1) Study the comparison of following power electronics devices regarding ratings, performance characteristics and applications: Power Diode, Power Transistor, Thyristor, Diac, Triac, GTO, MOSFET, MCT and SIT.

2) Determine V-I characteristics of SCR and measure forward breakdown voltage, latching and holding currents.

3) Find V-I characteristics of TRIAC and DIAC.

4) Find output characteristics of MOSFET and IGBT.

5) Find transfer characteristics of MOSFET and IGBT.

6) Find UJT static emitter characteristics and study the variation in peak point and valley point.

7) Study and test firing circuits for SCR-R, RC and UJT firing circuits.

8) Study and test 3-phase diode bridge rectifier with R and RL loads. Study the effect of filters.

9) Study and obtain waveforms of single-phase half wave controlled rectifier with and without filters. Study the variation of output voltage with respect to firing angle.

10) Study and obtain waveforms of single-phase half controlled bridge rectifier with R and RL loads. Study and show the effect of freewheeling diode.

11) Study and obtain waveforms of single-phase full controlled bridge converter with and RL loads. Study and show rectification and inversion operations with and without freewheeling diode.

12) Control the speed of a dc motor using single-phase half controlled bridge rectifier and full controlled bridge rectifier. Plot armature voltage versus speed characteristics.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Design & Construction of controlled rectifier circuits.

CO2. Discuss the operation of DC-DC choppers.

CO3. Discuss working details the operation of voltage source inverters.

CO4. Analyze the converters and design the components of them, under various load types.

CO5. Know the control of various semiconductor devices.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	H	H	H	M	-	-	-	M	M	-	M	M	L
CO2	L2	H	L	L	M	-	-	-	-	-	M	-	M	H	M
CO3	L2	H	L	M	M	-	-	-	-	-	L	-	M	H	L
CO4	L4	H	M	M	H	M	-	-	-	M	M	-	H	M	M
CO5	L1	H	M	M	H	-	-	-	-	-	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC410: Digital Electronics Lab

Course Objective(s):

- To get an insight about the basic introduction of Digital electronics.
- To Understand working of logic families and logic gates.

List of Experiments

1) To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs).

2) To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates.

3) To realize an SOP and POS expression.

4) To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.

5) To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor.

6) To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer.

7) Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven segment display.

8) Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.

9) Construct a divide by 2,4& 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.

10) Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss Combinational and Sequential logic circuits.

CO2. Understand the process of Analog to Digital conversion and Digital to Analog conversion.

CO3. Solve using PLDs to implement the given logical problem.

CO4. Know the basic introduction of Digital electronics.

CO5. Understand working of logic families and logic gates.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	L	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L3	H	M	M	H	-	-	-	-	M	M	-	M	M	L
CO3	L3	H	M	M	H	-	-	-	-	M	M	-	M	H	M
CO4	L1	M	M	L	M	-	-	-	-	-	L	-	L	H	M
CO5	L2	M	M	M	M	-	-	-	-	-	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEE PCC411: Measurement Lab

Course Objective(s):

- To provide various measurement devices, their characteristics, their operation and their limitations.
- To Analyze the dynamic response and the calibration of few instruments.

List of Experiments

1) Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes.

2) Study working and applications of Meggar, Tong-tester, P.F. Meter and Phase Shifter.

3) Measure power and power factor in 3-phase load by (i) Two-wattmeter method and (ii) One-wattmeter method.

4) Calibrate an ammeter using DC slide wire potentiometer.

5) Calibrate a voltmeter using Crompton potentiometer.

6) Measure low resistance by Crompton potentiometer.

7) Measure Low resistance by Kelvin's double bridge.

8) Measure earth resistance using fall of potential method.

9) Calibrate a single-phase energy meter by phantom loading at different power factors.

10) Measure self-inductance using Anderson's bridge.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Understand different measurement devices and its working principles.

CO2. Know the principle of calibration of a measuring instrument and plotting of calibration curves.

CO3. Demonstrate on working of ammeter, voltmeter, wattmeter, bridge and etc.

CO4. Understand statistical data analysis.

CO5. Analyze the dynamic response and the calibration of few instruments

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L1	M	L	M	M	-	-	-	-	M	L	-	L	M	M
CO3	L3	H	M	M	H	-	-	-	-	M	M	-	M	M	L
CO4	L2	M	L	L	M	-	-	-	-	-	L	-	L	M	L
CO5	L4	M	M	L	H	-	-	-	-	M	M	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 412: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

V SEMESTER

FIFTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEESC501	Electrical Materials	3	-	-	30	70	100	3
BTEEPCC502	Power System – I	3	-	-	30	70	100	3
BTEEPCC503	Control System	3	-	-	30	70	100	3
BTEEPCC504	Microprocessor	3	-	-	30	70	100	3
BTEEPCC505	Electrical Machine Design	3	-	-	30	70	100	3
Professional Elective I (any one)								
BTEEPEC506A	Restructured Power System	3	-	-	30	70	100	3
BTEEPEC506B	Electromagnetic Wave							
BTEEPEC506C	Digital Control System							
	Sub Total	18	**0**	**0**	**180**	**420**	**600**	**18**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC507	Power System-I Lab	-	-	2	30	20	50	1
BTEEPCC508	Control System Lab	-	-	2	30	20	50	1
BTEEPCC509	Microprocessor Lab	-	-	2	30	20	50	1
BTEEPCC510	System Programming Lab	-	-	2	30	20	50	1
BTEEPSIT511	Industrial Training			2	60	40	100	2
BTEESODECA512	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	--	50	1
	Sub Total	0	**0**	**10**	**180**	**120**	**350**	**7**
	TOTAL OF V SEMESTER	**18**	**0**	**10**	**360**	**540**	**950**	**25**

BTEEESC501: Electrical Materials

Course Objective:

- To provide students with a thorough understanding of the electrical properties and characteristics of various materials, used in the electrical appliances , devices , instruments and in the applications associated with generation, transmission and distribution of electric power.
- To provide students with a moderate level understanding of the physics behind the electrical engineering materials

Syllabus

UNIT-1

Elementary Materials Science Concepts:- Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect..

UNIT-2

Dielectric Properties of Insulators in Static and Alternating field:Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, Internal field in solids and liquids, Properties of Ferro-Electric materials, Polarization, Piezoelectricity, Frequency dependence of Electronic and Ionic Polarizability, Complex dielectric constant of non-dipolar solids, dielectric losses.

UNIT-3

Magnetic Properties and Superconductivity: Magnetization of matter, Magnetic Material Classification, Ferromagnetic Origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density.

UNIT-4

Conductivity of metals: Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.

UNIT-5

Semiconductor Materials:Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, Trends in materials used in Electrical Equipment.

Text Books

1. Electrical Engineering Materials by Alagappan and N and Kumar N.
2. A Course In Electrical Engineering Materials by Seth S P
3. Electrical Engineering Materials by Dekker A J
4. An Introduction to Electrical Engineering Materials by Indulkar C S and Thiruvengadam S.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: understand the material science essential to work in different industries

CO2: Motivate them to do innovative research while going for higher studies and also to work in R & D with scientific enthusiasm.

CO3: Evaluate of the electrical properties and characteristics of various materials, used in the electrical appliances, devices, instruments.

CO4: Apply the applications associated with generation, transmission and distribution of electric power.

CO5: Understand the physics behind the electrical engineering materials

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L4	M	L	L	M	-	-	-	-	M	L	-	M	H	M
CO3	L5	H	M	L	H	-	-	-	-	L	H	-	M	M	M
CO4	L3	H	L	M	M	-	-	-	-	M	M	-	H	H	M
CO5	L2	M	M	L	M	-	-	-	-	-	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC502: Power System-I

Course Objective:

- To Awareness of general structure of power system.
- To make students capable of analysis of mechanical and electrical design aspects of transmission system.
- To Impart the knowledge of protective relays and circuit breakers.

Syllabus

UNIT-1

Basic Concepts**:**-Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

UNIT-2

Power System Components:-Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance calculations for simple configurations. Travelling-wave Equations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Transformers: Three-phase connections and Phase-shifts. Three winding transformers, autotransformers, Neutral Grounding transformers. Tap-Changing in transformers. Transformer Parameters. Single phase equivalent of three-phase transformers. Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Real and Reactive Power Capability Curve of generators. Typical waveform under balanced terminal short circuit conditions – steady state, transient and sub transient equivalent circuits. Loads: Types, Voltage and Frequency Dependence of Loads. Per-unit System and per-unit calculations.

UNIT-3

Over-voltages and Insulation Requirements:-Generation of Over-voltages: Lightning and Switching Surges. Protection against Overvoltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges. Bewley Diagrams.

UNIT-4

Fault Analysis and Protection Systems:-Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding. Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

UNIT-5

Introduction to DC Transmission & Renewable Energy Systems DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission. Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators. Power Electronics interfaces of wind generators to the grid

Text Books

1. Modern Power System Analysis, Kothari Nagrath, McGraw Hill Education
2. Power System Operation and Control, S. Sivanagaraju & G. Sreenivasan, Pearson
3. Electrical Power Systems, C.L. Wadhwa, Newage Publishers

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss the concepts of power systems.
CO2: Describe the various power system components.
CO3: Evaluate fault currents for different types of faults.
CO4: Understand the design of basic protection schemes.
CO5: Classify the concepts of HVDC power transmission and renewable energy generation.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	L	L	-	-	-	-	-	M	-	M	H	M
CO2	L1,L2	H	L	L	L	-	-	-	-	M	L	-	H	M	M
CO3	L5	H	M	M	M	-	-	-	-	M	M	-	L	H	M
CO4	L2	H	L	L	L	-	-	-	-	-	M	-	M	H	L
CO5	L4	M	L	M	M	-	-	-	-	M	L	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC503: Control System

Course Objective:

- To obtain models of dynamic systems in transfer function and state space forms
- To provide the common control schemes
- To Analyze the system response and stability in both time-domain and frequency domain

Syllabus

UNIT-1

Introduction to control problem:-Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra

UNIT-2

Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT-3

Frequency-response analysis :-Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT-4

Introduction to Controller Design:-Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers

UNIT-5

State variable Analysis :-Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems Introduction to Optimal Control and Nonlinear Control :-Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis

Text Books

1. Control System Engineering, Nagrath & Gopal, Newage Publishers

2. Control Systems, Ambikapathy, Khanna Book Publishing Co. (P) Ltd., Delhi

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss the modeling of linear-time-invariant systems using transfer function and state-space representations.

