B. Tech (Electrical Engineering)

Ordinances, Scheme and Syllabus
2022-23
As per NEP
Total Credits- 162

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

1. **Duration of Course:**

The duration of course shall be four academic years consisting of eight (8) semesters i.e. two semesters in each year. In case of admission under lateral entry, the duration of the course shall be three years consisting of six (6) semesters i.e. two semesters in each year. The duration of each semester will be 18-20 weeks with ninety (90) teaching days.

2. **Maximum period for passing B. Tech. (Electrical Engineering)**

The candidate must pass all the subjects of all the semesters of B. Tech. in eight (8) years. The maximum period to pass the course for lateral entry candidates shall be six (6) years. If the candidate fails to pass all the subjects of the course within stipulated period, his/her registration will be cancelled.

3. **Eligibility for admission**

3.1 **Direct Entry:** A candidate must have passed 10+2 examination with Physics and Mathematics as compulsory subjects with one of the subjects of Chemistry, Biotechnology, Electrical Biology from recognized Boards or any other examination recognized as equivalent thereto, with 45% marks. 5% relaxation in marks shall be given to Schedule Caste/ Schedule Tribe or any rural and under privileged candidates.

3.2 **Lateral Entry**

A candidate must have passed Diploma from a recognized State Board of Technical Education with minimum of 45% marks. 5% relaxation in marks shall be given to Schedule Caste/ Schedule Tribe or any rural and under privileged candidates.

4. **Medium of Instructions**

The medium of instruction during the course and examinations shall be English.

5. **Examination Schedule, examination fee and examination forms:**

5.1 The examination of Odd semesters shall ordinarily be held in the month of December and that of Even semesters in the month of May, or on such other dates as may be fixed by the competent authority.

5.2 The candidates will be required to pay examination fees as prescribed by the University from time to time.

5.3 The Examination Form must reach in the office of the Controller of Examinations as per the schedule notified, from time to time.

5.4 The Examination Forms must be countersigned by the Director/Head of the Department along with the following certificate :--

(i) that he/she has been on the rolls of the University Teaching Department during the academic term preceding the end semester examination;
(ii) that he/she has attended not less than 75% Hour(s) delivered to that class in each paper; and
(iii) that he/she has a good moral character.

5.5 The shortage in the attendance of Hour(s) of the candidate may be condoned by the Vice-Chancellor, on the recommendations of Head of the Department, as per rules.

6. **Re-admission**

In case name of a student is struck off from the rolls due to non-payment of fee or continued absence from classes in any subject for one month and he/she will be re-admitted after payment of re-admission fee as prescribed by the University from time to time. However, the student will be allowed to appear in the end semester examination of that paper (s) only after attending the required Hour(s)/ practicals delivered to that paper(s). However, if a student falls short of attendance in all courses offered in a semester he/she shall be required to repeat the semester, along with the next batch of students.

7. **Scheme of Examinations**

The examination in each semester shall be conducted according to the syllabus prescribed for the semester. The end semester examination for each paper shall be of three hours duration.

8. **Minimum pass marks**

The minimum number of marks required to pass in each semester shall be 40% marks in each in Theory and Practical/Laboratory/Seminar/Viva-Voce paper and in Internal Assessment, separately.

9. **Grading of performances**

9.1 **Letter grades and grade points allocations:**

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given hereunder:-

Percentage of marks obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A+	9	Excellent
70.00 – 79.99	A	8	Very Good
60.00 – 69.99	B+	7	Good
50.00 – 59.99	B	6	Average
40.00 – 49.99	C	5	Pass
Less than 40.00	F	0	Fail
Absent	AB	0	Fail

9.2 Grades from 'O' to 'C' are pass grades.

9.3 A student who fails in any end semester shall be assigned a letter grade 'F' and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

9.4 A student who remains absent for any end semester examination shall be assigned a letter grade of 'AB' and a corresponding grade point of zero.

Semester Grade Point Average (SGPA) = $(\sum C_i G_i) / (\sum C_i)$

Where C_i = No. of credits assigned to i^{th} semester
G_i = No. of Grade equivalent point assigned to i^{th} semester.

Cumulative Grade Point Average (CGPA) = $$\frac{\sum (SGPA_j \times C_j)}{\sum C_j}$$

Where $SGPA_j$ = SGPA score of j^{th} semester
C_j = Total no. of credits in the j^{th} Semester

9.5 Percentage can be calculated as CGPA *10

10. **Declaration of class and Division**

The class shall be awarded on the basis of CGPA as follows:

CGPA: ≥7.5 provided that the candidate must have passed all the Semester Examinations in the first available attempt.	First Division with Distinction
CGPA: 6.0 to 7.49	First Division
CGPA: 5.0 to 5.99	Second Division
CGPA: 4.0 to 4.99	Third Division

11. **Internal Assessment of failed candidate**

The internal assessment award of a candidate who fails in the external examination shall be carried forward to the next Examination, if passed in Internal Assessment.

12. **Grace Marks**

12.1 The grace marks of 1% of total marks of the semester shall be given to a candidate to his best advantage so as to enable him to pass in one or more written papers, to make up aggregate to pass the examination/paper or for changing the result from FAIL to COMPARTMENT/PASS. If a fraction works out to be half or more, it shall be counted as one mark and fraction less than half shall be ignored

12.2 If a candidate appears in an examination to clear re-appear/compartment paper, the grace marks of 1% will be given only on the total marks of that particular paper.

13. **Re-evaluation**

A candidate who is not satisfied with his result may apply to the Examination Branch for re-evaluation in a subject/paper within 15 days of declaration of result along with a fee as prescribed by the university from time to time.

14. **Re-checking**

A candidate who is not satisfied with his result may apply to the Examination Branch for re-evaluation in a subject/paper within 15 days of declaration of result along with a fee as prescribed by the university from time to time.

15. **Special examination**

A Special Examination will be conducted for those students who are passing out but having re-appear(s) in the last semester and/or in the lower semesters. The special examination will be conducted within one month of the declaration of final semester result. The student shall have to pay prescribed fee for Special Examination.

16. **Re-appear/Supplementary examination**

In case of re-appear examination, the University will adopt even/odd semester examination or open semester system. The student will be eligible to appear in the re-appear papers of odd semester along with the odd semester regular examinations of subsequent batches and re-appear of even semester's paper of the even semester regular examinations in the case of even/odd semester examination.

The student will be eligible to appear in the re-appear papers of all semesters (even/odd) along with regular examinations of open semester examinations. Controller of Examination will implement any of the above examination system with the approval of the Vice-Chancellor.

17. **Mercy Chance**

The candidate will be given maximum two chances to appear in the supplementary examinations. After that, mercy chance may be given by the Vice-Chancellor on the recommendations of the Director of the concerned school on payment of a special fee.

18. **Syllabus for re-appear candidates**

A student who obtains re-appear(s) in a subject will be examined from the same syllabus which he/she studied as a regular student.

19. **Promotion Criteria**

19.1 A candidate who joins First Semester of B. Tech. (Electrical Engineering) may on completing attendance requirements appear in 1st semester examination. He/she shall be allowed to continue his/her studies in the 2nd Semester even if he/she does not clear any paper of the 1st semester and on completing attendance requirements may appear in the 2nd Semester examination.

19.2 A candidate shall not be eligible to join 3rd Semester of B. Tech (Electrical Engineering), if he/she has yet to clear more than 50% papers of First and Second Semesters taken together. A candidate who has cleared 50% or more papers of B. Tech. (Electrical Engineering) 1st and 2nd Semesters taken together may join 3rd Semester and on completing attendance requirements may take 3rd Semester Examination. He/she shall be allowed to continue his/her studies in the 4th Semester even if he/she does not clear any paper of the 3rd Semester and on completing attendance requirements may appear in 4th Semester examination.

19.3 A candidate shall not be eligible to join 5th Semester of B. Tech. (Electrical Engineering) if he/she has yet to clear more than 50% papers of 3rd and 4th Semesters taken together. A candidate who has cleared 50% or more papers of B. Tech. (Electrical Engineering) 3rd and 4th Semesters taken together may join 5th Semester and on completing attendance requirements may take 5th Semester Examination. He/she shall be allowed to continue his/her studies in the 6th Semester even if he/she does not clear any paper of the 5th Semester and on completing attendance requirements may appear in 6th Semester examination.

19.4 A candidate shall not be eligible to join 7th Semester of B. Tech. (Electrical Engineering) if he/she has yet to clear more than 50% papers of 5th and 6th

Semesters taken together. A candidate who has cleared 50% or more papers of B. Tech. (Electrical Engineering) 5th and 6th Semesters taken together may join 7th Semester and on completing attendance requirements may take 7th Semester Examination. He/she shall be allowed to continue his/her studies in the 8th Semester even if he/she does not clear any paper of the 7th Semester and on completing attendance requirements may appear in 8th Semester examination.

20. **Division Improvement**

A candidate who has passed B. Tech (Electrical Engineering) examination from this University may re-appear for improvement of division in one or more subjects in the succeeding semesters with regular candidates in order to increase the percentage for obtaining higher division. However, final year candidates who have passed an examination of the University may re-appear for improvement of performance under special examination as per rules of the university.

21. **Migration to this University**

21.1 Migration to this University will be allowed only after completion of the 1st year and is applicable only to those students who are eligible to register for 3rd semester.

21.2 Migration shall be allowed after completion of the second semester but before start of the 3rd semester.

21.3 The candidates shall not be allowed to change his/ her discipline of study in the process of migration.

21.4 Migration to an affiliated College /Institute of the University from other recognized universities will be allowed 15 days prior to of the start of the 3rd semester. The following conditions shall be apply:-

i) The candidate should have passed all the courses of the first year of the University from where he/she wants to migrate.

ii) The courses studied by the candidate in first year must be equivalent to the courses offered in this University. Deficiency, if any, should not be of more than two subjects. The candidate would be required to furnish an undertaking that he/she will attend classes and pass these courses (found deficient). The institute and the University where the student is studying and the Institute, to which migration is sought, have no objection to the migration.

iii) There is a vacant seat available in the discipline in the college in which migration is sought.

21.5 Power of Relaxation: Notwithstanding the existing Migration Rules, the Vice-Chancellor, after obtaining an undertaking/affidavit from the candidate, to his satisfaction, to be recorded in writing, shall be

authorized to consider the migration for the cases that are not otherwise covered under the above Migration Rules, with the approval of the Chancellor.

22. **Migration to any other University**

22.1 Migration to any other University will be allowed 15 days prior to of the start of the 3rd semester.

22.2 The candidate seeking migration from this University shall be apply for the approval of his migration to the University within 15 working days after passing the 2nd Semester/First Year Examination.

22.3 The Director/Head of the department concerned of the University will issue "No Objection Certificate" after the candidate has paid all the fees due for the remaining period of the full session as well as the annual dues as per rules. In addition to the above, Migration fee as prescribed by the University shall be charged from such candidates.

22.4 If a candidate, on completion of any course, applies for Migration Certificate, the same shall be issued on receipt of fee prescribed for Migration Certificate and on completion of other formalities etc.

23. **Award of Detail Marks Card**

Each candidate of First Year B. Tech (Electrical Engineering) (i.e. Semester-I & Semester-II), Second Year (i.e. Semester-III & Semester-IV), Third Year (i.e. Semester-V & Semester- VI) and Fourth Year (i.e. Semester – VII and Semester – VIII), on successfully completion of course and passing all the papers of each semester, shall be supplied detail of Marks Cards indicating CGPA score and Division obtained by him/her in the examination.

24. **Award of Degree**

The degree of B. Tech. (Electrical Engineering) stating the CGPA score and Division, will be awarded to the candidate who has successfully completed the course and passed all the papers of all the semesters,. The degree will be awarded at the University Convocation. However, a degree in absentia can be issued before the convocation, on completion of required formalities and payment of prescribed fee.