CO2: Understand the concept of stability and its assessment for linear-time invariant systems.

CO3: Know the simple feedback controllers.

CO4: Analyze the response of discretized systems

CO5: Design compensators using time-domain and frequency domain specifications

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	M	-	M	M	L
CO2	L2	H	M	L	M	-	-	-	-	-	L	-	L	M	L
CO3	L1	M	M	M	L	-	-	-	-	M	M	-	M	M	L
CO4	L4	M	H	M	H	-	-	-	-	M	H	-	L	H	L
CO5	L6	M	M	H	M	L	-	-	-	M	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC504: Microprocessor

Course Objective:

- To provide the basics of Digital Systems.
- To understand the working of a microprocessor.
- To compile and debug a Program.
- To generate an executable file and use it.

Syllabus

UNIT-1

Fundamentals of Microprocessors: Fundamentals of Microprocessor Architecture. 8-bitMicroprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

UNIT-2

The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles**.**

UNIT-3

Instruction Set and Programming: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools..

UNIT-4

Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

UNIT-5

External Communication Interface: Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee**.** Applications:LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing

Text Books

1. Microprocessors, Ramesh Gaonkar, Penram Publications
2. Advanced Microprocessors and Peripherals, Burchandi, TMH
3. Advanced Microprocessors, AK Gautam, Khanna Publishing House

Course Outcomes:

At the end of the course, the student will be able to:

CO1: understand the assembly language programming.

CO2: Know interfacing design of peripherals like I/O, A/D, D/A, timer etc.

CO3: Adapt Develop systems using different microcontrollers.

CO4: Understand Digital configuring and using different peripherals in a digital system.

CO5: Compute and debug a Program.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	L	M	M	-	-	-	-	-	L	-	M	H	L
CO2	L1	M	L	L	L	-	-	-	-	-	M	-	L	M	M
CO3	L3	H	L	H	M	-	-	-	-	M	M	-	M	M	L
CO4	L2	M	L	L	M	-	-	-	-	-	L	-	M	H	M
CO5	L3	M	M	M	M	-	-	-	-	M	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC505: Electrical Machine Design

Course Objective:

- To Acquire knowledge to carry out a detailed design of a dc machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.
- To Acquire knowledge to carry out a detailed design of a transformer and provide the information required for the fabrication of the same along with an estimate of various performance indices.

Syllabus

UNIT-1

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

UNIT-2

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

UNIT-3

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

UNIT-4

Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT-5

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Text Books

1.Electrical Machine Design; A. K. Sawhney; Publisher: Dhanpat Rai

2. Electrical Machine Design; R.K. Agarwal; Publisher: S.K.Kataria and Sons, Delhi

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the construction and performance characteristics of electrical machines.

CO2: Know the various factors which influence the Electric machine design

CO3: Discuss the principles of electrical machine design and carry out a basic design of an ac machine.

CO4: Use software tools to do design calculations.

CO5: Describe an alternator and provide the information required for the fabrication of the same along with an estimate of various performance indices

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	L	-	M	H	L
CO2	L1	H	H	L	H	-	-	-	-	H	M	-	M	H	M
CO3	L2	M	M	H	H	-	-	-	-	M	H	-	L	M	L
CO4	L3	M	M	M	M	-	-	-	-	M	L	-	M	H	M
CO5	L1,L2	H	L	M	M	-	-	-	-	-	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC506A: Restructured Power System

Course Objective:

- To provide in-depth understanding of operation of deregulated electricity market systems..
- To train the students to analyze various types of electricity market operational and control issues under congestion management.
- To examine topical issues in electricity markets and how these are handled world-wide in various markets.
- To learn different pricing mechanism and power trading in restructured power system.

Syllabus

UNIT-1.

Introduction to restructuring of power industry: Reasons for restructuring of power industry; Understanding the restructuring process, Entities involved, The levels of competition, The market place mechanisms, Sector-wise major changes required; Reasons and objectives of deregulation of various power systems across the world

UNIT-2.

Fundamentals of Economics: Consumer and suppliers behavior, Total utility and marginal utility, Law of diminishing marginal utility, Elasticity of demand and supply curve, Market equilibrium, Consumer and supplier surplus, Global welfare, Deadweight loss

UNIT-3.

The Philosophy of Market Models : Monopoly model, Single buyer model, Wholesale competition model, Retail competition model, distinguishing features of electricity as a commodity, Four pillars of market design, Cournot, Bertrand and Stackelberg competition model

UNIT-4.

Transmission Congestion Management: Transfer capability, Importance of congestion management, Effects of congestion, Classification of congestion management methods, ATC, TTC, TRM, CBM, ATC calculation using DC and AC model, Nodal pricing, Locational Marginal Prices (LMPs), Implications of nodal pricing, Price area congestion management Capacity alleviation methods, Re-dispatching, Counter-trade, Curtailment

UNIT-5.

Ancillary Service Management: Type and start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of ancillary services.

Pricing of transmission network usage and Market power: Introduction to transmission pricing, Principles of transmission pricing, Classification of transmission pricing, Rolled-in transmission pricing paradigm. Attributes of a perfectly competitive market, The firm's supply decision under perfect competition, Imperfect competition, Monopoly, Oligopoly. Effect of market power, Identifying market power, HHI Index, Entropy coefficient, Lerner index

Text Books

1. Restructured Power System and Electricity Market Forecasting" by M M Tripathi
2. Restructured Electrical Power Systems: Operation: Trading, and Volatility (Power Engineering (Willis))" by Mohammad Shahidehpour and M Alomoush
3. Power System Restructuring and Deregulation: Trading, Performance and Inforamtion Technology?" by Lol Lei Lai

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Discuss the need for restructuring of Power Systems, discuss different market models, different stakeholders and market power.

CO2: Understand and generalize the functioning and planning activities of ISO.

CO3: Describe the transmission open access pricing issues and congestion management.

CO4: Define transfer capability and estimate the transfer capability of small power systems.

CO5: Analyze ancillary services and understand reactive power as ancillary service and management through synchronous generator.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	L	-	M	H	L
CO2	L2	L	M	M	M	-	-	-	-	-	M	-	M	M	L
CO3	L1,L2	M	H	L	L	-	-	-	-	M	L	-	L	M	M
CO4	L1	M	M	L	M	-	-	-	-	-	L	-	L	H	L
CO5	L4	H	H	M	H	-	-	-	-	M	M	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC506B: Electromagnetic Wave

Course Objective:

- To impart knowledge on the concepts of Faraday‘s law, induced emf, electromagnetic waves ,Transmission lines and Maxwell‘s equations.
- To familiarize the students with the different concepts of electrostatic, magnetostatic and time varying electromagnetic systems.
- To understand and analyze radiation by antennas.

Syllabus

UNIT-1

Transmission Lines: Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

UNIT-2

Maxwell’s Equations: Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss’s law, Ampere’s Circuital law, Faraday’s law of Electromagnetic induction. Maxwell’s equations, Surfacecharge and surface current, Boundary conditions at media interface**.**

UNIT-3

Uniform Plane Wave: Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector**.**

UNIT-4

Plane Waves at Media Interface: Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

UNIT-5

Waveguides: Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide general approach, Rectangular waveguides. Antennas: Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

Text Books

1.Electromagnetic Fields & Waves, R.L. Yadava, Khanna Publishing House

2. Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill India

3. Engineering Electromagnetics, Narayana Rao, PH

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Analyse transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
CO2: Solve real life plane wave problems for various boundary conditions.
CO3: Analyse the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.
CO4: Show TE and TM mode patterns of field distributions in a rectangular wave-guide.
CO5: Analyse radiation by antennas.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	H	H	H	-	-	-	-	-	M	-	M	M	M
CO2	L3	M	H	H	H	-	-	-	-	M	M	-	L	M	L
CO3	L4	H	M	M	H	-	-	-	-	M	L	-	L	H	L
CO4	L3	M	M	M	M	-	-	-	-	-	M	-	M	H	M
CO5	L2,L4	M	L	L	M	-	-	-	-	-	L	-	M	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC506C: Digital Control System

Course Objective:

- To understand the basic principles and modeling of digital control system in transfer function and state-space domain.
- To understand application of Laplace and Z-transforms and its correlation for digital control system.

Syllabus

UNIT-1

Discrete Representation of Continuous Systems: Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

UNIT-2

Discrete System Analysis: Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

UNIT-3

Stability of Discrete Time System: Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT-4

State Space Approach for discrete time systems: State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability. 0

UNIT-5

Design of Digital Control System: Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Discrete output feedback control: Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems

Text Books

1.Gopal, Digital Control and State Variable Methods, McGraw Higher Ed

2. A. Ambikapathy, Control Systems, Khanna Publishing House, Delhi

3. V.I. Goerge, Digital Control Systems, Cengage

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Evaluate discrete representation of LTI systems.

CO2: Analyse stability of open loop and closed loop discrete-time systems.

CO3: Design and analyse digital controllers.

CO4: Know state feedback and output feedback controllers.

CO5: Understand the basic principles and modeling of digital control system in transfer function and state-space domain.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L5	M	H	M	H	-	-	-	-	M	M	-	M	M	L
CO2	L4	H	H	M	H	-	-	-	-	M	M	-	M	H	M
CO3	L6	H	M	H	M	L	-	-	-	M	L	-	M	M	L
CO4	L1	M	L	L	M	-	-	-	-	-	M	-	L	M	L
CO5	L2	M	L	M	M	-	-	-	-	-	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC507: Power System-I Lab

Course Objective(s):

- To analyze the performance of power system networks by conducting various experiments.
- To study different power system equipment by conducting suitable experiments.

List Of Experiments

1) Generating station design: Design considerations, basic schemes and single line diagram of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations.

2) Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law.

3) Study of short term, medium term and long term load forecasting.

4) Sending end and receiving end power circle diagrams.

5) Substations: Types of substations, various bus–bar arrangements. Electrical equipment for substations.

6) Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer.

7) Design an EHV transmission line

8) Study filtration and Treatment of transformer oil.

9) Determine dielectric strength of transformer oil.

10) Determine capacitance and dielectric loss of an insulating material using Schering bridge.