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Vision of the Department:

To produce dynamic, competent, knowledgeable electrical engineers who shall lead a Nation to a better future by establishing the strong teaching and research environment.

Mission of the Department:

M1: To provide our students an education of the highest quality.

M2: To promote excellence in teaching, research, consultancy activities and positive contribution to the society.

M3: To create and sustain an environment of learning in which students transform theory into practice with due consideration of ethical and economic issues

M4: To prepare our students for life-long learning to meet intellectual, ethical and career challenges.

Program Educational Objectives (PEO's):

PEO1: Encourage to develop start-up companies developing Electrical Engineering equipment's/appliances/machines to contribute to the society

PEO2: Graduates will be able to communicate effectively, adopt lifelong learning, act with Integrity and have inter-personal skills needed to engage in, lead and nurture diverse teams, with commitment to their ethical and social responsibilities.

PEO3: To train students of Electrical Engineering program who can contribute to teaching profession, research & development by pursuing higher studies.

Program Specific Outcomes (PSO's):

PSO1: To apply the knowledge of Mathematics and Science in solving simple Electrical Engineering problems.

PSO2: To specify, design and analyze systems that efficiently generate, transmit, distribute and utilize electrical power

Program Outcomes (PO's)

PO1.Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2.Problem Analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3.Design/Development of Solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4.Conduct Investigations of Complex Problems: Use research-based knowledge 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 teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO11.Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12. **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Electrical Engineering

Program: B. Tech

Semester I

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-101	Basics of Electrical Engineering	Theory	40	60	100	3	0	0	3
2.	BTEE-102	Integrated Project- I	Practical	40	60	100	0	0	4	Q/NQ
3.	BTEM-103	Engineering Mathematics	Theory	40	60	100	3	0	0	3
4.	BTIT-104	Fundamentals of Information Technology	Theory	40	60	100	3	0	0	3
5.	BTEP-105	Engineering Physics	Theory	40	60	100	3	0	0	3
6.	BTED-106	Engineering Drawing	Theory	40	60	100	3	0	0	3
7.	DBEF-101	Employability Skills Foundation	Theory	40	60	100	3	0	0	3
Language (Select any one)										
8.	DBLH-101	Hindi	Theory	40	60	100	3	0	0	3
	DBLP-101	Punjabi	Theory	40	60	100	3	0	0	
	DBLU-101	Urdu	Theory	40	60	100	3	0	0	
Life Skill Course (Select any one)										
9.	DBNC-101	NCC	Practical	40	60	100	1	0	2	2
	DBNS-101	NSS	Practical	40	60	100	0	0	4	
Total										**23**

L- Lecture , T- Tutorial , P- Practical , C- Credit ,Q-Qualified, NQ- Not Qualified

Course Code: BTEE-101

Title of the Course: Basics of Electrical Engineering

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Basic knowledge about the laws and terms of Electric circuits.
CO2: Analysis of Single phase AC circuits.
CO3: Analyze the three phase AC circuits.
CO4: To solve the electrical network using mesh and nodal analysis by applying network theorems

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	W	S	M	W	M	W	W	S
CO2	M	S	S	M	S	M	W	W	S	M	M	S
CO3	M	S	M	M	M	W	W	W	M	W	W	S
CO4	S	S	S	W	S	M	M	W	W	M	M	S

Unit	Course Outlines	Hour(s)
1	**Basic Laws:** Ohm's law, Kirchhoff's voltage and current laws, Nodes-Branches and loops, Series elements and Voltage Division, Parallel elements and Current Division, Star-Delta transformation, Independent sources and Dependent sources, source transformation **Practicals:** • To verify Ohm's Law and its limitations. • To verify Kirchhoff's Laws	10
2	**AC Fundamentals-I:** Reviews of Complex Algebra, Sinusoids, phasors, Phasor Relations of circuit elements, Impedance and admittance, Impedance Combinations, Series and Parallel combination of Inductors and capacitor, Mesh analysis and Nodal analysis **Practicals:** • To verify A.C. series and parallel circuits. • Reactance calculation of variable reactance choke coil	10
3	**AC Fundamentals-II:** RMS and average values, Form factors, Steady state Analysis of series, Parallel and Series Parallel combination of R,L,C with Sinusoidal excitation, Instantaneous power, Real power, Reactive power and Apparent power, concept of Power factor, Frequency Measurement of power in 3 phase circuits, Measurement of R, L, C parameters.	6

4	**Network Theorems and Resonance:** Superposition theorem, Thevenin's theorem, Nortorn's theorem, Maximum Power Transfer Theorem, Reciprocity theorem, Resonance in Electrical circuits: Analysis of series and parallel Resonance **Practicals:** • To determine and verify Thevenin's theorem • To determine and verify Norton's theorem	10

Total -36

Recommended Books:

1. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill
2. P.M. Chandrashekaraiah , "Basic Electrical Engineering", New Edition, Rajeswaripublications
3. B.L. Theraja, A.K. Theraja A Textbook of Electrical Technology, Vol. 2, 23rd Edition,Publisher: S Chand & Co Ltd
4. .https://www.pdfdrive.com/electrical-technology-by-bl-theraja-volume-3-e58462612.html
5. https://nptel.ac.in/courses/108105112/
6. https://www.pdfdrive.com/basic-electrical-and-electronics-engineering-basic-e11452318.html
7. https://www.pdfdrive.com/electrical-and-electronic-principles-and-technology-third-edition- e34387005.html
8. https://nptel.ac.in/courses/108/108/108108076/
9. https://www.btechguru.com/courses--nptel--basic-courses-(semesters-i-and-ii)--basic-electronics-and-lab-video-lecture--C-SC--CR10003V.html

Course Code: BTEE-102

Title of the Course: Integrated Project -I

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code: BTEM-103

Title of the Course: Engineering Mathematics

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Apply the knowledge of calculus to plot graphs of functions and solve the problem of maxima and minima.
CO2: Determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
CO3: Evaluate multiple integrals and their applications to engineering problems.
CO4: Examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima.

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
CO'S	Program Outcome (PO's)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	S	S	M	M	S	W	W	M	M	W	M	M
CO2	S	S	M	S	M	M	M	M	S	M	W	M
CO3	S	S	S	M	M	W	W	S	M	M	M	W
CO4	S	S	S	S	M	M	W	M	M	M	W	M

Unit	Course Outlines	Hour(s)
1	**Linear Algebra:** Algebra of matrices; Inverse and rank of a matrix; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem	**9**
2	**Calculus:** Functions of single variable: Limit, continuity and differentiability; Mean value theorems, Maxima and minima; Taylor's theorem; Fundamental theorem and mean value-theorems of integral calculus. **Sequence and Series:** Convergence of sequence and series; Tests for convergence; Power series; Taylor's series; Fourier Series; Half range sine and cosine series	**9**
3	**Vector Calculus:** Scalar and vector fields, differentiation of vectors, velocity and acceleration. Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Line, surface and volume integrals. Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem. Green's theorem in plane, Stoke's theorem.	**9**

4	**Complex Variables** Analytic functions; Cauchy-Riemann equations; Line integral, Cauchy's integral theorem and integral formula; Taylor's series and Laurent series; Residue theorem and its applications **Probability and Statistics** Axioms of probability; Conditional probability; Bayes' Theorem; Discrete and continuous random variables: Binomial, Poisson and normal distributions; Correlation and linear regression.	**9**

Total- 36

Recommended Books:

1. Thomes, G.B, Finney, R.L. Calculus and Analytic Gemetry, Ninth Edition, Peason Education.
2. Kreyszig, E., Advanced Engineering Mathematics, Eighth edition, John wiley.
3. Peter. V. O‟ Nil, Advanced Engineering Mathematics, Wordsworth Publishing Company.
4. Bindra,.J.S., Applied Mathematics, Volume-I, Kataria Publications.
5. Jain, R.K and Lyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publishing Company.
6. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi

E-Book Links:

https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf

Course Code: BTIT-104

Title of the Course: Fundamentals of Information Technology

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: To understand the basic building blocks of general purpose digital computer system like computer hardware/software, memory and peripheral devices, internet applications and services.

CO2: To understand the program development life cycle using various tools like flowcharts and algorithms and pseudo-code.

CO3: To classify operators, expressions, character set, data types and control structures.

CO4: To understand the concept of modular programming and code reusability using library functions.

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W	W	S	W	M	W	S	M	S	S
CO2	S	M	M	S	S	W	M	W	S	M	M	S
CO3	S	M	M	S	S	W	M	W	S	M	M	S
CO4	S	M	M	S	S	W	M	W	S	M	M	S

Unit	Course Outlines	Hour(s)
1	**Introduction to Computers** Define a Computer System, Block diagram of a Computer System and its Working, Memories, RAM, ROM, Secondary storage Devices, Computer Software and Hardware, Input and Output Devices. Introduction to the operating system, its functions and types, working Introduction to word processors And its features, creating, editing, printing and saving documents, spell check, Mail merge, Introduction of Power point presentations, Spreadsheets and Simple graphs, evolution of Internet and its applications and services.	9
2	**Overview of C++ Language** Introduction to C++ language, Structure of a C++ program, Concepts of Compiling and linking, IDE and its features; Basic terminology - Character set, Tokens, identifiers, keywords, fundamental data types, literal and symbolic Constants, declaring variables, initializing variables, type modifiers. Operators.	9

3	**Control Structures** Decision making statements: if, nested if, if – else. Else if ladder, switch, Loops and iteration: while loop, for loop, do – while loop, nesting of loops, Break statement, continue statement, goto statement, use of control structures Through illustrative programming examples.	9
4	**Arrays and Strings** Declaration of arrays, initialization of array, accessing elements of array, I/O Of arrays. String as array of characters, initializing string variables, I/O of strings, string Manipulation functions (strlen, strcat, strcpy, strcmp), passing strings to a Function. **Classes and Objects** Defining classes and declaring objects, public and private keywords, Constructors and destructors, defining member functions inside and outside of a class, accessing members of a class, friend function.	9

Total- 36

Recommended Books:

1. E. Balagurusamy, Object-Oriented Programming with C++, Tata McGraw Hill.
2. P. K. Sinha and PritiSinha, Computer Fundamentals, BPB Publications.
3. Lafore R., Object Oriented Programming in C++, Waite Group.
4. BjarneStroustrup, The C++ Programming Language, Addison Wesley.
5. Lippman F. B, C++ Primer, Addison Wesley.
6. R. S. Salaria, Computer Concepts and Programming in C++, Salaria Publishing House.
7. Gurvinder Singh, KrishanSaluja, Fundamentals of Computer Programming & IT, Kalyani Publishers.
8. R. S. Salaria, Fundamentals of Computers, Salaria Publishing House.

Course Code: BTEP-105

Title of the Course: Engineering Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Gain a knowledge and understanding of fundamental physical concepts in the areas covered in this class.
CO2: Apply an understanding of Superconducting and magnetic materials.
CO3: Acquire problem solving skills and the ability to synthesize in quantum mechanics.
CO4: Explain how physics applies to the concepts of Lasers.
CO5: Recognize how and when physics methods and principles can help address problems in their surroundings and then apply those methods and principles to solve real world problems.