11) Flash over voltage testing of insulators.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Design considerations, basic schemes and single line diagram.

CO2. Compute the experimental results and correlating them with the practical power system.

CO3. Describe layout of various power plants.

CO4. Analyze the performance of transmission lines

CO5. Know various tests on transformer.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L6	H	M	H	H	M	-	-	-	M	M	-	H	H	M
CO2	L3	M	H	L	H	-	-	-	-	-	M	-	M	M	M
CO3	L1,L2	H	L	M	L	-	-	-	-	M	L	-	H	M	L
CO4	L4	H	H	M	H	-	-	-	-	M	M	-	L	M	L
CO5	L1	M	M	L	M	-	-	-	-	-	L	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC508: Control System Lab

Course Objective(s):

- To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.
- To Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

List Of Experiments

1. (a) Plot step response of a given TF and system in state-space. Take different values of damping ratio and wn natural undamped frequency. (b) Plot ramp response.

2. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse

3. To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system.

4. To Study the frequency response of following compensating Networks, plot the graph and final out corner frequencies. (a) Leg Network (b) Lead Network. (c) Leg-lead Network.

5. Draw the bode plot in real time for a Non-Inverting amplifier.

6. Draw the bode plot in real time for an Inverting amplifier.

7. Draw the bode plot for second order transfer function.

8. Draw the bode plot for first order transfer function.

9. Design and analyse Tow- Thomas biquad filter.

10. Design and calculate Kp, Ki for PI controller.

11. Design PID controller and also calculate Kp, Ki, Kd for it.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.

CO2. Manipulate any system in Laplace domain to illustrate different specification of the system using transfer function concept.

CO3. Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.

CO4. Memorize time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.

CO5. Discuss different types of analysis in frequency domain to explain the nature of stability of the system.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	M	M	M	H	-	-	-	-	M	M	-	L	H	M
CO2	L3	M	M	L	M	-	-	-	-	-	M	-	M	M	M
CO3	L4	H	L	M	M	-	-	-	-	-	L	-	M	H	M
CO4	L1	M	L	L	M	-	-	-	-	-	M	-	L	M	L
CO5	L2	H	M	L	L	-	-	-	-	M	L	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC509: Microprocessor Lab

Course Objective(s):

- To expose students to the operation of typical microprocessor (8085) trainer kit.
- To prepare the students to be able to solve different problems by developing different programs.

List Of Experiments

1. Study the hardware, functions, memory structure and operation of 8085- Microprocessor kit.
2. Program to perform integer division: (1) 8-bit by 8-bit (2) 16-bit by 8-bit.
3. Transfer of a block of data in memory to another place in memory
4. Transfer of black to another location in reverse order.
5. Searching a number in an array.
6. Sorting of array in: (1) Ascending order (2) Descending order.
7. Finding party of a 32-bit number.
8. Program to perform following conversion (1) BCD to ASCII (2) BCD to hexadecimal.
9. Program to multiply two 8–bit numbers
10. Program to generate and sum 15 Fibonacci numbers.
11. Program for rolling display of message “India”, “HELLO”.
12. To insert a number at correct place in a sorted array.
13. Reversing bits of an 8-bit number.
14. Fabrication of 8-bit LED interfaces for 8085 kit through 8155 and 8255.
15. Data transfer on output port 8155 & 8255 & implementation of disco light, running light, and sequential lights on the above mentioned hardware.
16. Parallel data transfer between two DYNA-85 kit using 8253 ports.
17. Generation of different waveform on 8253/8254 programmable timer

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Know relevant information to supplement to the Microprocessor and Microcontroller course.

CO2. Investigate set up programming strategies and select proper mnemonics and run their program on the training boards.

CO3. Evaluate possible causes of discrepancy in practical experimental observations in comparison.

CO4. Demonstrate experimental procedures on Microprocessor and Microcontroller analyze their operation under different cases.

CO5. Classify professional quality textual and computational results, incorporating accepted data analysis and synthesis methods, simulation software, and word-processing tools.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	L	M	L	M	-	-	-	-	-	M	-	L	M	M
CO2	L4	M	L	M	M	-	-	-	-	M	L	-	M	M	L
CO3	L5	H	M	M	H	-	-	-	-	M	M	-	M	H	M
CO4	L3	M	M	M	H	-	-	-	-	-	L	-	M	M	L
CO5	L4	M	L	M	M	-	-	-	-	L	L	-	L	H	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC510: System Programming Lab

Course Objective(s):

- To familiarize the student in introducing and exploring MATLAB software.
- To enable the student on how to approach for solving Engineering problems using simulation tools

List Of Experiments

1. Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multidimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets)

2. Write a MATLAB program for designing Rheostat.

3. Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)

4. Write a program to generate Machine Op- code table using two pass Assembler.

5. Single Phase Full Wave Diode Bridge Rectifier With LC Filter

6. Simulate Three phase Half wave diode rectifier with RL load.

7. Starting Of A 5 HP 240V DC Motor With A Three-Step Resistance Starter.

8. Simulate OC/SC test of 1-phase transformer.

9. Simulate Torque- speed characteristics of induction motor.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss to express programming & simulation for engineering problems

CO2. Evaluate to find importance of this software for Lab Experimentation.

CO3. Manipulate the basic mathematical, electrical, electronic problems in Matlab.

CO4 Discuss the simulate basic electrical circuit in Simulink.

CO5. Describe programming files with GUI Simulink

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	L	M	M	-	-	-	-	-	M	-	L	M	M
CO2	L5	M	M	M	M	-	-	-	-	-	M	-	M	M	L
CO3	L3	M	L	L	M	-	-	-	-	-	M	-	M	H	M
CO4	L2	M	M	L	M	-	-	-	-	-	L	-	L	H	L
CO5	L1	L	M	M	M	-	-	-	-	-	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPSIT 511: Industrial Training

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P01 1	PO 12	PS O1	PS O2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 512: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

VI SEMESTER

SIX SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEESC601	Computer Architecture	3	-	-	30	70	100	3
BTEEPCC602	Power System-II	3	-	-	30	70	100	3
BTEEPCC603	Power System Protection	3	-	-	30	70	100	3
BTEEPCC604	Electrical Energy Conversion and Auditing	3	-	-	30	70	100	3
BTEEPCC605	Electric Drives	3	-	-	30	70	100	3
Professional Elective I (any one)								
BTEEPEC606A	Power System Planning	3	-	-	30	70	100	3
BTEEPEC606B	Digital Signal Processing							
BTEEPEC606C	Electrical and Hybrid Vehicles							
	Sub Total	18	**0**	**0**	**180**	**420**	**600**	**18**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC607	Power System-II Lab	-	-	2	30	20	50	1
BTEEPCC608	Electric Drives Lab	-	-	2	30	20	50	1
BTEEPCC609	Power System Protection Lab	-	-	2	30	20	50	1
BTEEPCC610	Modelling and Simulation Lab	-	-	2	30	20	50	1
BTEESODECA611	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	--	50	1
	Sub Total	0	**0**	**8**	**120**	**80**	**250**	5
	TOTAL OF VI SEMESTER	**18**	**0**	**8**	**300**	**500**	**850**	**23**

BTEEECS601: Computer Architecture

Course Objective(s):

- To understand the basic principles and hardware structures of computer systems including personal computers and workstations
- To provide how to design computers.
- To cover data representation, CPU organization, instruction classification, language processing of assemblers and compilers, pipelining for performance enhancement, memory hierarchy, cache memory, and IO peripheral devices. In addition, high-performance computer systems are to be introduced.

Syllabus

UNIT-1

Introduction to computer organization: Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organisation

UNIT-2

Memory organization System: memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks

UNIT-3

Input – output Organization: Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

UNIT-4

16 and 32 microprocessors: 80 x 86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

UNIT-5

Pipelining: Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set Different Architectures: VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

Text Books

1. Computer Fundamentals Architecture and Organization, B. Ram, New Age
2. Computer Organization & Architecture, Rajaraman, PHI Learning

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Understand the concepts of microprocessors, their principles and practices.

CO2: Describe the efficient programs in assembly language of the 8086 family of microprocessors.

CO3: Organize a modern computer system and be able to relate it to real examples.

CO4: Discuss the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5: Discuss embedded applications using ATOM processor.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L3	H	M	M	M	-	-	-	-	-	L	-	M	M	M
CO2	L1	M	L	L	M	-	-	-	-	M	M	-	M	M	M
CO3	L4	M	M	M	H	-	-	-	-	M	M	-	L	H	L
CO4	L2	M	M	M	M	-	-	-	-	-	M	-	M	M	M
CO5	L2	M	M	M	M	-	-	-	-	-	L	-	L	L	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC602: Power System-II

Course Objective(s):-

- To provide knowledge of load density calculation in an area and forecasting of load in advance using different methods.
- To provide the information of power system economics and factors affecting the economic load dispatch.

Syllabus

UNIT-1

Power Flow Analysis: Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.

UNIT-2

Stability Constraints in synchronous grids: Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

UNIT-3

Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap Changing Transformers. Power flow control using embedded dc links, phase shifters

UNIT-4

Monitoring and Control:Overview of Energy Control Centre Functions**:** SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control

UNIT-5

Power System Economics and Management: Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework

Text Books

1. Modern Power System Analysis, Kothari & Nagrath, McGraw Hill Education
2. Power System Operation and Control, Sivanagaraju & Sreenivasan, Pearson
3. Electrical Power Systems, C.L. Wadhwa, Newage Publishers

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Use numerical methods to analyse a power system in steady state.

CO2: Understand stability constraints & improvement in a synchronous grid.

CO3: Describe various methods to control the voltage, frequency and power flow.

CO4: Understand the monitoring and examine of a power system.

CO5: Evaluate of power system economics.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L2	M	M	L	L	-	-	-	-	-	M	-	M	M	M
CO3	L1,L2	M	M	L	M	-	-	-	-	M	L	-	L	M	M
CO4	L2	M	L	M	M	-	-	-	-	-	M	-	L	M	L
CO5	L5	M	M	M	M	-	-	-	-	M	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC603: Power System Protection

Course Objective(s):-

- To discuss protection of power systems against faults and transient over voltages
- To introduce students to power system protection and switchgear.
- To teach students theory and applications of the main components used in power system protection for electric machines, transformers, bus bars, overhead feeders.
- To teach students the theory, construction, applications of main types Circuit breakers, Relays for protection of generators, transformers and protection of feeders from over-voltages and other hazards.

Syllabus

UNIT-1

Introduction and Components of a Protection System: Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers.

UNIT-2

Faults and Over-Current Protection:Review of Fault Analysis, Sequence Networks. Introduction to Over-current Protection and over-current relay co-ordination.

UNIT-3

Equipment Protection Schemes: Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.

UNIT-4

Digital Protection: Computer-aided protection, Fourier analysis and estimation of Phasor from DFT. Sampling, aliasing issues.

UNIT-5

Modeling and Simulation of Protection Schemes: CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing. System Protection**:** Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of- step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text Books

1. Power System Protection & Switchgear, TMH Publisher, by Badri Ram.

2. Switchgear & Protection, Haroon Asfaq, Khanna Book Publishing

3. Switchgear & Protection, Khanna publication, By S S Rao

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Discuss the different components of a protection system.

CO2: Evaluate fault current due to different types of fault in a network.

CO3: Describe the protection schemes for different power system components.

CO4: Discuss the Computer-aided protection.

CO5: Categorize various system protection schemes, and the use of wide-area measurements

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	L	M	-	-	-	-	-	M	-	M	H	M
CO2	L5	H	M	M	H	-	-	-	-	M	L	-	M	H	M
CO3	L1.L2	M	L	M	M	-	-	-	-	M	L	-	L	M	L
CO4	L2	M	M	L	M	-	-	-	-	-	L	-	M	M	L
CO5	L4	H	L	L	M	-	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC604: Electrical Energy Conservation and Auditing

Course Objective(s):-

- To design and development of various energy management technologies.
- To identify, formulate and solve fields problem in a multi-disciplinary frame individually or as a member of a group.

Syllabus

UNIT-1

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

UNIT-2

Basics of Energy and its Various Forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion**.**

UNIT-3

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

UNIT-4

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT-5

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems. Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology

Text Books

1.Energy Engineering and Management by Chakrabarti A.

2.Coal India Limited Management Trainee Electrical Engineering by GKP.

3. Handbook on Energy Audit and Environment Management by Y P Abbi and Shashank Jain.

4. Energy Management and Conservation by K V Sharma and P Venkataseshaiah.

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Understandthe current energy scenario and importance of energy conservation.

CO2: Analyze the concepts of energy management.

CO3: Describe the methods of improving energy efficiency in different electrical systems.

CO4: Calculate the concepts of different energy efficient devices.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L4	H	M	M	H	-	-	-	-	M	M	-	M	M	M
CO3	L1,L2	M	M	M	M	-	-	-	-	-	L	-	M	H	M
CO4	L3	H	H	L	H	-	-	-	-	M	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC605: Electrical Drives

Course Objective(s):-

- To provide basics of electric drive analysis.
- To be able to analyze and design systems with electric drive.
- To provide fundamental knowledge in dynamics and control of Electric Drives.
- To justify the selection of Drives for various applications.

Syllabus

UNIT-1

DC motor characteristics: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque- speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation

UNIT-2

Chopper fed DC drive: Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.Multi-quadrant DC drive: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single- quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking

UNIT-3

Closed-loop control of DC Drive: Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design

UNIT-4

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

UNIT-5

Scalar control or constant V/f control of induction motor:Review of three-phase voltage source inverter, generation of three- phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation Control of slip ring induction motor:Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery

Text Books

1.Fundamentals of Electrical Drives, Dubey, Narosa Publishing House

2. Electrical drives by De Nisit K and Sen Prasanta K.

3.Electric Motor Drives by R Krishnan

Course Outcomes:

At the end of the course, the student will be able to:

CO1: summarize the basics of electric drive analysis

CO2**:** Discuss the characteristics of dc motors and induction motors.

CO3: Calculate the speed-control of dc motors and induction motors.

CO4: Examine Scalar control or constant V/f control & PWM Signal of induction motor

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	M	-	M	M	M
CO2	L2	H	M	M	M	-	-	-	-	-	M	-	L	H	M
CO3	L3	M	M	M	H	-	-	-	-	M	L	-	L	H	L
CO4	L4	M	M	M	M	-	-	-	-	M	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC606A: Power System Planning

Course Objective(s):-

- To analyze and evaluate an electric power system for generation planning and load forecasting, and
- To execute production costing analysis and long term generation expansion plans in a deregulated environment

Syllabus

UNIT-1

Introduction of power planning: National and Regional Planning, structure of Power System, planning tools. Electricity Regulation, Electrical Forecasting, forecasting techniques modeling.

UNIT-2

Power system Reliability: System Reliability, Reliability Planning Criteria for Generation, Transmission and Distribution, Grid Reliability, Reliability Target, Security Requirement, Disaster Management, Roadmap for Reliability and Quality.

UNIT- 3

Generation Planning: Objectives & Factors affecting Generation Planning, Generation Sources, Integrated Resource Planning, Generation System Model, Loss of Load (Calculation and Approaches), Outage Rate, Capacity Expansion, Scheduled Outage, Loss of Energy, Evaluation Methods. Interconnected System, Factors affecting interconnection under Emergency Assistance.

UNIT-4

Transmission & Distribution Planning: Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability. Radial Networks – Introduction, Network Reconfiguration, Evaluation Techniques, Interruption Indices, Effects of Lateral Distribution Protection, Effects of Disconnects, Effects of Protection Failure, Effects of Transferring Loads, Distribution Reliability Indices

UNIT-5

Demand Side Planning: Computer aided planning, wheeling. Environmental effects, the greenhouse effect. Technological impacts. Insulation coordination. Reactive compensation

Text Books

1 Electrical Power System Design, M. V. Deshpande

2 Electrical Power System Design, B. R. Gupta

3 A Course in Electrical Power,Soni, Gupta & Bhatnagar

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand and distinguish characteristics of distribution systems from transmission systems

CO2: Discuss the distribution system design based on forecasted data

CO3: Identify and draw the appropriate sub–station location

CO4: Describe distribution system for a given geographical service area from alternate design alternatives

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	M	M	M	-	-	-	-	-	M	-	M	H	L
CO2	L2	M	M	H	M	-	-	-	-	M	L	-	L	M	L
CO3	L3	M	M	M	H	-	-	-	-	M	L	-	M	M	M
CO4	L1,L2	M	L	M	L	-	-	-	-	M	L	-	M	H	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC606B: Digital Signal Processing

Course Objective(s):-

- To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
- To make students aware about the meaning and implications of the properties of systems and signals.

Syllabus

UNIT-1

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

UNIT-2

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

UNIT-3

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

UNIT-4

Design of Digital filters: Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non- parametric spectral estimation. Introduction to multi-rate signal processing

UNIT-5

Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Text Books

1. Digital Signal Processing, S. Salivahanan, McGraw Hill
2. Digital Signal Processing, S.K. Mitra, TMH
3. Digital Signal Processing, Ashok Ambardar, Cengage
4. Digital Signal Processing, A. Anand Kumar, PHI

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Define signals mathematically in continuous and discrete-time, and in the frequency domain.

CO2:Analyse discrete-time systems using z-transform.

CO3: Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.

CO4: Define the digital filters for various applications.

CO5: Apply digital signal processing for the analysis of real-life signals.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	L	M	M	-	-	-	-	M	M	-	M	H	M
CO2	L4	H	H	M	H	-	-	-	-	M	L	-	-	H	M
CO3	L2	H	L	M	M	-	-	-	-	-	L	-	-	M	H
CO4	L1	M	L	M	M	-	-	-	-	-	M	-	L	M	H
CO5	L3	M	M	L	M	-	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC606C: Electrical and Hybrid Vehicles

Course Objective(s):-

- To focus on mechatronic system and component design of HEV based on the requirements to power flow management, power conversion and thus to vehicle dynamics and energy/fuel efficiency.

Syllabus

UNIT-1

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT-2

Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT-3

Electric Trains Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-4

Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

UNIT-5

Energy Management Strategies:: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Text Books

1. Electric and Hybrid Vehicles by Tom Denton.

2. Electric and Hybrid Vehicles: Technologies, Modeling and Control – A Mechatronic Approach (Wiley Desktop Editions) by Amir Khajepour and M Saber Fallah.

3. Electric and Hybrid Vehicles: Design Fundamentals, Second Edition by Iqbal Husain.

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Describe hybrid vehicles and their performance.

CO2:Discuss the different possible ways of energy storage.

CO3: Examine the different strategies related to energy storage systems.

CO4: Draw the electric vehicle drive systems

CO5: Describe of energy management strategies

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1,L2	M	M	M	M	-	M	M	-	-	M	-	M	M	M
CO2	L2	H	M	M	M	-	-	-	-	-	L	-	M	H	H
CO3	L4	M	L	L	M	-	-	-	-	M	L	-	L	H	H
CO4	L3	M	M	L	L	-	L	M	-	M	M	-	M	H	M
CO5	L1	L	M	M	L	-	-	-	-	-	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC607: Power System-II Lab

Course objective(s):-

- To analyze the performance of power system networks by conducting various experiments.
- To study different power system protective equipment by conducting suitable experiments.
- To develop computer programs for analysis of power systems

List Of Experiments

1. Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault.
2. Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software.
3. Three phase short circuit analysis in a synchronous machine (symmetrical fault analysis)
4. Study of voltage security analysis.
5. Study of overload security analysis and obtain results for the given problem using MATLAB or any software.
6. Study of economic load dispatch problem with different methods.
7. Study of transient stability analysis using MATLAB/ETAP Software.
8. Power flow analysis of a slack bus connected to different loads.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understanding the students to do load flow and short circuit calculations

CO2**:** Examine and computational analysis on power systems

CO3: Solve power flow problem using numerical method

CO4: Discuss the numerical methods for solution of stability analysis

CO5: Describe the deregulated power system

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	-	-	-	-	M	-	M	H	H
CO2	L4	H	M	L	M	-	-	-	-	M	L	-	M	H	H
CO3	L3	H	M	L	H	-	-	-	-	M	M	-	M	M	M
CO4	L2	M	M	M	L	-	-	-	-	M	M	-	L	M	M
CO5	L1,L2	M	M	L	M	-	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC608: Electric Drives Lab

Course objective(s):-

- To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics
- To impart industry oriented learning
- To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

List Of Experiments

1. Study and test the firing circuit of three phase half controlled bridge converter.
2. Power quality analysis of 3 phase half controlled bridge converter with R and RL loads.
3. Power Quality analysis of 3-phase full controlled bridge converter feeding R and RL load.
4. Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads.
5. Experimental analysis of 3-phase AC voltage regulator with delta connected, star connected (with floating load), R& RL load
6. Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic.
7. Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic.
8. Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator.
9. Control speed of a 3-phase BLDC motor.
10. Control speed of a 3-phase PMSM motor using frequency and voltage control
11. Control speed of universal motor using AC voltage regulator.
12. Study 3-phase dual converter.
13. Study speed control of dc motor using 3-phase dual converter.
14. Study three-phase cyclo-converter and speed control of synchronous motor using cyclo-converter.
15. Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know basics of electric drive System

CO2**:** Understand the Performance of the fundamental control practices associated with AC and DC machines like starting, reversing, braking, plugging, etc.