CO/PO Mapping
(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

CO'S	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	M	S	M	M	M	M	W	M	M	M	M
CO3	M	S	S	M	S	W	M	M	M	M	W	W
CO4	S	S	M	S	M	M	W	W	W	S	M	W
CO5	M	M	S	M	M	S	M	S	W	M	S	W

Unit	Course Outlines	Hour(s)
1	**Semiconductor Devices and their Materials:** Classification of Semiconductors, PN junction diode and V-I characteristics. Properties of superconductors, Zero resistance, Meisner effect, BCS theory, Types of Superconductors: Type-I and Type-II. Applications of superconductivity. **Practicals:** • Characteristics of PN junction Diode • Determination of Fermi energy for a conductor	9
2	**Magnetic Materials:** Classification of Dia, Para and Ferro Magnetic Materials, Hysteresis Curve on the basis of Domain Theory of Ferro Magnetism, Soft and Hard Magnetic Materials, Ferrites and their Applications. **Practicals:** • Study B-H curve using CRO • Magnetic field of a circular coil carrying current	9
3	**Quantum Mechanics:** Wave-Particle duality, Phase velocity, group velocity and particle velocity, De-Broglie wavelength, Heisenberg's uncertainty principle, Wave function and its Physical significance, Eigen	9

	functions and Eigen values, Schrodinger's wave equation (Time-independent and time dependent), Normalized wave function. **Practicals:** • Verification of Stefan's law	
4	**Lasers:** Spontaneous & Stimulated emissions, Einstein's Coefficients, Population Inversion, Pumping Mechanisms, Three & four level laser systems; Ruby, He-Ne Laser. Applications. **Practicals:** • Wavelength of Laser source • Characteristics of Laser	**9**

Total- 36

Text Book(s):

1. Engineering Physics – Wiley precise textbook series, Wiley India Pvt. Ltd, New Delhi.
2. R. K. Gaur, S. L. Gupta ; Engineering Physics – Dhanpat Rai Publications; 2011 Edition
3. Hitendra K Malik, A K Singh; Engineering Physics – Tata McGraw Hill Education; 2017

Reference Book(s):

1. S. O. Pillai: Solid State Physics, (New Revised Sixth Edition) – New Age International (P) Limited, Publishers, New Delhi, 2009.
2. N. H. Ayachit, P. K. Mittal: Engineering Physics – I. K. International Publishing House Pvt. Ltd. New Delhi, 2011.
3. M. N. Avadhanulu and P.G. Kshirsagar: Engineering Physics – S Chand & Company Ltd., Ram Nagar, New Delhi, 2010.
4. D. Halliday, R. Resnick, and J. Walker: Fundamentals of Physics - Wiley publications, 2017.
5. Leonard. I. Schiff, "Quantum Mechanics", Third Edition, Tata McGraw Hill, 2010
6. Practical Physics, C.L. Arora, S. Chand & Co.
7. Practical Physics, R.S. Sirohi, Wiley Eastern

Video Lecture:

1. https://nptel.ac.in/courses/122103010/
2. https://nptel.ac.in/courses/122107035/
3. https://nptel.ac.in/courses/122103011/

Course Code: BTED-106

Title of the Course: Engineering Drawing

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Comprehend general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional objects in two-dimensional views

CO2: Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.

CO3: Sketch the projections of simple solids like prisms, pyramids, cylinder and cone and obtain the traces of plane figures.

CO4: To interpret Orthographic, Isometric and Perspective views of objects

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	W	W	M	M	W	M	M
CO2	S	S	S	S	M	M	W	W	S	W	W	M
CO3	S	S	S	S	M	W	W	W	M	M	M	S
CO4	S	S	S	M	M	W	W	M	M	W	W	M

Unit	Course Outline	Hour(s)
1	**Introduction-** Engineering drawing, dimensioning, points, lines, planes. Types of projections, concept of solid as 3dimensional object, lines and planes, first and third angle practices. Projections of lines, planes and simple geometrical solids, placed in simple positions with single rotation of the face, edge or axis of solid with respect to one of the principal planes of projection11	**16**
2	**Sectioning:** Section of simple geometrical solids, types of sectional planes, true shape of section	**4**
3	**Isometric Projection** Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids such as cube, prism, pyramid and cylinder, and assignments on isometric projection of simple machine parts.	**8**
4	**Orthographic Projection** Review of principle of Orthographic Projection, Sketch/drawing of blocks, and of simple machine parts.	**8**
		Total-36

Recommended Books

1. Narayana K L and Kanaiah P, “Engineering Graphics”, Tata McGraw Hill Publishing Company Limited, New Delhi,2018
2. Gill P S, “Engineering Graphics and Drafting”, Katria and Sons, Delhi,2013
3. Bhat N D, “Elementary Engineering Drawing-Plane and solid Geometry”, Chartotar
4. Publishing House, Anand,2010
5. Luzzadde Warren J, “Fundamentals of Engineering Drawing”, Prentice Hall of India Private Limited, New Delhi,1976
6. https://www.swayamprabha.gov.in/
7. https://nptel.ac.in/course.html
8. www.pdfdrive.net
9. www.scienceebookonline.info
10. www.digitallibraries.Com

Course Code: DBEF-101

Title of the Course: Employability Skills Foundation

L	T	P	Credits
3	0	0	3

Course Outcomes:

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

Course Code: DBLH-101

Title of the Course: Hindi

L	T	P	Credits
3	0	0	3

पाठ्यक्रम

1. **हिंदी साहित्य का इतिहास** ;(**केवल आदिकाल और भक्तिकाल**)

   (1) हिन्दी साहित्य की इतिहास लेखन परंपरा

   (2) आचार्य रामचन्द्र शुक्ल का काल विभाजन

   (3) आदिकाल

   नामकरण , परिस्थितियां, प्रवृत्तियां , मुख्य काव्य धाराएं , मुख्य रचनाएं , मुख्य कवि या रचनाकार

   (4) भक्तिकाल

   नामकरण , परिस्थितियां , प्रवृत्तियां , मुख्य काव्य धाराएं , मुख्य रचनाएं , मुख्य कवि या रचनाकार

2. **व्याकरण खण्ड**

   (केवल परिभाषा और भेद उदाहरण सहित**)**

   संज्ञा,

   सर्वनाम,

   क्रिया,

   विशेषण,

   क्रिया-विशेषण

सहायक ग्रन्थ:

1. हिन्दी व्याकरण**:** कामता प्रसाद गुरु, किताब घर, दिल्ली
2. हिंदी साहित्य का इतिहास .....आचार्य रामचन्द्र शुक्ल

Course Code: DBLP-101

Title of the Course: Punjabi

L	T	P	Credits
3	0	0	3

ਭਾਗ—ੳ

ਕਥਾ ਰੰਗ, ਸੰਪਾ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ

ਨਿਬੰਧ ਰਚਨਾ : ਸਮਾਜਿਕ, ਵਾਤਾਵਰਨ ਅਤੇ ਸਭਿਆਚਾਰ ਵਿਸ਼ਾ

ਭਾਗ—ਅ

ਵਿਆਕਰਨਕ ਇਕਾਈਆਂ ਅਤੇ ਪੰਜਾਬੀ ਧੁਨੀ–ਵਿਉਂਤ, ਸਵਰ, ਵਿਅੰਜਨ,

ਸ਼ਬਦ–ਸ਼੍ਰੇਣੀਆਂ ਅਤੇ ਰੂਪਾਂਤਰਨ : ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸੰਬੰਧਕ, ਯੋਜਕ ਅਤੇ ਪ੍ਰਸ਼ਨ ਸੂਚਕ ਸ਼ਬਦ

Course Code: DBLU-101

Title of the Course: Urdu

L	T	P	Credits
3	0	0	3

Unit	Course Outline	Hour(s)
1	Introduction: Introduction to Urdu Literature and Language Development of Urdu language: Social and Cultural Background Linguistic relation of Urdu with Hindi and Punjabi.	**9**
2	Urdu Literature: Contribution of Fort William College to Urdu Contribution of : Sir Syed, Mohd Husain Azad, Shibli	**9**
3	Urdu Novel: Development of Urdu Novel, Short introduction for Aazmaish bt Prof. Mohd. Mujeeb, Umrao Jan by Mirza Hadi Ruswa, Aag ka Darya by Quratul-Ain Haider	**9**
4	Urdu Short Stories: Namak ka Darogha: Prem Chand I.C.S. : Ali Abbas Husaini Apne dukh mujhe de do: Rajinder Singh Bedi	**9**
		Total-36

Course Code: DBNC-101

Title of the Course: NCC

L	T	P	Credits
1	0	2	2

Course Outcomes:
CO1: Define thinking, reasoning, critical thinking and creative thinking
CO2: To think critically about different life related issues.
CO3: Think divergently and will try to break functional fixedness
CO4: Creatively in their real-life problems.

CO/PO mapping

(S/M/W indicates strength of correlation) S- Strong , M-Medium , W- Weak

CO'S	Program Outcome (PO's)											
	PO1	PO 2	PO 3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2
CO1	S	S	S	S	M	M	M	W	M	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S
CO4	S	W	W	W	M	M	M	W	S	M	M	S

Subject	Course Outline	Hour(s)
NCC General	Introduction of NCC, History, Aims, Objective of NCC & NCC as Organization, Incentives of NCC, Duties of NCC Cadet. NCC Camps: Types & Conduct.	6
National Integration and Awareness	National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security.	4
Personality Development	Intra & Interpersonal skills - Self-Awareness & Analysis, Empathy, Critical & creative thinking, Decision making and problem solving.	2
Social Service and Community Development	Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare.	3

Drill	Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna Parade Par, Visarjan, Line Tod, Tej Chal, Tham aur Dhire Chal, Tham.	12
Field Craft and Battle Craft	Introduction of Field Craft & Battle craft, Judging Distance, Method of Judging Distance.	3
Map Reading	Definition of Map, Conventional signs, Scale and Grid System, Topographical forms and technical terms, Relief, Contours and gradients, Cardinal points and types of North, Magnetic Variation and Grid Convergence.	3
Weapon Training	Introduction & Characteristics of .22 rifle, Handling of .22 rifle.	5
Social Service and Community Development	Cadets will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, Jan Jeevan Hariyali Abhiyan, Beti Bachao Beti Padhao etc.	7

Total- 45

Text Book(s):

1. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) :
   Common Subjects: 2019
2. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) :
   Specialized Subject: 2019
3. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Air Force) :Specialized Subject: 2019
4. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Navy) : Specialized Subject: 2019

Course Code: DBNS-101

Title of the Course: NSS

L	T	P	Credits
0	0	4	2

Course Outcomes:

CO1: Orientation: history, objectives, principles, symbol and badge.
CO2: NSS programs and activities
CO3: Community mobilization, Understanding youth
CO4: Volunteerism and Shramdan

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	M	M	S	S	M	M
CO2	S	S	M	S	M	S	M	M	S	S	M	M
CO3	S	S	M	S	M	S	M	M	S	S	M	M
CO4	S	S	M	S	M	S	M	M	S	S	M	M

Unit	Course outlines	Hour(s)
I	Introduction and Basic Concepts of NSS : • Definition of NSS : Aims & Objectives of NSS, • Roles and responsibilities of various NSS functionaries, • Emblem ,flag, Motto, Song, Badge, NSS day etc, • Organizational structure (from national to regional level).	**10**
	NSS Programmes and Activities : • Concept of regular activities(one day camp), special seven day conduction camping, day and night camps and relevance of celebration of important days recognized by united nations, Centre, State Govt. & University • Basis of adoption of village/slums, methodology of conduction survey • Coordination with different agencies • Maintenance of the diary	**8**

II	Community Mobilization • Functioning of community stakeholders • Designing the message in the context of the problem and the culture of the community • Identifying methods of mobilization • Youth-Adult partnership • Concept of Community development	**9**
	Volunteerism and Shramdan • Indian tradition of volunteerism • Value system of volunteerism • Motivation and constraints of volunteerism • Shramdanasa part of volunteerism, Role of NSs volunteers in Swatch Bharat Abhiyan • Role of NSS volunteers in Digital India	**8**
III	Project Work/Practical: Conducting surveys/activities on special themes as follows • Social Harmony and National Integration • Indian Constitution and Social Justice • Concept of Society and Social Issues in India • Health, Hygiene and Sanitation Programmes • Citizens duties, Human Rights consumer Rights	**10**

Total: 45

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Electrical Engineering

Program: B. Tech

Semester II

S. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-201	Electrical Circuit Analysis	Theory	40	60	100	3	0	0	3
2.	BTEE-202	Integrated Project- II	Practical	40	60	100	0	0	4	Q/NQ
3.	BTEC-203	Engineering Chemistry	Theory	40	60	100	3	0	0	3
4.	DBAC-101	Arts and Creative Expressions	Theory	40	60	100	3	0	0	3
5.	DBSC-101	Sociology	Theory	40	60	100	3	0	0	3
6.	DBLE-101	English	Theory	40	60	100	3	0	0	3
7.	DBUI-101	Understanding India	Theory	40	60	100	3	0	0	3
Life Skill Course (Select any one)										
8.	DBNC-102	NCC	Practical	40	60	100	1	0	2	2
	DBNS-102	NSS	Practical	40	60	100	0	0	4	
Total										**20**

L- Lecture , T- Tutorial , P- Practical , C- Credit, Q-Qualified, NQ- Not Qualified

Course Code: BTEE-201

Title of the Course: Electrical Circuit Analysis

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Gain a thorough understanding of the electrical properties and characteristics of various materials, used in the electrical appliances, devices, instruments and in the applications
CO2: Develop various methodology/strategies through various domain of analysis to evaluate performance characteristics of electrical networks and analyze their operation under different operating conditions for various electrical/electromagnetic systems.
CO3: Apply computer mathematical and simulation programs to solve various real life multidisciplinary topics through circuit solution
CO4: Estimate parameters for different types of attenuators and filters used in signal modulation for power systems and communication systems.