CO3: calculation the operation of inverters and Cyclo converters

CO4: Evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	M	L	M	-	-	-	-	-	M	-	L	H	M
CO2	L2	M	M	M	M	-	-	-	-	-	L	-	M	M	L
CO3	L3	H	M	M	H	-	-	-	-	M	M	-	M	M	M
CO4	L5	M	M	M	M	-	-	-	-	M	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC609: Power System Protection Lab

Course objective(s):-

- To provide experimental and project oriented verification of principles of industrial system design and power system protection.
- To get laboratory experience that will be invaluable to a student who intends to make power engineering his professional career.

List Of Experiments

1. To determine fault type, fault impedance and fault location during single line to ground fault.
2. To determine fault type, fault impedance and fault location during single line-toline fault.
3. To determine fault type, fault impedance and fault location during double line to ground fault.
4. To study the operation of micro-controller based over current relay in DMT type and IDMT type.
5. To analyse the operation of micro-controller based directional over current relay in DMT type and IDMT type.
6. To study the micro-controller based under voltage relay.
7. To study the micro-controller based over voltage relay.
8. To study the operation of micro-controller based un-biased single-phase differential relay.
9. To study the operation of micro-controller based biased single-phase differential relay.
10. To study the operation of micro-controller un-based biased three phase differential relay.
11. To study the operation of micro-controller based biased three phase differential relay.

Course Outcomes:

At the end of the course, the student will be able to:

CO1**:** Calculate the fault current due to different types of fault in a network.

CO2: Use of microcontrollers for protection System

CO3: Understand the basic principles of digital protection.

CO4: Describe the fundamentals of electromechanical relays and digital protective relaying

CO5: Classify the construction & working principle of directional over current protection

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L4	H	H	H	H	-	-	-	-	M	M	-	L	M	M
CO2	L3	H	M	M	H	-	-	-	-	-	L	-	M	M	M
CO3	L2	M	L	M	M	-	-	-	-	-	L	-	M	H	M
CO4	L1,L2	M	M	M	M	-	-	-	-	M	M	-	M	M	M
CO5	L4	M	M	L	M	-	-	-	-	M	M	-	L	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC610: Modelling and Simulation Lab

Course objective(s):-

- To introduce various system modeling and simulation techniques, and highlight their applications in different areas.
- To do modeling, design, simulation, planning, verification and validation. After learning the simulation techniques, the students are expected to be able to solve real world problems which cannot be solved strictly by mathematical approaches

List of Experiments

1. Simulate Swing Equation in Simulink (MATLAB)
2. Modeling of Synchronous Machine.
3. Modeling of Induction Machine.
4. Modeling of DC Machine.
5. Simulate simple circuits.
6. (a) Modeling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device.
7. (a) Modeling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices.
8. FACTS Controller designs with FACT devices for SMIB system.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Use of these tools for any engineering and real time applications

CO2**:** Describe the Implement the simulation model using MATLAB.

CO3:Describe the working principles of FACTS devices and their operating characteristics.

CO4: Understand the modelling and simulation of various machines.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L3	H	M	M	M	-	-	-	-	-	M	-	M	M	M
CO2	L2	M	M	M	H	-	-	-	-	M	M	-	M	H	H
CO3	L1	M	M	M	M	-	-	-	-	M	L	-	L	H	H
CO4	L2	L	L	L	L	-	-	-	-	-	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 611: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

VII SEMESTER

SEVENTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Professional Elective I (any one)								
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEPEC701A	Wind & Solar Energy Systems.	3	-	-	30	70	100	3
BTEEPEC701B	Power Quality and FACTS							
BTEEPEC701C	Control System Design							
Open Elective I (any one)								
BTEEOEC702A	Principle of Electronic Communication	3	-	-	30	70	100	3
BTEEOEC702B	Water Pollution Control Engineering							
BTEEOEC702C	Micro and Smart System Technology							
	Sub Total	6	**0**	**0**	**60**	**140**	**200**	**6**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC703	Embedded System Lab	-	-	4	60	40	100	2
BTEEPCC704	Advanced Control System Lab	-	-	4	60	40	100	2
BTEEPSIT705	Industrial Training	1	-	0	30	20	50	1
BTEEPSIT706	Seminar	2	-	0	30	20	50	1
BTEESODECA707	Social Outreach, Discipline & Extra Curricular Activates			0	-	-	50	1
Sub Total		3	**0**	**8**	**180**	**120**	**350**	**7**
TOTAL OF VII SEMESTER		**9**	**0**	**8**	**240**	**260**	**550**	**13**

BTEEPEC701A: Wind and Solar Energy Systems

Course Objective(s):-

- To understand the various forms of non conventional energy resources.
- To provide the present energy scenario and the need for energy conservation
- To explain the concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial application

Syllabus

Unit-1

Physics of Wind Power

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics- probability distributions, Wind speed and power-cumulative distribution functions.

Unit-2

Wind Generator Topologies

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Unit-3

Solar Photovoltaic

Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit-4

Network Integration Issues

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems

Unit-5

Solar Thermal Power Generation

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Text Books/ Reference Books:

T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005.

G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.

S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.

H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” John Wiley and Sons Ltd., 2006.

G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004.

J. A. Duffie and W. A. Beckman, “Solar Engineering of Thermal Processes”, John Wiley & Sons, 1991

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Know the History of wind energy resources and different Function.

CO2. Discuss Winds energy as alternate form of energy and to know how it can be tapped

CO3 Use of solar energy and the various components used in the energy production with respect to applications

CO4 Classify about the Hybrid and isolated operations of solar PV and wind systems

CO5: Understand the Power system interconnection system

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	M	M	M	-	M	M	-	-	M	-	M	M	L
CO2	L2	M	M	M	M	-	M	M	-	M	M	-	L	M	L
CO3	L3	H	M	L	M	-	L	-	-	M	L	-	M	H	M
CO4	L4	H	M	M	M	-	M	M	-	-	M	-	M	H	M
CO5	L2	M	L	M	M	-	-	-	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, ‘-’ for No correlation

BTEEPEC701B : Power Quality and FACTS

Course Objective(s):-

- To impart knowledge about the power quality and its assessments.
- To provide the concept of power flow control through various power electronic controllers including state of art FACTS controllers, operational aspects, capabilities and their integration in power flow analysis.
- To provide the effectiveness of Filters in distribution system for harmonic mitigation etc.
- To know the application of FACTS controllers as case studies in the power System

Syllabus

Unit-1

Transmission Lines and Series/Shunt Reactive Power Compensation

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation

Unit-2

Thyristor-based Flexible AC Transmission Controllers (FACTS)

Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Unit-3

Voltage Source Converter based (FACTS) controllers

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter

Unit-4

Application of FACTS

Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single- machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Waveform Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve..

Unit-5

DSTATCOM

Reactive Power Compensation, Harmonics and Unbalance mitigationin Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM**.**

Dynamic Voltage Restorer and Unified Power Quality Conditioner- Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.

Text/Reference Books

1 N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.

2 K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.

3 T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.

4 R. C. Dugan, "Electrical Power Systems Quality", McGraw Hill Education, 2012.

5 G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know the basic concept of active and reactive power in electrical power system

CO2: Apply Modeling concepts of commonly used FACTS controllers will be understood.

CO3: Understand how FACTS controllers, enhance the power system stability.

CO4: Solved FACTS devices improve the power system operation

CO5: Identify Application of harmonics filters for harmonic mitigation shall be understood

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	M	M	M	-	-	-	-	-	L	-	M	H	H
CO2	L3	M	M	M	H	-	-	-	-	-	M	-	M	M	M
CO3	L2	M	L	L	M	-	-	-	-	M	M	-	L	H	M
CO4	L4	M	M	M	M	-	-	-	-	-	L	-	M	H	H
CO5	L2	L	L	M	M	-	-	-	-	M	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC 701C : Control System Design

Course Objective(s):-

- To teach the fundamental concepts of Control systems and mathematical modelling of the system.
- To teach the concept of time response and frequency response of the system.
- To teach the basics of stability analysis of the system.
- To understand and differentiate the basics of linear time-invariant control system.

Syllabus

Unit-1

Design Specifications

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

Unit-2

Design of Classical Control System in the time domain:

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

Design of Classical Control System in frequency domain

Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

Unit-3

Design of PID controllers:

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control

Unit-4

Control System Design in state space:

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Unit-5

Nonlinearities and its effect on system performance:

Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis

Text Books/ Reference Books:

1 N. Nise, “Control system Engineering”, John Wiley, 2000.
2 I. J. Nagrath and M. Gopal, “Control system engineering”, Wiley, 2000.
3 M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.
4 K. Ogata, “Modern Control Engineering”, Prentice Hall, 2010.
5 B. C. Kuo, “Automatic Control system”, Prentice Hall, 1995.
6 J. J. D’Azzo and C. H. Houpis, “Linear control system analysis and design (conventional and modern)”, McGraw Hill, 1995.
7 R. T. Stefani and G. H. Hostetter, “Design of feedback Control Systems”, Saunders College Pub, 1994

Course Outcomes:

At the end of the course, the student will be able to:

CO1.Understand alternate representations of dynamic systems (time domain, frequency domain, state space)

CO2. Define various design specifications in the system .

CO3. Calculate the controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).

CO4 Design controllers using the state-space approach.