CO/PO Mapping
(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	W	M	M	W	M	M	M	W
CO2	S	S	S	W	W	M	M	W	M	M	W	S
CO3	S	S	W	M	S	W	W	W	W	W	W	M
CO4	S	S	S	W	W	M	M	W	M	M	W	S

Unit	Course Outlines	Hour(s)
1	Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.	9
2	Graph theory and Networks equations: Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	9
3	Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	9
4	Filter Circuits: Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	9

Total -36

Recommended Books

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
3. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli4th edition. Tata McGraw Hill Education Pvt. Ltd.
4. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai& Co Pvt. Ltd.

Course Code: BTEE-202

Title of the Course: Integrated Project -II

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code: BTEC-203

Title of the Course: Engineering Chemistry

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
CO2: Students will be able to clearly communicate the results of scientific work in oral, written and electronic formats to both scientists and the public at large.
CO3: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
CO4: Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

CO/PO mapping

(S/M/W indicates strength of correlation) S- Strong , M-Medium , W- Weak

CO'S	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	W	S	S	W	W	S	W	S	M
CO2	S	S	M	M	S	W	M	W	W	W	M	S
CO3	S	M	S	M	S	W	S	W	S	W	S	S
CO4	S	S	S	M	S	S	M	S	M	W	S	S

Unit	Course Outlines	Hour(s)
1	**Spectroscopy and its Applications:** An introduction. **Spectroscopic techniques and Applications:** Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet & Visible and Raman spectroscopy **Photochemistry:** Introduction; Photo-physical & photochemical processes; Light sources in photochemistry; Beer-Lambert Law; Laws of Photochemistry; Quantum yield(primary and overall); Primary and secondary photochemical reactions; Jablonski diagram	**12**
2	**Analytical aspects of water:** Sources, conservation of water, impurities in water and their effects; Hardness & Types. Boiler	**9**

	troubles, causes and effects. Softening of water, lime-soda, ion-exchange process and numerical problem, Methods of prevention. WHO guideline and BIS guideline for drinking water. **Practical:** • To determine the total hardness of water by EDTA method. • To determine the physical & chemical parameters of the drinking water.	
3	**Green Chemistry and its Applications:** Introductory overview - Definition and concepts of Green chemistry; Emergence of Green chemistry; Twelve principles of Green Chemistry with emphasis on the use of alternative feedstock (bio-fuels); Alternative solvents. **Corrosion and its Prevention:** Introduction; Different types of corrosion, Theories of the corrosion - Wet and Dry corrosion; Mechanisms of corrosion; various methods of corrosion control. Factors influencing rate of corrosion	**9**
4	**Engineering Materials:** Glass, ceramics, refractory, composites, magnetic materials, Polymers & structure property relationship. Thermoplastic & thermosetting plastics. Preparation, properties &applications of some commodity and engineering polymers. **Practical:** • To determine the strength of HCl by conductometer.	**6**

Total-36

Recommended Books

1. Uppal M.M, Jain and Jain, Engineering Chemistry, Khanna Publishers, 35th Edition, 2013.
2. PC Jain and Monica Jain, A test Book of Engineering Chemistry, Dhanpat Rai Publications, New Delhi, 12th Edition, 2012.
3. SS Dara & Dr. SS Umare, -A Text book of Engineering Chemistry, S Chand & Company Ltd., 12th Edition, 2011.
4. RV Gadag and Nitthyananda Shetty, A Text Book of Engineering Chemistry, IK International Publishing house, 2nd Edition, 2016.
5. B.S. Jai Prakash, R. Venugopal, Sivakumaraiah& Pushpa Iyengar,- Chemistry for Engineering Students", Subash Publications, Bangalore.5th Edition, 2014
6. Kuriacose, J.C, Rajaram, J.; Chemistry in Engineering and Technology (Vol. 1&2); McGraw Hill, 1984.
7. Vogel A-I, Quantitative Inorganic and Organic Analysis, Oxford ELBS.

Course Code: DBAC-101

Title of the Course: Art & Creative Expressions

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Understanding Elements and Principles of Fine Art
CO2: Creates capacity to combine elements and principles of art to create experiment and alter Fine Art.
CO3: Creating products or Fine Art based on the principles and elements of art.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
CO's	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	S	S	S	S	S	M	S	S	S	M	M	S
CO2	S	S	S	S	S	M	S	S	S	M	M	S
CO3	S	S	S	S	S	M	S	S	S	M	M	S

Unit	Course Outlines	Hour(s)
1	• Definition of Fine Art • Definition of Fine Art and Scope • Classification of Colours	**12**
2	• Elements of Art • Form , Colours • Space , Texture	**12**
3	• Principal of Art • Ryhthem • Harmony	**12**

Recommended Books

1. The Transformation of Nature in Art,Year 1934 Paperback – January 1, 1934 by Ananda K. Coomaraswamy
2. Color Indian Art (World Culture Coloring) Paperback – Illustrated, July 24, 2014 by Mr. Mrinal Mitra (Author), Ms. Swarna Mitra (Editor), Mrs. Malika Mitra (Editor)

Course Code: DBSC-101

Title of the Course: Sociology

L	T	P	Credits
3	0	0	3

Unit	Course Outlines	Hour(s)
1	Sociology: Nature, Scope and Significance Relationship with History, Economics, Political Science, and Psychology.	**9**
2	Basic Concepts: Society, Community, Social Structure Gender, Patriarchy, Matriarchy, Gender Roles	**9**
3	Social Groups & Processes: Definition, Nature and types of Groups- Primary Secondary & Reference Group; Processes- Co-operation, Conflict and Accommodation.	**9**
4	Social Institutions: Marriage, Family- Their Functions and Types Kinship; Features and function	**9**

Course Code: DBLE-101

Title of the Course: English

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: To acquaint the learners with ideas related to the art of creative writing.
CO2: To help learners understand the principles of creative writing.
CO3: To hone the creative and critical faculties of the learners.
CO4: To give practice to the learners of the various forms of creative writing.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
CO's	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	S	S	S	S	S	M	S	S	S	M	M	S
CO2	S	S	S	S	S	M	S	S	S	M	M	S
CO3	S	S	S	S	S	M	S	S	S	M	M	S

Unit	Course Outlines	Hour(s)
1	**Fundamentals of Creative Writing** 1. Meaning and significance of creative writing. 2. Genres of creative writing.	**9**
2	**Elements of Creative Writing** 1. Plot, Setting, Character, Dialogue, Point of view 2. Literary Devices and Figurative Language 3. Elements of Style 4. Grammar and the Structure of Language 5. Proof reading and Editing	**9**
3	**Traditional Forms of Creative Writing** 1. Fiction, Short story, Novella, Novel 2. Poetry, Drama, Essay, Fable 3. Biography, Memoire, and Autobiography 4. Travelogues, Diaries, Self-narrative writing	**9**
4	**New Trends in Creative Writing** 1. Web Content Writing and Blog Writing 2. Script Writing 3. Journalistic Writing	**9**

	4. Copywriting 5. Graphic Novel 6. Flash Fiction	

Recommended Books

1. Abrams, M.H. *Glossary of Literary Terms*. Wadsworth Publishing Company, 2005.
2. Bell, James Scott. *How to Write Dazzling Dialogue*. Compendium Press, 2014.
3. Bell, Julia and Magrs, Paul. *The Creative Writing Course- Book*, Macmillan, 2001.

Course Code: DBUI-101

Title of the Course: Understanding India

L	T	P	Credits
3	0	0	3

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
CO's	**Programme Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	S	S	S	S	S	M	S	S	S	M	M	S
CO2	S	S	S	S	S	M	S	S	S	M	M	S
CO3	S	S	S	S	S	M	S	S	S	M	M	S

Unit	**Course Outlines**	**Hour(s)**
1	**Indus Valley Civilization**: Extent, Period and Downfall **Rig Vedic Period**: Social, Religious, Economic and Political Life of the People. **Caste system**: Origin and Growth **Gupta Period**: Foundation, Development of Literature, Art, Science & Technology **Foundation of Turks Empire**: Invasions of Mehmud Gazni and Mohammad Gouri	**18**
2	**Advent of the Mughals**: Foundation of Mughal Empire, Development of Art & Architecture. **Establishment & Expansion** of British Empire Battle of Plassey &Buxar **Administrative Reforms**: Cornwallis, William Bentick and Dalhousie **Uprising of 1857**: Political, Social, Religious, Economic and immediate causes, failure & Results. **Indian National Movement**: Role of Revolutionaries, Role of Mahatma Gandhi, Independence & Partition	**18**

Recommended Books

1. R.S. Tripathi : Prachin Bharat ka Ithas
2. V.C. Pandey: Political and Cultural History of India
3. R. N. Mookherji: Ancient India
4. N. N. Ghosh: Early India
5. R.C. Majumdar: An Advanced History Of India
6. A.L. Srivastava: The Delhi Sultnate
7. S.R. Sharma: Mughal Empire in India
8. Ishwari Parsad: A History of Modern India
9. P.E. Roberts: History of British India
10. J.S. Grewal: Cambridge History of India

Course Code: DBNC-102

Title of the Course: NCC

L	T	P	Credits
1	0	2	2

Course Outcomes:
CO 1: Perform foot drill gracefully.
CO 2: Give and follow the different word of command.
CO 3: Fire a weapon effectively with fair degree of marksmanship.
CO 4: Do the social service and feel connected with social problems.

CO/PO mapping

(S/M/W indicates strength of correlation) S- Strong , M-Medium , W- Weak

CO'S	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	M	W	M	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S
CO4	S	W	W	W	M	M	M	W	S	M	M	S

Subject	Course Outline	Hours
Personality Development	(i) Thinking- Meaning and Concept of thinking, Reasoning, Process of thinking. (ii) Critical Thinking- Meaning & concept of critical thinking, Features of critical thinking, Process of critical thinking. (iii) Creative thinking- Meaning & concept of creative thinking, Features of creative thinking, Process of creative thinking, levels of Creativity, Characteristics of creative person.	5
Leadership	(i) Leadership capsule. (ii) Important Leadership traits, Indicators of leadership and evaluation. (iii) Motivation- Meaning & concept, Types of motivation. Factors affecting motivation. (iv) Ethics and Honor codes.	5
Social Service and Community	(i) Protection of Children & Women Safety. (ii) Road/Rail Safety.	5

Development	(iii) New Government Initiatives. (iv) Cyber and mobile Security Awareness.	
Drill	(i) Foot Drill Dahine, Baen, Aageaur Piche Kadam Lena. (ii) Tej Chal se Murdna, Tej Chal se Salute Karna, Tej Kadam Taal aur Tham, Tej Kadam Taal se Kadam Badalna. (iii) Teeno Teen se Ek File aur ek file se Teeno Teen Banana	12
Field Craft and Battle Craft	(i) Indications of landmarks and Targets. (ii) Intro, Definitions, Types of Ground, Indication of Landmarks, Methods of iden of targets, difficult targets.	4
Map Reading	(i) Protractor Bearing and its conversion methods. (ii) Service protractor and its uses. (iii) Prismatic compass and its uses and GPS. (iv) Navigation by compass and GPS.	5
Weapon Training	(i) Range procedure & Theory of group. (ii) Short Range firing.	4
Social Service and Community Development	Cadets will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, Jan Jeevan Hariyali Abhiyan, Beti Bachao Beti Padhao etc. as per the requirement and similar announced days-National and state level.	5

Total- 45

Text Books:

1. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Common Subjects: 2019
2. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Specialized Subject: 2019
3. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Air Force) :Specialized Subject: 2019
4. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Navy) : Specialized Subject: 2019

Course Code: DBNS-102

Title of the Course: NSS

L	T	P	Credits
0	0	4	2

Course Outcomes:
CO1: Orientation: history, objectives, principles, symbol and badge.
CO2: NSS programs and activities
CO3: Community mobilization, Understanding youth
CO4: Volunteerism and Shramdan

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	M	M	S	S	M	M
CO2	S	S	M	S	M	S	M	M	S	S	M	M
CO3	S	S	M	S	M	S	M	M	S	S	M	M
CO4	S	S	M	S	M	S	M	M	S	S	M	M

Unit	Course outlines	Hour(s)
Unit-I	Introduction and Basic Concepts of NSS : • Definition of NSS : Aims & Objectives of NSS, • Roles and responsibilities of various NSS functionaries, • Emblem ,flag, Motto, Song, Badge, NSS day etc, • Organizational structure (from national to regional level).	**10**
	NSS Programmes and Activities : • Concept of regular activities(one day camp), special seven day conduction camping, day and night camps and relevance of celebration of important days recognized by united nations, Centre, State Govt. & University • Basis of adoption of village/slums, methodology of conduction survey • Coordination with different agencies • Maintenance of the diary	**8**

Unit-II	Community Mobilization • Functioning of community stakeholders • Designing the message in the context of the problem and the culture of the community • Identifying methods of mobilization • Youth-Adult partnership • Concept of Community development	**9**
	Volunteerism and Shramdan • Indian tradition of volunteerism • Value system of volunteerism • Motivation and constraints of volunteerism • Shramdanasa part of volunteerism, Role of NSs volunteers in Swatch Bharat Abhiyan • Role of NSS volunteers in Digital India	**8**
Unit-III	Project Work/Practical: Conducting surveys/activities on special themes as follows • Social Harmony and National Integration • Indian Constitution and Social Justice • Concept of Society and Social Issues in India • Health, Hygiene and Sanitation Programmes • Citizens duties, Human Rights consumer Rights	**10**

Total- 45

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester III

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-301	Electrical Machines - I	Theory	40	60	100	3	0	0	3
2.	BTEE-302	Electrical Machines –I Lab	Practical	40	60	100	0	0	2	1
3.	BTEE-303	Digital Electronics	Theory	40	60	100	3	0	0	3
4.	BTEE-304	Digital Electronics Lab	Practical	40	60	100	0	0	2	1
5.	BTEE-305	Electrical and Electronic Measurements	Theory	40	60	100	3	0	0	3
6.	BTEE-306	Electrical and Electronic Measurements Lab	Practical	40	60	100	0	0	2	1
7.	BTEE-307	Integrated Project-III	Practical	40	60	100	0	0	4	Q/NQ
8.	DBES-101	Environmental Science	Theory	40	60	100	3	0	0	3
9.	DBEI-301	Employability Skills Intermediate	Theory	40	60	100	3	0	0	3
Life Skill Course (Select any one)										
10.	DBNC-103	NCC	Practical	40	60	100	1	0	2	2
	DBNS-103	NSS	Practical	40	60	100	0	0	4	
Total										**20**

L- Lecture, T- Tutorial , P- Practical , C- Credit , Q-Qualified, NQ- Not Qualified

Course Code: BTEE-301

Title of the Course: Electrical Machines- I

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Understand operation, constructional details and performance of Transformers
CO2: Conduct testing and experimental procedures on different types of Transformers
CO3: Analyze different connections and parallel operation of Transformers
CO4: Identify and solve Transformer related problem with the knowledge of materials used.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	W	S	M	W	M	W	W	S
CO2	M	S	S	S	S	M	W	W	S	M	M	S
CO3	M	S	S	S	M	W	W	W	M	W	W	S
CO4	S	S	S	S	S	M	M	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	Electromechanical energy conversion: Basic principles, conservation of energy, physical phenomenon involved in conversion, energy balance, energy stored inmagnetic field, Magnetic circuits, magneto motive force magnetic field strength, permeability, reluctance, analogy between electric and magnetic-circuits, B-H curve	9
2	Single Phase Transformer**:** Construction, working principle of operation, E.M.F. equation, phasor diagram under loaded and unloaded condition, rating of transformers, losses in transformer, transformer testing, open and short circuit tests, back to back test, voltage regulation and efficiency, condition for maximum efficiency, equivalent circuit, ideal Transformer, parallel operation of single phase transformers, applications of transformers	9
3	Three winding transformer, construction of three phase transformer, three phase transformer connections: Star-star connection, delta-delta connection, delta-star connection, star-delta connection, phasor groups, three phase to two phase and six phase conversion, scott connection- three phase to two phase conversion, phase shifting from primary to secondary windings, Parallel operations of three phase transformers, harmonics and excitation phenomenon, inrush current phenomenon.	9
4	Different types of insulting materials for transformer core, winding,	9

	insulation, need for bushings, various cooling techniques, effect of temperature on the performance of transformer.	

Total -36

Recommended Books

1. P.S. Bhimbra, 'Electrical Machinery', Khanna Publishers, Delhi,2004
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', TMH,2002.
3. AshfaqHussian, 'Electrical Machines', DhanpatRai and Company,2002.
4. S.J. Chapman, 'Electrical Machinery Fundamentals', McGraw Hill, New York,2010.

E-Books and online learning material

https://www.pdfdrive.com/electrical-machines-e189264944.html (2017)
https://www.pdfdrive.com/single-phase-transformer-construction-operation-e53351524.html (2017)

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108106071/
2. https://www.coursera.org/lecture/linear-circuits-ac-analysis/5-1-transformers-dB0z9
3. https://swayam.gov.in/nd1_noc19_ee60/

Course Code: BTEE-302

Title of the Course: Electrical Machine-I Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Acquire skills to operate all types of transformers.
CO2: Demonstrate knowledge on construction, operation of various types of transformers

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	M	M	W	W	M	M	W	S
CO2	S	S	S	M	M	W	M	W	S	S	M	S

Experiments
1. Construction of transformers 2. To perform Load test on a single phase transformer. 3. To perform Open circuit and short circuit tests on a single phase transformer 4. Separation of core losses of a single phase transformer 5. To find the efficiency and voltage regulation of single phase transformer under different loading conditions. 6. To perform parallel operation of two single phase transformers. 7. To study the various connections of three phase transformer. 8. To perform Scott connections on three phase transformer to get two phase supply. 9. Sumpner's test on a pair of single phase transformers

Course Code: BTEE-303

Title of the Course: Digital Electronics

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Perform radix conversions
CO2: Minimize a given boolean function by using k-map or tabular method
CO3: Analyze and Design a combinational circuit
CO4: Analyze and design flip-flops and latches and design sequential systems composed of standard sequential modules, such as counters and registers.
CO5: Acquire knowledge of the nomenclature and technology in the area of analog and digital signals with their conversion techniques.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	W	W	M	S	W	W	W	W	W	W	M
CO2	M	S	S	W	W	W	W	W	W	W	W	W
CO3	S	S	S	M	M	W	W	W	W	W	M	M
CO4	M	S	S	S	W	W	W	W	W	W	S	W
CO5	S	M	S	S	S	W	W	W	W	W	W	M

Unit	Course Outlines	Hour(s)
1	Introduction to number system, Binary, decimal, Octal, hexadecimal, BCD number system, binary operations: Addition, Subtraction. Multiplication and division, ASCII code. Excess 3 codes and Gray code. Logic gates: OR, AND, NOT, NOR, NAND, Ex-OR gates, Basic theorems of Boolean algebra, sum of products and product of sums. Minimisation using theorems, minimisation using K-map up to 4 variables.	14
2	Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, adders, subtractors, code converters, parity checkers, BCD display drive.	7
3	Flip Flop fundamentals, different flip flop configurations: SR, JK, D, T. Edge triggered and clocked flip flops, Registers: Types of Registers, series and parallel shift: circuit diagram, timing wave form and operations. Counters: synchronous and asynchronous, Johnson counter.	8

4	Introduction, Weighted register D/A converter, binary ladder D/A converter, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A/D converter, A/D accuracy and resolution.	9

Total -36

Recommended Books

1. D.P. Kothari and J.S. Dhillon, 'Digital Circuits and Design', Pearson,2015.
2. R.P. Jain, 'Modern Digital Electronics', TMH,2016.
3. V. Singh, "Learn Digital Electronics: Principles, Devices And Applications", 2016
4. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Ed.,2011.
5. A. K. Maini, "Digital Electronics: Principles, Devices and Applications, Wiley, 2007.

E-Books and online learning material

https://www.pdfdrive.com/foundation-of-digital-electronics-and-logic-design-e31966419.html (2014)
https://www.pdfdrive.com/modern-digital-electronics-e182203848.html (2016)

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/117106086/
2. https://nptel.ac.in/courses/108105113/
3. https://nptel.ac.in/courses/117105080/

Course Code: BTEE-304

Title of the Course: Digital Electronics Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Test and verify working and truth tables of combinational and sequential circuits.

CO2: Familiarization with Digital Trainer Kit and associated equipment to do various experiments

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	W	W	W	S	M	M	S
CO2	S	S	S	M	S	W	W	W	S	W	M	S

Experiments
1. To Study Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and realization of OR, AND, NOT and XOR functions using universal gates.
2. To design Half Adder using Logic gates
3. To design Full Adder using Logic gates
4. To design Half Subtractor using Logic gates.
5. To design Full Subtractor using Logic gates
6. To design 4-Bit Binary-to-Gray Code Converter on breadboard.
7. To design 4-Bit Gray-to-Binary Code Converter on breadboard.
8. Design and verification of Truth-table of multiplexer.
9. Design and verification of Truth-table of Demultiplexer.
10. Design and test S-R flip-flop using NOR/NAND gates.
11. To study and Verify the truth table of a JK flip flop using IC 7476
12. To study and Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode

Course Code: BTEE-305

Title of the Course: Electrical and Electronic Measurements

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Identify and select suitable bridges for the measurement of electrical circuit parameters
CO2: Estimate accurately the values of R, L and C for suitable bridges
CO3:Distinguish the concept behind the operation of analog and digital instruments and Oscilloscopes for the measurement of electrical quantities.
CO4: Understand the basic principles of transducers and their applications.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	W	S	W	M	W	W	S	M
CO2	W	M	M	S	M	W	W	W	M	M	W	M
CO3	M	S	M	M	W	M	W	W	W	M	M	M
CO4	S	S	M	S	M	W	M	W	M	W	M	W

Unit	Course Outlines	Hour(s)
1	Introduction to measuring techniques, necessity of measurements, block diagram of measurement system, Measurement of Resistance: Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger. Measurement of Inductance and Capacitance: Maxwell Inductance, Hay's, Anderson and Schering Bridges, Measurement of frequency by Wein bridge method	9
2	Measurement of Power, Energy and Power factor: Construction and working of dynamometer wattmeter, errors, LPF wattmeters. Measurement of reactive power in three phase circuits using one wattmeter. Block diagram and working of Electronic energy meter. Construction and operation of single phase dynamometer type power factor meter. Problems.	9
3	Basic principle and construction of Analog CRO, sweep modes, applications in measurement of voltage, frequency (Lissajous pattern), Introduction to Dual Trace Oscilloscope, Digital Storage Oscilloscope, sampling oscilloscope. Comparison between analog and digital oscilloscope.	9
4	Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characterises,	9

	Errors of CT and PT. Turns compensation, Illustrative examples Transducers: Transducer and its classifications, basic requirements of Transducer/Sensors. Displacement Transducers: LVDT.	