CO5. Discuss effect of various non-linarites on system performance

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	M	-	M	H	M
CO2	L1	H	M	M	M	-	-	-	-	M	M	-	M	M	M
CO3	L4	M	H	M	H	-	-	-	-	M	M	-	L	M	M
CO4	L6	M	M	H	M	-	-	-	-	M	L	-	M	M	M
CO5	L2	M	M	L	H	-	-	-	-	-	L	-	M	M	M

H- High, M- Moderate, L- Low, ‘-’ for No correlation

BTEEOEC702A: Principle of Electronic Communication

Course objective(s):-

- To Impart knowledge on analog and digital modulation techniques as well as make the students to understand about various wireless and cellular, mobile, satellite and telephone communication systems

Syllabus

Unit-1

Introduction:

Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels**.**

Unit-2

Simple description on Modulation:

Analog Modulation-AM, Frequency modulation-FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

Unit -3

Telecommunication Systems:

Telephones Telephone system, Paging systems, Internet, Telephony.

Networking and Local Area Networks:

Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

Unit-4

Satellite Communication:

Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication:

Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

Unit-5

Cellular and Mobile Communications:

Cellular telephone systems, AMPS, GSM, CDMA and WCDMA.

Wireless Technologies:

Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

D. Rao: Renewable Energy

H. Khan: Non-Conventional Energy Resources, MGH.

Reference Books:

N. Mathur: Non-Conventional Resources of Energy.

Boyle: Renewable Energy, 3rded Oxford.

Bent Sorensen, 4th ed.: Renewable Energy, Elsevier.

V. N. Kishore: Renewable Energy Engineering and Technology, TERI.

Garg & Prakash: Solar Energy : Fundamentals and Applications, MGH

David Boyles: Bio Energy, Elis Horwood Ltd.,

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Understand the work on various types of modulations

CO2. Use of these communication modulations in implementation

CO3 Classify various wireless and cellular, mobile and telephone communication systems

CO4. Analyze different parameters of analog communication techniques

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	-	L	-	M	H	H
CO2	L3	M	M	M	M	M	-	-	-	M	M	-	L	H	H
CO3	L4	M	L	M	M	M	M	-	-	M	L	-	M	H	M
CO4	L4	M	L	M	M	M	-	-	-	-	L	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEOEC702B: Water Pollution control Engineering

Course Objective(s):-

- To provide students with a scientific and technical background in water quality monitoring, pollution control technologies and environmental management.
- To focus on unit operations for municipal and industrial wastewater treatment. Students will also be introduced to the European legislative framework on water quality.

Syllabus

Unit-1

Introduction:

Characterisation and monitoring of industrial and municipal waste water, recycling and reuse of wastewater. Basic philosophy and selection of water pollution treatment plants; Design criteria: hydraulic loading rate, organic loading rate, residence time, dilution rate.

Unit-2

Physico-Chemical Treatment Methods:

Sedimentation, coagulation, flocculation, thickening, floatation. Biological Treatment Fundamentals: Microbial metabolism, bacterial growth kinetics; Biological nitrification, denitrification and phosphorus removal; Anerobic fermentation and aerobic treatment.

Unit-3

Aerobic Suspended and Attached Growth Biological Treatment Processes:

Aerated lagoon, activated sludge systems, trickling filter, sequential batch reactor, fluidized bed bioreactors. Anaerobic Suspended and Attached Growth Biological Treatment Processes: UASB and hybrid UASB reactors, bio-towers.

Unit-4

Advanced Treatment Processes:

Membrane processes- reverse osmosis, ultrafiltration, nanofiltration and electrodialysis; Wet air oxidation, adsorption and ion-exchange; Wet-land and root-zone treatment of industrial and municipal wastes; Design of sludge drying beds, thermal and biological processes for sludge and land fillings.

Unit-5

Case Studies: Waste water treatment and disposal strategies in petroleum, petrochemical, fertilizer, distillery, pulp and paper industries.

Text Books/ Reference Books:

- Pollution Control in Process Industries" by Mahajan S P.
- " Liquid waste of Industry – Theories, Practices and Treatment" by N L Nemerow.
- " Physico-Chemical Processes for Water Quality Control" by W J Weber.
- " Industrial Gas Cleaning" by W Strauss.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Define control common water pollutants in municipal and industrial wastewater.

CO2: Describe unit operations used for wastewater treatment

CO3: Show how to look at the major water pollutants, their sources, physical, chemical and biological transformations and impacts.

CO4: Calculate the various unit operations and unit processes used in water treatment

CO5. Interpret the results of laboratory analysis for water characterization

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	L	L	M	-	M	M	-	-	M	-	H	M	L
CO2	L1,L 2	H	M	M	M	-	M	M	-	M	M	-	M	M	M
CO3	L6	H	M	M	H	-	-	M	-	-	M	-	L	H	L
CO4	L3	M	M	L	H	-	M	-	-	M	L	-	M	M	L
CO5	L4	M	M	M	M	-	-	-	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEOEC702C: Micro and Smart System Technology

Course objective(s):-

- To gain knowledge of Smart Materials, Sensors & Actuators, Microsystems.
- To Understand the Operation of Smart Devices & Systems, Electronic Circuits & Control for MEMS, Methodology of Micro-manufacturing.

Syllabus

Unit-1

Introduction: introduction to micro and smart systems: (a) Smart-material systems- History, Introduction and evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products. (b) Microsystems- Introduction, History and their evolution, Feynman's vision. Micro machined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products

Unit-2

MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:

a) Definitions and salient features of sensors, actuators, and systems.

b) Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conduct metric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.

c) Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print head, electrostatic comb-drive and micro motor, magnetic micro relay, shape memory-alloy based actuator, electro-thermal actuator.

d) Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin.

Unit-3

MICROMANUFACTURING AND MATERIAL PROCESSING:

a. Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.

b. Silicon micromachining: surface, bulk, moulding, bonding based process flows.

c. Thick-film processing:

d. Smart material processing: e. Processing of other materials: ceramics, polymers and metals f. Emerging trends

Unit-4

MODELING:

a. Scaling issues.

b. Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.

c. Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

Unit-5

INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples. Examples from smart systems and micromachined accelerometer or a thermal cycler BEL pressure sensor, thermal cycler for DNA amplification, and active vibration control of a beam

Text Books/ Reference Books:

1. MEMS & Microsystems: Design and Manufacture, Tai-Ran Tsu,Tata Mc- Graw-Hill.

2. "Micro and Smart Systems" by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof.K.N.Bhat., John Wiley Publications.

3. Microsystems Design, S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.

4. Analysis and Design Principles of MEMS Devices, Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.

5. Design and Development Methodologies, Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.

6. MEMS- Nitaigour Premchand Mahalik, The Mc-GrawHill 2007.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Define Smart Materials, Sensors & Actuators , Microsystems.

CO2: Understand the Working Methodology of Smart Devices & Systems, Electronic Circuits & Control for MEMS, Methodology of Micro-manufacturing

CO3: Discuss the Working Methodology of Elastic deformation and stress analysis of beams and plates

CO4: Apply knowledge of Integration of microelectronics and micro devices

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	L	L	L	-	-	-	-	-	M	-	-	H	H
CO2	L2	H	M	M	H	-	-	-	-	M	L	-	M	M	M
CO3	L2	M	M	M	M	-	-	-	-	M	M	-	-	H	M
CO4	L3	M	L	M	M	-	-	-	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC703: Embedded System Lab

Course objective(s):-

- To make students familiar with the basic concepts and terminology of the target area, the embedded systems design flow.
- To give students an understanding of the embedded system architecture.
- To acquaint students with methods of executive device control and to give them opportunity to apply and test those methods in practice;

List of Experiments

1 Introduction to Embedded Systems and their working.

2 Data transfer instructions using different addressing modes and block transfer.

3 Write a program for Arithmetic operations in binary and BCD-addition, subtraction, multiplication and division and display.

4 Interfacing D/A converter & Write a program for generation of simple waveforms such as triangular, ramp, Square etc.

5 Write a program to interfacing IR sensor to realize obstacle detector.

6 Write a program to implement temperature measurement and displaying the same on an LCD display.

7 Write a program for interfacing GAS sensor and perform GAS leakage detection.

8 Write a program to design the Traffic Light System and implement the same using suitable hardware.

9 Write a program for interfacing finger print sensor.

10 Write a program for Master Slave Communication between using suitable hardware and using SPI

11 Write a program for variable frequency square wave generation using with suitable hardware.

12 Write a program to implement a PWM based speed controller for 12 V/24V DC Motor incorporating a suitable potentiometer to provide the set point.

Course Outcomes:

At the end of the course, the student will be able to:

CO1:Understand basic concepts in the embedded computing systems area

CO2: Know the applications of embedded systems

CO3: Distinguish the optimal composition and characteristics of an embedded system

CO4: Compute the program an embedded system at the basic level

CO5: Discuss the development of embedded software

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	H	-	-	-	-	-	L	-	M	H	M
CO2	L1	M	L	L	M	-	-	-	-	-	M	-	M	H	H
CO3	L4	M	M	M	M	-	-	-	-	M	M	-	M	H	H
CO4	L3	M	M	L	H	-	-	-	-	M	L	-	L	M	M
CO5	L2	M	M	M	M	-	-	-	-	M	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC704: Advanced Control System Lab

Course objective(s):-

- To have a strong knowledge on MATLAB software**.**
- To get the basic knowledge on practical control system
- To get the knowledge on applications of machines & electronic devices with control systems.

List of Experiments

1 Determination of transfer functions of DC servomotor and AC servomotor.

2 Time domain response of rotary servo and Linear servo (first order and second order) systems using MATLAB/Simulink.

3 Simulate Speed and position control of DC Motor

4 Frequency response of small-motion, linearized model of industrial robot (first and second order) system using MATLAB.

5 Characteristics of PID controllers using MATLAB. Design and implementation of P, PI and PID Controllers for temperature and level control systems;

6 Design and implement closed loop control of DC Motor using MATLAB/Simulink and suitable hardware platform.

7 Implementation of digital controller using microcontroller;

8 Design and implementation of controller for practical systems - inverted pendulum system.

9 To design and implement control action for maintaining a pendulum in the upright position (even when subjected to external disturbances) through LQR technique in an Arduino Mega.

10 The fourth order, nonlinear and unstable real-time control system (Pendulum & Cart Control System)

11 Mini project on real life motion control system

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss various engineering projects

CO2. Knowing About the MATLAB software

CO3. Analyze the Lead, Lag, and Lead-Lag systems in control systems

CO4.Design PID controllers for given control system model

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P011	PO12	PSO1	PSO2
CO1	L2	H	M	M	M	-	-	-	-	M	M	-	H	M	M
CO2	L1	M	L	L	L	-	-	-	-	-	M	-	M	M	M
CO3	L4	M	M	M	M	M	-	-	-	L	L	-	M	M	M
CO4	L6	M	M	M	M	M	-	-	-	-	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPSIT 705: Industrial Training

Course Objectives:

- To acquire and apply fundamental principles of engineering.
- To identify, formulate and present model problems.
- To identify, formulate and model problems and find engineering solution based on a systems approach.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Become master in one's specialized technology

CO3: Become updated with all the latest changes in technological world.

CO4: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P01 1	PO 12	PS O1	PS O2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPSIT 706: Seminar

Course Objectives:

- To Awareness of how to use values in improving your own professionalism.
- To Learning about personal and communication styles for team building.
- To identify, formulate and present model problems.
- To Learning management of values.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Personalize and create a communication style for individual & team building.

CO2: Use values in improving one's own professionalism

CO3: Develop the higher cognitive abilities that are analysis, synthesis and evaluation.

CO4: Ability to identify, formulate and present model problems.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P011	PO 12	PSO1	PSO2
CO1	L2	M	H	L	H	L	-	-	-	-	L	-	L	M	M
CO2	L3	M	L	H	H	L	-	-	-	-	L	-	M	H	M
CO3	L6	M	H	M	M	L	-	-	-	-	L	-	M	M	M
CO4	L2	M	M	M	M	L	-	-	-	-	M	-	L	M	H

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 707: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs,

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

VIII SEMESTER

EIGHT SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Professional Elective I (any one)								
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTEEPEC801A	HVDC Transmission System	3	-	-	30	70	100	3
BTEEPEC801B	Line Commutated & Active Rectifiers							
BTEEPEC801C	Advanced Electric Drives.							
Open Elective I (any one)								
BTEEOEC802A	Electrical & Electronic Ceramics	3	-	-	30	70	100	3
BTEEOEC802B	Robotics and Control							
BTEEOEC802C	Composite Materials							
Sub Total		6	**0**	**0**	**60**	**140**	**200**	**6**
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTEEPCC803	Energy System Lab	-	-	4	60	40	100	2
BTEEPSIT804	Project	3	-	-	120	80	200	4
BTEESODECA805	Social Outreach, Discipline & Extra Curricular Activates	-		-	-	--	50	1
Sub Total		3	**0**	**4**	**180**	**120**	**350**	7
TOTAL OF VIII SEMESTER		**9**	**0**	**4**	**240**	**260**	**600**	**13**

BTEEPEC801A: HVDC Transmission System

Course objective(s):-

- To introduce students with the concept of HVDC Transmission system.
- To familiarize the students with the HVDC converters and their control system.
- To expose the students to the harmonics and faults occur in the system and their prevention.

Syllabus

Unit-1

DC Transmission Technology:

Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVdc Systems. Components of a HVdc system. Line Commutated Converter and Voltage Source Converter based systems.

Unit-2

Analysis of Line Commutated and Voltage Source Converters:

Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links. Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

Unit-3

Control of HVDC Converters:

Principles of Link Control in a LCCHVdc system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation

Unit-4

Components of HVdc systems:

Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes

Unit-5

Stability Enhancement using HVDC Control:

Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems **MTdc Links:** Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Introduction to Modular Multi-level Converters

Text Books/ Reference Books:

1 K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.

2 J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., 1983.

3 E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.

Course Outcomes:

At the end of the course, the student will be able to:

CO1 Know the advantages of dc transmission over ac transmission

CO2. Understand the operation of Line Commutated Converters and Voltage Source Converters.

CO3. Analyze the control strategies used in HVDC transmission system.

CO4. Apply various methods to the improvement of power system stability an HVDC system.

CO5. Describe the Multi-Terminal and Multi-Infeed Systems

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	H	L	L	L	-	-	-	-	-	L	-	M	H	M
CO2	L2	H	M	M	H	-	-	-	-	-	M	-	H	H	M
CO3	L4	M	M	M	M	-	-	-	-	M	L	-	M	M	M
CO4	L3	H	M	M	M	-	-	-	-	M	L	-	M	M	M
CO5	L1,L2	M	L	L	L	-	-	-	-	-	M	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC801B: Line-Commutated and Active Rectifiers

Course objective(s):-

- To provide the students a deep insight in to the working of different switching devices with respect to their characteristics
- To analyze different converters and control with their applications.
- To study advanced converters and switching techniques implemented in recent technology

Syllabus

Unit-1

Diode rectifiers with passive filtering:

Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

Unit-2

Thyristor rectifiers with passive filtering:

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape

Unit-3

Multi-Pulse converter:

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6- pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Unit-4

Single-phase ac-dc single-switch boost converter:

Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed loop control structure.

Ac-dc bidirectional boost converter:

Review of 1-phase inverter and 3-phase inverter, power circuits of 1- phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

Unit-5

Isolated single-phase ac-dc flyback converter:

Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop control structure.

Text Books/ Reference Books:

1 G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.

2 J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", AddisonWesley, 1991.

3 L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

4 N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

5 R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2001.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss the design and control of rectifiers, converters

C02. Classify the power electronic converters in power control applications

CO3. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.

CO4. Design the AC voltage controller and Converter.

CO5. Analyse controlled rectifier circuits

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	H	H	H	-	-	-	-	M	M	-	M	M	M
CO2	L3	H	M	M	M	-	-	-	-	M	M	-	M	M	L
CO3	L2	M	L	L	M	-	-	-	-	L	L	-	M	M	L
CO4	L1,L2	M	L	L	L	-	-	-	-	M	M	-	M	M	M
CO5	L4	H	M	M	H	-	-	-	-	M	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPEC801C: Advanced Electric Drives

Course objective(s):-

- To know Electrical drives that play an important part as electromechanical energy converters in transportation, materials handling and most production processes. The course tries
- To give unified treatment of complete electrical drive systems, including the mechanical parts, electrical machines, and power converters and control.

Syllabus

Unit-1

Power Converters for AC drives:

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

Unit-2

Induction motor drives:

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).

Unit-3

Synchronous motor drives:

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Unit-4

Permanent magnet motor drives:

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM

Unit-5

Switched reluctance motor drives:

Evolution of switched reluctance motors, various topologies for SRM drives, comparison. Closed loop speed and torque control of SRM.

DSP based motion control: Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control

Text Books/ Reference Books:

1 B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.

2 P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.

3 H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.

4 R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Understand the operation of power electronic converters and their control strategies.

CO2. Analyze the Implement sine-triangle and Space Vector PWM techniques on analog and digital platforms

CO3. Know simulate the behavior of high performance induction Motor drives using the principles of Vector Control and DTC

CO4. Apply the concept of vector control to PMSM drives

CO5. Describe the vector control strategies for ac motor drives

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	M	M	-	M	H	M
CO2	L4	H	M	M	H	-	-	-	-	-	M	-	M	M	L
CO3	L1	H	L	L	L	-	-	-	-	-	L	-	M	H	M
CO4	L3	M	M	M	M	-	-	-	-	M	L	-	L	M	M
CO5	L1,L2	H	M	L	L	-	-	-	-	M	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEOEC802A Electrical and Electronic Ceramics

Course objective(s):-

- To understand the fundamentals (structure, properties and processing) of ceramic materials to appreciate its advantages and limitations
- To apply those fundamentals for selecting and developing ceramic materials for different engineering applications.

Syllabus

Unit-1

Ferroelectric and Piezoelectric Ceramics:

Symmetry and other criteria of ferroelectricity, ferroelectric phase transitions. Effect of compositional modifications on properties of ferroelectric and piezoelectric ceramics. Piezoelectric transducers, Motors, Piezoelectric positioners, loudspeakers and gas igniters. Pyroelectric and electro-optic ceramics and their applications.

Unit-2

Ceramic Capacitors:

Performance categories of ceramic capacitors with typical compositions. Multilayer and barrier layer capacitors.

Unit-3

Thermistors and Varistors:

NTC and PTC thermistors, ZnO varistors and their applications

Unit-4

Magnetic Ceramics:

Soft and hard magnetic materials. Spinels: crystal structure, magnetic structure and their properties, Hexaferrite: crystal structure, magnetic structure and their properties. Basic principle of magnetic recording, GMR materials.

Unit-5

Superionic Solids:

Classification and structural features of superionic solids. Applications in oxygen sensors, fuel cells, high density energy storage batteries.

Text Books/ Reference Books:

Relva C. Buchanan, Ceramic Materials for Electronics, CRC Press

Ceramic Materials for Electronics Relva C. Buchanan,M. Dekker

Electronic Ceramics, Levinson CRC Press

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Know the structure and properties of different ceramic materials

CO2.Understand the testing methods for evaluating the mechanical properties of ceramic materials

CO3. Distinguish between the electrical and magnetic properties in ceramic systems

CO4. Discuss appreciate the properties of ceramic materials for different engineering applications

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L1	M	L	L	L	-	-	-	-	-	L	-	M	M	M
CO2	L2	H	M	M	H	-	-	-	-	M	M	-	M	M	L
CO3	L4	H	M	M	M	-	-	-	-	-	L	-	M	M	L
CO4	L2	H	M	M	H	-	-	-	-	M	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEOEC802B: Robotics and Control

Course objective(s):-

- To Provide the common control schemes
- To develop the ability to analyze and design the motion for articulated systems
- To develop an ability to use software tools for analysis and design of robotic systems.

Syllabus

Unit-1

Introduction to control problem-

Industrial Control examples. Transfer function. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho- generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis. Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multiloop control configurations, stability concept, relative stability, Routh stability criterion

Unit-2

Time response of second-order systems-

steady-state errors and error constants. Performance specifications in time-domain. Lead and lag compensation**.** Frequency-response analysis**-** Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain.. Lead and Lag compensation.