Total -36

Recommended Books

1. H. Cooper, 'Modern Electronic Instrumentation and Measurement Techniques',2007.
2. A.K. Sawhney, Electronic Instrumentation and Measurement', DhanpatRai&Sons, 2012.
3. Jones and Chin, 'Electronic Instruments and Measurement',2010.
4. B.C. Nakra and K.K. Chaudhary, 'Instrumentation Measurement Analysis', TataMcGraw-Hill,4th edition, 2016
5. Sanjay Gupta & Joseph John, 'Virtual Instrumentation Using Lab VIEW', TMG; Tata McGraw Hills,2014.

E-Books and online learning material

1. https://www.pdfdrive.com/electrical-and-electronics-measurements-and-instrumentation-e33434708.html(2013)
2. https://www.pdfdrive.com/electronic-measuring-instruments-e33712233.html(2016)
3. https://nptel.ac.in/content/syllabus_pdf/108105153.pdf

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108105153/
2. https://swayam.gov.in/nd1_noc19_ee44/
3. https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032

Course Code: BTEE-306

Title of the Course: Electrical and Electronic Measurements Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Calculate the unknown Capacitance, Inductance and Resistance using AC and DC Bridges experimentally
CO2: Acquire hand on experience about different measurement devices and its working principles.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	M	M	W	W	M	M	W	S
CO2	S	S	S	M	M	M	W	W	M	M	W	S

Experiments
1. Study of principle of operation of various types of electromechanical measuring instruments. 2. To measure high value of DC current and voltage using shunt and multiplier. 3. To measure low resistance using wheat stone bridge. 4. To measure active and reactive power in 3-phase balanced load by one wattmeter 5. method. 6. To measure the active power in 3-phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter readings. 7. To study and calibrate single phase energymeter. 8. Measurement of resistance using Kelvin's Bridge. 9. Measurement of self-inductance using Anderson's Bridge. 10. Measurement of capacitance using Schering Bridge. 11. Measurement of frequency using Wein's Bridge. 12. Measurement of displacement using LVDT. 13. Temperature measurement using temperature sensor (RTD). 14. Light measurement using LDR and photo cell censor. 15. Determination of frequency and phase angle using CRO. 16. Measurement of unknown voltage using potentiometer.

Course Code: BTEE-307

Title of the Course: Integrated Project -III

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code: DBES-101

Title of the Course: Environmental Science

L	T	P	Credits
3	0	0	3

Course Outcomes:

After undergoing this course student will be able to:

CO1: Articulate the interdisciplinary context of environmental issues.

CO2: Identify and justify key stakeholders in humanities and social sciences that need to be a part of sustainable solutions.

CO3: Formulate an action plan for sustainable alternatives that integrate science, humanist, and social perspectives.

CO4: Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

CO/PO mapping

(S/M/W indicates strength of correlation) S- Strong , M-Medium , W- Weak

CO'S	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	W	S	S	W	W	S	M	S	M
CO2	S	S	M	M	S	M	M	W	W	S	M	S
CO3	S	M	S	M	S	W	S	M	S	W	S	S
CO4	S	S	M	W	S	S	W	W	S	M	S	M

UNIT	COURSE OUTLINE	HOUR(S)
I	**The Multidisciplinary Nature of Environmental Studies** Definition, scope and importance Need for public awareness. **Natural Resources** Renewable and Non-renewable Resources: • Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Energy resources: Growing energy needs, renewable and non-	8

	renewable energy sources, use of alternate energy sources. Case studies. (d) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.	
II	**Ecosystems** • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the ecosystem **Biodiversity and Its Conservation** • Introduction, definition: genetic, species and ecosystem diversity. • Biodiversity at global, National and local levels.	10
III	**Environmental Pollution** • Definition • Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards • Solid waste management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. **Social Issues and the Environment** • From unsustainable to sustainable development. • Water conservation, rain water harvesting, watershed management. • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and Control of Pollution) Act. • Wildlife Protection Act. • Forest Conservation Act.	10

IV	**Human Population and the Environment** • Population growth, variation among nations. • Population explosion—Family Welfare Programme. • Environment and human health. • Human rights. • Value education. • HIV/AIDS. • Women and Child Welfare. • Role of Information Technology in environment and human health. • Case Studies. **Field Work** • Visit to a local area to document environmental assets—river/forest/grassland/hill/mountain. • Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds. • Study of simple ecosystems—pond, river, hill slopes, etc. • (Field work equal to 5 lecture hours	15

Total- 36

Reference Books –

1. " Environmental Science" by Miller T G.
2. " Introduction to Environmental Engineering and Science" by Gilbert M Masters.
3. " The Biodiversity of India" by BharuchaErach.
4. " Essentials of Ecology" by Townsend C and Michael Begon.
5. https://nptel.ac.in/courses/122102006/
6. https://swayam.gov.in/nd2_cec19_bt03/preview
7. https://www.pdfdrive.com/environmental-science-e12033451.html

Course Code: DBEI-301

Title of the Course: Employability Skills Intermediate

L	T	P	Credits
3	0	0	3

Course Outcomes:

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

Course Code: DBNC-103

Title of the Course: NCC

L	T	P	Credits
1	0	2	2

Course Outcomes

CO1: Admire and get inspired from the accomplishments of leaders from various walks of life.
CO2: Develop public speaking skills.
CO3: Appreciate the need & requirement for disaster management and his role in disaster management activities.
CO4: Know the history & geographical peculiarity of our borders & coastal regions

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	M	W	M	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S
CO4	S	W	W	W	M	M	M	W	S	M	M	S

Subject	Course Outline	Hours
Personality Development	(i) Group Discussions - Change your Mindset (ii) Public Speaking.	5
Leadership	Case Studies – APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy	4
Disaster Management	(i) Disaster Management Capsule. (ii) Organisation. (iii) Types of Disasters. (iv) Essential Services. (v) Assistance. (vi) Civil Defense Organisation.	3
Adventure	(i) Trekking including selection of route and administration planning (ii) Cycle expedition including selection of route and administration planning (iii) Rock climbing	1

Border and Coastal Areas	History, Geography & Topography of Border/ Coastal Areas.	2
Drill	(i) Arm Drill. (ii) Rifle ke saath Savdhan, Vishram aur Aram se. (iii) Rifle ke saath Parade Par aur Saj, Rifle ke saath Visarjan, Line Tod. (iv) Bhumi Shastra aur Uthao Shastra, Bagal Shastra aur Baju Shastra.	8
Field Craft and Battle Craft	(i) Observation. (ii) Camouflage. (iii) Concealment	4
Map Reading	(i) Setting of Map. (ii) Findings North and Own Position	4
Weapon Training	Short Range firing	4
Social Service and Community Development	Cadets will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, Jan Jeevan Hariyali Abhiyan, Beti Bachao Beti Padhao etc as per the requirement and similar announced days- National and State level.	5
Obstacle Training	(i) Obstacle training - Introduction, Safety measures, Benefits. (ii) Obstacle Course- Straight balance, Clear Jump, Gate Vault, Zig- Zag Balance, High Wall.	5

Total- 45

Text Book(s):

1. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Common Subjects: 2019
2. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Specialized Subject: 2019
3. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Air Force) :Specialized Subject: 2019
4. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Navy) : Specialized Subject: 2019

Course Code: DBNS-103

Title of the Course: NSS

L	T	P	Credits
0	0	4	2

Course Outcomes
CO1: Orientation: history, objectives, principles, symbol and badge.
CO2: NSS programs and activities
CO3: Community mobilization, Understanding youth
CO4: Volunteerism and Shramdan

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	M	M	S	S	M	M
CO2	S	S	M	S	M	S	M	M	S	S	M	M
CO3	S	S	M	S	M	S	M	M	S	S	M	M
CO4	S	S	M	S	M	S	M	M	S	S	M	M

Unit	Course outlines	Hour(s)
I	Introduction and Basic Concepts of NSS : • Definition of NSS : Aims & Objectives of NSS, • Roles and responsibilities of various NSS functionaries, • Emblem ,flag, Motto, Song, Badge, NSS day etc, • Organizational structure (from national to regional level).	**10**
	NSS Programmes and Activities : • Concept of regular activities(one day camp), special seven day conduction camping, day and night camps and relevance of celebration of important days recognized by united nations, Centre, State Govt. & University	**8**
II	Community Mobilization • Functioning of community stakeholders	**9**

	• Designing the message in the context of the problem and the culture of the community • Identifying methods of mobilization • Youth-Adult partnership • Concept of Community development	
	Volunteerism and Shramdan • Indian tradition of volunteerism • Value system of volunteerism • Motivation and constraints of volunteerism • Shramdanasa part of volunteerism, Role of NSs volunteers in Swatch Bharat Abhiyan • Role of NSS volunteers in Digital India	**8**
III	Project Work/Practical: Conducting surveys/activities on special themes as follows • Social Harmony and National Integration • Indian Constitution and Social Justice • Concept of Society and Social Issues in India • Health, Hygiene and Sanitation Programmes • Citizens duties, Human Rights consumer Rights	**10**

Total- 45

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester IV

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-401	Electrical Machines – II	Theory	40	60	100	3	0	0	3
2.	BTEE-402	Electrical Machines-II Lab	Practical	40	60	100	0	0	2	1
3.	BTEE-403	Electronic Devices and Circuits	Theory	40	60	100	3	0	0	3
4.	BTEE-404	Electronic Devices and Circuits Lab	Practical	40	60	100	0	0	2	1
5.	BTEE-405	Control System	Theory	40	60	100	0	0	2	1
6.	BTEE-406	Control System Lab	Practical	40	60	100	3	0	0	3
7.	BTEE-407	Integrated Project-IV	Practical	40	60	100	0	0	4	Q/NQ
8.	DBAI-101	Artificial Intelligence	Theory	40	60	100	4	0	0	4
9.	DBHY-101	Health and Wellness-Yoga	Theory	40	60	100	1	0	2	2
Life Skill Course (Select any one)										
10.	DBNC-104	NCC	Practical	40	60	100	1	0	2	2
	DBNS-104	NSS	Practical	40	60	100	0	0	4	
Total										**20**

Training-II of 4-6 Weeks during summer vacations after 4th semester

L- Lecture, T- Tutorial , P- Practical , C- Credit , Q-Qualified, NQ- Not Qualified

Course Code: BTEE-401

Title of the Course: Electrical Machines-II

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Understand operation and constructional details of rotating machines.
CO2: Understand all basic concepts of DC motors and generators.
CO3: Acquire knowledge about testing and speed control of DC machines