Unit-3

Robot arm Kinematics:

Introduction, The direct Kinematics Problem, Rotation Matrices, Composite Rotation Matrix, Rotation matrix about an arbitrary axis, Rotation matrix with Euler angle representation, Geometric interpretation of Homogeneous transformation matrices, composite homogeneous transformation matrix, Links joints and their parameters. The Denavit Hartenberg representation. Kinematic equations for manipulators, Other specifications of the locations of the End-Effector, Classification of Manipulators, The inverse Kinematics problem, Inverse Transform Technique for Euler Angles Solution

Unit-4

Planning of Manipulator Trajectories:

Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory. Sensing: Range sensing, Triangulation, Structured Lighting Approach, Time-of- Flight range finders Proximity sensing, Inductive sensors, Hall effect sensors, Capacitive Sensors, Ultrasonic sensors, Optical Proximity Sensors, Touch sensors, Binary sensors, Analog sensors, Force and Torque sensing, Elements of a Wrist sensor. LOW-LEVEL VISION: Image acquisition, illumination Techniques, imaging

geometry, some basic transformations, perspective transformations. Higher-Level Vision: Segmentation, Edge Linking and Boundary detection

Unit-5

Camera model, camera calibration, stereo imaging, some basic relationships between pixels, Neighbours of a Pixel, connectivity, distance measures, Preprocessing, Spatial-Domain methods, Frequency- Domain methods, Smoothing, Enhancement, Edge detection, Thresholding. Thresholding. Region-oriented segmentation, the use of motion, description, Boundary descriptors, Regional descriptors.

Text Books/ Reference Books:

1. Robotics control sensing Vision and Intelligence- K.S.Fu, R.C. Gonzalez, C.S.G. Lee, McGraw Hill, 1987.

2. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

3. Introduction to Robotics Mechanics and control– John J. Craig, 2nd Edition, Pearson education, 2003.

4. Nagrath&Gopal, "Modern Control Engineering", New Age International, New Delhi

5. James G.Keramas, "Robot Technology Fundamentals" , Cengage learning

Course Outcomes:

At the end of the course, the student will be able to:

CO1.Understand the modeling of linear-time-invariant systems using transfer function

CO2. Define the concept of stability and its assessment for linear-time invariant systems.

CO3. Classify the features of different types of compensators and to design compensators using time-domain and frequency domain specifications.

CO4. Understand to do construct the path planning for a robotic system.

CO5. calculate the forward kinematics and inverse kinematics of serial and parallel robots.

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	-	-	M	M	-	M	H	H
CO2	L1	H	L	L	L	-	-	-	-	-	M	-	L	H	H
CO3	L4	M	M	M	H	-	-	-	-	-	L	-	M	H	M
CO4	L2	H	M	M	M	-	-	-	-	M	M	-	M	M	M
CO5	L4	M	M	M	M	-	-	-	-	-	L	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEOEC802C: Composite Materials

Course objective(s):-

- To understand the mechanical behaviour of composite materials
- To get an overview of the methods of manufacturing composite materials

Syllabus

Unit-1

Basics of composites:

ObjectiveDefinition, Classification, Metal matrix, polymer matrix and ceramic matrix composites. Fibres, Matrices, Properties of various type of fibres. Various types of matrix materials and their properties. Polymers, Properties of polymers like epoxy, polyester and phenolic. Applications of composites in Engineering.

Unit-2

Elastic behaviour of composite Lamina-

Micromechanics and Macro-mechanics approach Micromechanics: Volume fraction, weight fraction, density of composites, Lamina, longitudinal elastic properties, Transverse elastic properties, In-Plane shear modulus, Poisson's ratio.

Unit-3

Elastic behaviour of composite Lamina-

Macro-mechanics: Stress-Strain relations, General Anisotropic materials, Especially Orthotropic material, Transversely Isotropic material, Isotropic material, Stress-Strain relations for a Thin Lamina. Thermal and moisture expansion of a lamina.

Unit-4

Testing of Composites:

Mechanical testing of composites, Tensile testing, Compressive testing, Intra-Laminar shear testing, Fracture testing, Experimental characterization of mechanical and hygrothermal constants

Unit-5

Failure and Maintenance of Composites:

Failure types in laminates, Damage to laminate structures, Quality control, Case Studies.

Text Books:

Text / Reference Books:

1 Mathews F. L. and Rawlings R. D., "Composite Materials: Engineering and Science", 1st Edition, Chapman and Hall, London, England, 1994.

2 Chawla K. K., "Composite materials", Second Edition, Springer – Verlag,1998.

3 Agarwal, B. D. and Broutman, Composites", John Wiley & Sons

4 Daniel, I. M. and Ishaai., O., "Engineering Mechanics of Composite Materials", Oxford University Press.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites

CO2. Understanding the different manufacturing methods available for composite material

CO3. Illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.

CO4. Analyze problems on micromechanical behavior of lamina

CO5. Evaluate Thermal and moisture expansion of a lamina

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	M	M	M	M	-	M	M	-	L	M	-	M	M	M
CO2	L2	M	M	M	M	-	M	M	-	L	M	-	M	M	M
CO3	L3	L	M	M	M	-	-	M	-	-	M	-	L	M	L
CO4	L4	L	L	M	M	-	-	-	-	-	L	-	M	M	M
CO5	L5	M	M	M	H	-	-	-	-	M	L	-	M	M	L

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPCC803: Energy Systems Lab

Course objective(s):-

- To introduce the concepts and phenomenon of different sources of Power Generation.
- To give an idea about the fundamental concepts of electrical power distribution, both AC & DC

List of Experiments

1 V-I characteristics of solar panels at various levels of insolation.

2 Experiment of solar Charge controller, PWM, MPPT with boost converter and algorithms.

3 Experiment on Shadowing effect and diode based solution in1kWpSolar PV System.

4 Study of wind turbine generators with DC generators, DFIG, PMSG etc.

5 Performance Study of Solar Flat Plate Thermal Collector Operation with Variation in Mass Flow Rate and Level of Radiation.

6 Characterization of Various PV Modules Using large area Sun Simulator.

7 Study of micro-hydel pumped storage system.

8 Experiment on Fuel Cell and its operation.

9 Study of 100 kW or higher solar PV plant.

10 Study different components of Micro Grid.

11 To design and simulate hybrid wind-solar power generation system using simulation software.

12 Experiments on Performance Assessment of Hybrid (Solar-Wind- Battery) Power System.

13 Simulation study on Intelligent Controllers for on-grid and off-grid Hybrid Power Systems.

Course Outcomes:

At the end of the course, the student will be able to:

CO1. Discuss various power sources for generation of power Merit/Demerits.

CO2. Describe the solar panels at various levels of insolation

CO3. Calculate usage of electrical power

CO4. Define the functions of Substation

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	P011	PO12	PSO 1	PSO 2
CO1	L2	H	M	M	M	-	-	M	-	H	M	-	M	M	M
CO2	L1,L2	H	M	M	L	-	-	M	-	H	L	M	M	H	H
CO3	L4	M	H	M	H	-	-	-	-	M	M	-	M	M	M
CO4	L1	H	M	M	L	-	-	-	-	M	M	-	M	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEEPSIT 804: Project

Course Objective:

- To introduce the concept and methods required for the construction of large software intensive system.
- To develop a broad understanding of the discipline of software engineering and management of software system.
- To provide an understanding of both theoretical and methodological issues involve in modern software engineering project management and focus strongly on practical techniques.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Capability to acquire and apply fundamental principles of engineering.

CO2: Be a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills.

CO3: Identify, formulate and model problems and find engineering solution based on a systems approach.

CO4: Capability and enthusiasm for self-improvement through continuous professional development and life-long learning

Table: Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P011	PO 12	PSO1	PSO2
CO1	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO2	L3	M	L	H	L	M	-	-	-	-	L	-	L	M	M
CO3	L3	M	M	H	L	M	-	-	-	-	M	-	L	M	M
CO4	L4	M	M	H	L	M	-	-	-	-	M	-	L	M	M

H- High, M- Moderate, L- Low, '-' for No correlation

BTEESODECA 805: Social Outreach, Discipline & Extra Curricular Activities

Course Objectives:

- To allowing students to explore strengths and talents outside of academics.
- To helping students develop stronger time-management and organizational skills.
- To giving students the opportunity to build friendships and participate in group activities outside of the tight circle of the regular classroom.
- To helping to build confidence and self-esteem.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop their self-confidence, leadership qualities, and their responsibilities towards the community.

CO2: Have an impact on academic development, personal development, and civic responsibility

CO3: Understand the value of Social Work.

CO4: Understand the Significance of Discipline in student's Life

CO5: Contribute towards in social up-gradation by social organization like, Art of Living, Yoga etc., Blood donation, Awareness programs, personality development programs.

Table : Mapping of Course Outcomes with Program Outcomes

Course Outcome	Bloom Level	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	P0 11	PO 12	PS O1	PS O2
CO1	L2	-	-	-	-	-	M	L	M	M	-	-	-	-	-
CO2	L4	-	-	-	-	-	M	M	M	L	-	-	-	-	-
CO3	L1	-	-	-	-	-	M	L	M	L	-	-	-	-	-
CO4	L2	-	-	-	-	-	M	M	M	M	-	-	-	-	-
CO5	L2	-	-	-	-	-	M	M	L	M	-	-	-	-	-

H- High, M- Moderate, L- Low, '-' for No correlation

6. TEACHING-LEARNING PROCESS/ METHODOLOGY (TLM):

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of technical program in a canonical manner. In this context, applications of technical program and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment methods. Students have great freedom of choice of course which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Class room Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.

2. **Tutorials:** To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.

3. **Practical:** To provide scientific visualization and obtaining results of Technical program in practical sessions. These sessions provide vital insights into scientific concepts and draw learner's attention towards limitations of scientific computations. During practical, scientific models arising in real life problems can also be simulated.

4. **Choice based learning/Open elective:** LOCF in this undergraduate program provides great flexibility both in terms of variety of courses and range of references in each course.

5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance.

6. **Textbooks learning:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.

7. **E-learning:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.

8. **Self-study materials:** Self-study material provided by the teachers is an integral part of learning. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.

9. **Assignment/Problem solving:** Assignments at regular intervals involving applications of theory are necessary to assimilate basic concepts of courses. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.

10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportunity to observe applications of scientific concepts. These visits also give an opportunity to realize the power of mathematical ideas and their translation in problem solving.

13. **Training programs:** Training programs organized by various agencies/institutesprovide an opportunity to learn various dimensions of courses.

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