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	W	M	S	W	W	W	W	W
CO2	S	M	M	S	M	M	M	W	M	W	W	W
CO3	M	S	S	M	S	S	S	W	W	W	W	S

Unit	Course Outlines	Hour(s)
1	Basic Concepts of Rotating electrical machines, Torque Production, Constructional Featres, general Terminologies, EMF Polygon, MMF in windings, Rotating Magnetic Field, Machine Ratings, Machine applications. General Concepts of DC Machines: Principles and construction, Circuit Model , interpolar and compensating windings, brushes, armature core, armature windings, winding pitch, commutator pitch, commutator segments, armature reaction: de-magnetizing and cross magnetizing effects.	9
2	DC Generators**:** Operation, emf equation, effect of speed upon voltage and flux, types of DC generators. Characteristics of series, shunt and compound generators, voltage regulation, Condition for maximum efficiency, applications	9
3	DC Motors: Operation, concept of back emf, torque equation, power developed, Characteristics of DC motors (series, shunt and compound), effect of saturation and applications.	9
4	Speed control of DC motors, Ward-Leonard control (Voltage control), various starting techniques for DC motors: Three-point starter, four-point starter, Electric breakings of DC shunt and series motors, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Retardation test, Field's test.	9
		Total -36

Recommended Books

1. P.S. Bimbhra, 'Electrical Machinery', KhannaPublishers,2004
2. I.J. Nagrath and D.P. Kothari, 'Electric Machines', Tata McGraw Hill, 2004.
3. Fitzgerald Kingsley, and Stephen Umans, 'Electric Machinery', McGraw Hill,2002.
4. J.B. Gupta, 'Theory and Performance of Electrical Machinery', S.K. Kataria andSons,2015
5. S.J. Chapman, 'Electrical Machinery Fundamentals', McGraw Hill, New York,2010.

E-Books and online learning material

1. https://www.pdfdrive.com/electrical-machines-e41259165.html (2014)
2. https://www.pdfdrive.com/dc-machines-e33432586.html (2012)
3. https://www.coursera.org/lecture/motors-circuits-design/2-dc-motor-principle-of-operation-PZ5N4
4. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-39(TB)(ET)%20((EE)NPTEL).pdf

Online Courses and Video Hour(s)

1. https://www.youtube.com/watch?v=D4RFFnzRdkk
2. https://nptel.ac.in/courses/108106071/
3. https://swayam.gov.in/nd1_noc19_ee60/

Course Code: BTEE-402

Title of the Course: Electrical Machines-II Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Acquire skills to operate all types of dc machines and transformers.
CO2: Start, control the speed and determine the efficiency of different types of DC Motors in various ways and to perform testing on transformers.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	M	M	W	W	M	M	W	S
CO2	S	S	S	M	M	W	M	W	S	S	M	S

Experiments

1. To study the constructional details of direct current (d.c.) machine and to draw sketches of different components.
2. To study various components/cut-section of DC machines.
3. To perform starting techniques of various DC machines.
4. To obtain torque and speed characteristics of a D.C. Shunt motors.
5. To obtain external characteristics of a D.C. shunt generators.
6. To obtain external characteristics of a D.C. series generators.
7. To obtain external characteristics of DC compound generators.
8. Speed control of a dc shunt motor by varying armature circuit and field circuit methods.
9. To obtain performance characteristics of universal motor.
10. To perform Swinburne's Test.
11. To calculate the power rating of DC machines.
12. To determine losses and efficiency of DC machines.

Course Code: BTEE-403

Title of the Course: Electronic Devices and Circuits

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Study PN junction diode, ideal diode, diode models and its circuit analysis
CO2: Compare the different configurations of BJT, draw its characteristics.
CO3: Design various Power amplifiers such as Class A, Class B, Class AB amplifiers etc.
CO4: Develop the parameters of feedback amplifier circuit and describe different types of oscillator circuits.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	W	W	M	M	W	W	W	W	M
CO2	S	M	M	S	M	M	W	W	M	W	W	M
CO3	S	M	S	W	M	W	M	W	M	M	S	W
CO4	M	M	S	M	S	W	W	W	W	W	W	S

Unit	Course Outlines	Hour(s)
1	**Introduction:** Introduction to semiconductors theory, P type and N-Type semiconductors, different types of diodes, Drift current, diffusion current. Rectifiers **Practicals:** • To draw V-I characteristics of PN junction diode (Ge, Si, switching and signal). • To design half wave rectifier. • To design full wave and bridge rectifiers.	9

	• To analyse the response of Zener diode asregulator	
2	**Bipolar Junction Transistor:** Working action of NPN and PNP. CE, CB and CC configurations, Current components, Concept of D.C. and A.C. load line and operating point, Q point selection, bias stability, various biasing circuits- fixed bias, collector to base bias, emitter bias, voltage divider, Stability factors. **Practicals:** • To plot the input and output characteristics of CE configuration. • To plot the input and output characteristics of CB configuration.	9
3	**Power Amplifiers**: Classifications according to mode of operation and driving output, Class A direct coupled with resistive load, operation of class-B power amplifier, Push-Pull Amplifiers, Concept of feedback in amplifiers: Positive and negative feedback, effect of negative feedback. **Practicals:** • To examine the characteristics of a Class-A amplifier. • To examine the characteristics of Class-B amplifier. • To analyse the characteristics of Class-B push-pull amplifier	9
4	**Field Effect Transistors**: FET construction and working, P-channel and N-channel JFETs. Comparison with BJT, Characteristics of JFET, JFET parameters- AC drain resistance, trans-conductance, amplification factor, dc drain resistance. Construction, working and characteristics of MOSFET. Comparison of BJT, JFET and MOSFET. **Practicals:** • To plot the characteristics of FET. • To plot the characteristics of MOSFET.	9
		Total -36

Recommended Books

1. Thomas F. Schubert Jr. & Ernest M. Kim, "Fundamentals of Electronics : Book 1: Electronic Devices and Circuit Applications", Morgan and claypool publishers, 2015
2. Boylstad and Nashelsky, 'Electronic Devices and Circuits', Prentice Hall,2010.
3. Malvino, 'Electronic Principles', McGraw Hill,2007.
4. V.K. Mehta, 'Principles of Electronics', S. Chand,2014

E-Books and online learning material

1. https://www.pdfdrive.com/electronic-devices-and-circuits-by-salivahanan-e27058879.html (2012)
2. https://www.pdfdrive.com/electronic-devices-and-circuits-e33507447.html (2016)
3. https://www.sciencedirect.com/book/9780082034070/electronic-devices-and-circuits

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108108112/
2. https://swayam.gov.in/nd1_noc19_ee38/

Course Code: BTEE-404

Title of the Course: Electrical Circuit Analysis

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1:
CO2: Evaluate two-port network parameters.
CO3: Evaluate Network Transfer function for any Electrical Network
CO4: Design and synthesis of various types of filters.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	W	W	W	W	W	W	W	W	M
CO2	M	S	S	S	W	W	W	W	W	W	W	M
CO3	M	S	S	M	S	M	W	W	W	W	W	W
CO4	S	S	S	S	W	W	W	W	W	W	W	W
CO5	S	S	S	S	S	W	W	W	W	W	W	W

Unit	Course Outlines	Hour(s)
1	Network Topology- Definitions of Graph and Tree, Basic cutset and tieset matrices for planar networks, Loop and nodal methods of analysis of networks with dependent and independent voltage and current sources, Duality and Dual networks.	9
2	Two Port Networks, Network functions, Impedance and admittance function, Transfer functions terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks To calculate and verify 'Z' parameters of two-port network. To calculate and verify 'Y' parameters of two-port network.	9
3	Laplace Transformation: Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems.	9
4	Filters Synthesis: Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T-section, π-section, terminating half section, pass bands and stop bands, Design of Constant-K, m-derived filters, Composite filters	9

Total -36

Recommended Books

1. Bird John, 'Electrical Circuit Theory and Technology', Newnes,Routledge Publication,2013.
2. Abhijit Chakraborty, 'Circuit Theory', DhanpatRai, 2016
3. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuits Analysis, McGraw Hill publishers, 9thedition, New Delhi, 2020.
4. Charles K. Alexander, Mathew N.O. Sadiku, Fundamentals of Electric Circuits, Second Edition, McGraw Hill, 2019.
5. ,2006
6. Mohan, Sudhakar Sham, 'Circuits and Networks Analysis and Synthesis', TMH,2017.
7. Ravish R Singh, 'Network Analysis and Synthesis', Tata McGraw Hill,2017.

E-Books and online learning material

1. http://gn.dronacharya.info/EEEDept/Downloads/subjectinfo/IV/NETWORK_ANALYSIS_SYNTHESIS/NPTEL_Links.pdf
2. https://www.pdfdrive.com/network-analysis-and-synthesis-e175329463.html (2016)
3. https://www.pdfdrive.com/electrical-circuit-theory-and-technology-e42801364.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108105159/
2. https://www.classcentral.com/course/swayam-network-analysis-17705
3. https://nptel.ac.in/courses/108102042/

Course Code: BTEE-405

Title of the Course: Control System

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Apply transfer function models to analyze physical systems.
CO2: Analyze the systems in time domain and frequency domain.
CO3: Analyze the linear systems for absolute and relative stability
CO4: Design compensators in frequency domain.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	W	M	M	W	W	W	W	W	M
CO2	S	S	W	W	W	M	W	W	M	W	M	M
CO3	M	S	W	S	W	S	M	W	M	W	S	S
CO4	S	W	S	M	S	W	W	W	S	S	W	S

Unit	Course Outlines	Hour(s)
1	**Introductory Concepts**: Plant, Systems, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.	10
2	**Modeling**: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.	10

3	**Time Domain Analysis**: Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion **Root Locus Technique:** The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.	9
4	**Compensation**: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation **Control Components**: Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.	7

Total -36

Recommended Books

1. K. Ogata, 'Modern Control Engineering', Prentice Hall,2011.
2. B.C. Kuo, 'Automatic Control System', Prentice Hall, 2010.
3. I.J. Nagrath and M. Gopal, 'Control System Engineering', Wiley Eastern Ltd, 6th Edition, 2017
4. B.S. Manke, 'Linear Control Systems',2017

E-Books and online learning material

1. https://www.pdfdrive.com/control-systems-engineering-sixth-edition-e17317677.html
2. https://www.pdfdrive.com/digital-control-and-state-variable-methods-e38195713.html
3. https://www.pdfdrive.com/linear-control-system-analysis-and-design-with-matlab-sixth-edition-automation-and-control-e187590194.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108106150/
2. https://www.youtube.com/watch?v=FctwbH9lzg4

Course Code: BTEE-406

Title of the Course: Control System Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

At the end of the course, students should be able to

CO1: Acquire skills to understand all types of control components
CO2: Analyze the stability of control systems

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	M	W	M	W	W	M	M	S
CO2	W	S	S	M	S	W	W	W	S	W	M	S

Experiments

1. To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
2. To study the Synchro Transmitter-Receiver set and to use it as an error detector.
3. To study the Speed-Torque characteristics of an AC Servo Motor and to explore its applications.
4. To study the Speed-Torque characteristics of a DC Servo Motor and explore its applications.
5. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers.
6. To study the speed control of an A.C. Servo Motor using a closed loop and an open loop system.
7. To study the operation of a position sensor and study the conversion of position in to corresponding voltage

8. To study various electro-mechanical transducers i.e. resistive, capacitive and inductive transducers
9. To study a LVDT (AC-AC, DC-DC) as a transducer and its processing circuits
10. To study the characteristics of a thermocouple, a thermistor and a RTD
11. To study the variations of time lag by changing the time constant using control engineering trainer

12. To simulate a third order differential equations using an analog computer and calculate time response specifications

13. To design a Lag compensator and test its performance characteristics.

Course Code: BTEE-407

Title of the Course: Integrated Project -IV

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code : DBAI-101
Title of the Course: Artificial Intelligence

L	T	P	Credits
4	0	0	4

Course Outcomes:
CO1: Understand and implement Natural versus Artificial Intelligence
CO2: Apply Reasoning under certainty and AI Language.
CO3: Implement Artificial Intelligence techniques. Clarification in the Concepts of Non-Monotonic reasoning: Truth Maintenance Systems
CO4: Manage projects in multidisciplinary environments for the society.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	M	W	M	W	W	M	M	S
CO2	W	S	S	M	S	W	W	W	S	W	M	S
CO3	S	M	M	S	M	W	M	W	W	M	M	S
CO4	W	S	S	M	S	W	W	W	S	W	M	S

Unit	Course Outlines	Hour(s)
1	Introduction to AI: Definitions, Basic Elements of AI, Application Areas Natural versus Artificial Intelligence, Turing test for the systems. Problem Formulation: Defining problem as a state space search, Problem reduction, problem characteristics, Production Systems. Blind Search Techniques: Depth First Search & Breadth First Search Heuristic Search Techniques: Hill climbing, Best First Search & Optimal A* search	12
2	Reasoning under certainty: Introduction to Monotonic Reasoning, Logics: Syntax & Semantics of Prepositional logic, Syntax & Semantics of First Order Predicate Logic (FOPL) Well Formed Formulae (Wffs), Conversion to Clausal Form, Substitution, Unification & its algorithm, Resolution.	11

3	Reasoning under uncertainty: Introduction to Non-Monotonic Reasoning, Concepts of Non-Monotonic reasoning: Truth Maintenance Systems (TMS) Default Reasoning & Closed World Assumptions. Logics for non-monotonic reasoning: Modal Logics, Temporal Logics & Fuzzy Logics. Knowledge Acquisition, Knowledge Organization & Knowledge Representation Knowledge Representation Schemas: Semantic Nets	12
4	Learning in AI: Definition, types of learning. Expert System: Architecture and components of an expert system, Applications. Natural language processing: Features of natural language, Steps in Natural Language Processing	10

Recommended Books

1. E. Rich and K. Knight," Artificial Intelligence", Tata McGraw Hill Publications
2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.
3. E. Charnaik and D. McDermott," Introduction to artificial Intelligence", Addison-Wesley Publishing Company.
4. Nils J. Nilson, "Principles of Artificial Intelligence", Narosa Publishing Co.
5. M. Chandwick and J.A. Hannah, "Expert Systems for Personal Computers", Galgotia Publications Pvt.Ltd.

Course Code: DBHY-101
Title of the Course: Health and Wellness-Yoga

L	T	P	Credits
1	0	2	2

Unit	Course Outlines	Hour(s)
1	**Health:** Introduction, Concept and Factors influencing health. **Health Education**: Introduction, Objectives, Importance, Scope, Principles, Practice of Health Education, Planning & Evaluation in Health Education Programmes. **Health Services**: Organisation and Administrative Set Up of Health Services in India **Health Problem in India:** Problems Related to Communicable Diseases: (HIV- AIDs, Hepatitis, Malaria, Rabies and Tetanus). **Health instructions:** Types, Role of Teacher, Health Instructions at Primary, Middle & Secondary Stage and their Methods to Imparting Health Instruction	9
2	**Wellness:** Concept, definition, differences between fitness and wellness Components of wellness: Quality of life and healthy life style approach, self-management skills to adhere to healthy life style behavior, SMART Goal evaluation fixation, stress Management, relevant fitness swallower issues. Disease prevention and control, Communicable disease and non-communicable disease	9
3	**Yoga:** Introduction, Historical background and Origin of Yoga, Meaning and Concept of Yoga and its relationship with Physical Education and Sports. **Yoga in present global scenario:** Yoga as a Science; and recent advances in Yoga. **Pranayama**: meaning, types and its importance. **Asanas:** Asanas- meaning , types, principles, Techniques of asanas and effects of asanas on various systems of the body-circulatory, respiratory and digestive system. **Meditation:** Meaning, definition, types and techniques of meditation. **Yoga and Treatment:** Therapeutic and Corrective Values of Yoga Practices special reference to disease like: Diabetes, Asthma, Constipation, Obesity, Cervical, Gastric and Acidity	9
4	**Practical - Selected Games** **Surya Namaskara, Selected Yogasanas** 1. Kukkutasana 2. Uttana-Kurmasana 3. Simhasana 4. Matsyendrasana 5. Paschimottanasana 6. Dhanurasana 7. Matsyasana 8. Baddha-Padmasana 9. Gorakshasana 10. Uttana-Mandukasana 11. Garudasana 12. Ushtrasana	14

	13.	Bhujangasana	14.	Chakrasana	15.	Sarvangasana	
	16.	Mayurasana	17.	Sirshasana	18.	Sankatasana	
	19.	Setubandhasana	20.	Konasana	21.	Trikonasana	
	22.	Karanpedasana	23.	Pada-angushthasana	24.	Ashwathasana	

Recommended Books:-

1. Ashton, D: Adminstration of Physical Education for Women, New York: The Ronald Press Company, 1968.
2. Kamlesh, M.L. and Sangral, M.S. : History and Principles of Physical Education, Prakash Brothers, 1983.
3. Wuest and Bucher: Foundations of Physical Education and Sports, B.I. Publications Pvt. Ltd., New Delhi.
4. William , H.F. : Physical Education and Sports in Changing Society, Surjeet Publication, Delhi.
5. Warner.W. K Hoeger and Sharon.A Hoeger : Fitness & Wellness.wordworth Publications
6. Debnath, Monica "Basic Core Fitness through Yoga and Naturopathy" (2006-07) Sports Publication, G-6,23/23B EMCA House, Ansari Road, Darya Ganj New Delhi
7. Yogeswar, "Text Book of Yoga",(2004) Penguin Books.
8. Harvey, Paul "Yoga for Everybody", (2001)Tucker Slingsby Publisher Ltd.
9. Sharma, Lalita "All You Wanted to Know About Yoga", (1991)Sterling Publisher Pvt. Ltd.
10. Sarawati, S Satyananda "Asana, Pranayam, Mudra and Bandhas".
11. Pandey, P.K. and Gongopadhay, S. R. "Health Education for School Children", Friends Publication, Delhi.
12. Park, J.E. and Park, K, "Text Book of Community Health for Nurses", (1982) Asrani Publisher, Jabalpu.
13. Park, J.E. and Park, K. "Text Book of Preventive and Social Medicine", (1985) Bnasidar Bhanot, Publisher, Jabalpur.
14. Singh, Ajmer., Bains, Jagdish., Gill, Jagtar Singh. and Brar, Rashpal Singh "Essential of physical Education" (2017). Kalyani Publisher, Ludhiana, Punjab.
15. Dr. Paramvir singh ,Physical Education & Yoga. Publication bureau Punjabi university Patiala.

Course Code: DBNC-104

Title of the Course: NCC

L	T	P	Credits
1	0	2	2

Course Outcomes

CO 1: Acquire adequate skill sets to overcome their weakness and reshape their personality.
CO 2: Imbibe good moral values and character traits in their daily life.
CO 3: Become useful members of the society and form part of disaster response team, if need arises.
CO 4: Respect the diversity of different Indian cultures.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	W	M	M	M	M	M	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S
CO4	S	W	W	W	M	M	M	W	S	M	M	S

Subject	Course Outline	Hour(s)
Personality Development	Introduction to Personality Development, Factors influencing/shaping personality, Time Management and Interview Skills.	4
Leadership	Leadership Traits, Moral Values and Character Traits.	3
Disaster Management	Assistance during natural disasters, Do's and Don'ts for NCC Cadets performing Disaster Management Duties.	10
Environmental awareness and Conservation	Adventure Environmental Awareness and Conservation.	3
General Awareness	General Awareness	4
Armed Forces	**Armed Forces (Contact Hrs. 2) (Army).**Army, Navy, Air Force and Central Armed Police Forces. **General Service Knowledge (Contact Hrs. 2) (Air Force).** Armed Forces & IAF Capsule, Modes of Entry in IAF, Civil Aviation, Aircrafts-Types, Capabilities & Role. **Naval Orientation (Contact Hrs. 2)**	6

	(Navy).Armed Forces & Navy Capsule, EEZ Maritime Security & ICG.	
Drill	(i) Arm Drill. (ii) Salami Shastra. (iii) Squad Drill with Arms.	7
Field Craft and Battle Craft	(i) Fire and Move Capsule. (ii) Field signal- with hand, with Weapons, Signal with Whistle. (iii) Field signals as means of giving orders. (iv) Field signals by day, Field signals by night. (v) Section Formation.	4
Map Reading	(i) Map to Ground. (ii) Ground to Map.	4
Weapon Training	Short Range firing.	4
Social Service and Community Development	Cadets will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, Jan Jeevan Hariyali Abhiyan, Beti Bachao Beti Padhao etc as per the requirement and similar announced days- National and State level.	6
Health and Hygiene	(i) Hygiene & Sanitation (Hygiene- Personal & Camp Hygiene). (ii) First Aid in common medical emergencies. (iii) Treatment & Care of Wounds.	5

Total -60

Text Book(s)

1. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Common Subjects: 2019
2. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Army) : Specialized Subject: 2019
3. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Air Force) :Specialized Subject: 2019
4. National Cadet Corps : Senior Division and Senior Wing: Cadets Hand Book (Navy) : Specialized Subject: 2019

Project Work/Practical:
Conducting surveys/activities on special themes as follows

- Social Harmony and National Integration
- Indian Constitution and Social Justice
- Concept of Society and Social Issues in India
- Health, Hygiene and Sanitation Programmes
- Citizens duties, Human Rights consumer Rights
- Special Camp and their Planning

Course Code: DBNS-104
Title of the Course: NSS

L	T	P	Credits
0	0	4	2

Course Outcomes:
CO1: Orientation: history, objectives, principles, symbol and badge.
CO2: NSS programs and activities
CO3: Community mobilization, Understanding youth
CO4: Volunteerism and Shramdan

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	M	M	S	S	M	M
CO2	S	S	M	S	M	S	M	M	S	S	M	M
CO3	S	S	M	S	M	S	M	M	S	S	M	M
CO4	S	S	M	S	M	S	M	M	S	S	M	M

Unit	Course outlines	Lecture(s)
1	Introduction and Basic Concepts of NSS : • Definition of NSS : Aims & Objectives of NSS, • Roles and responsibilities of various NSS functionaries, • Emblem ,flag, Motto, Song, Badge, NSS day etc, • Organizational structure (from national to regional level).	**10**
	NSS Programmes and Activities : • Concept of regular activities(one day camp), special seven day conduction camping, day and night camps and relevance of celebration of important days recognized by united nations, Centre, State Govt. & University • Basis of adoption of village/slums, methodology of conduction survey • Coordination with different agencies • Maintenance of the diary	**8**

2	Community Mobilization • Functioning of community stakeholders • Designing the message in the context of the problem and the culture of the community • Identifying methods of mobilization • Youth-Adult partnership • Concept of Community development	**9**
	Volunteerism and Shramdan • Indian tradition of volunteerism • Value system of volunteerism • Motivation and constraints of volunteerism • Shramdanasa part of volunteerism, Role of NSs volunteers in Swatch Bharat Abhiyan • Role of NSS volunteers in Digital India	**8**
3	Project Work/Practical: Conducting surveys/activities on special themes as follows • Social Harmony and National Integration • Indian Constitution and Social Justice • Concept of Society and Social Issues in India • Health, Hygiene and Sanitation Programmes • Citizens duties, Human Rights consumer Rights	**10**
	Total	**45**

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester V

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-501	Electrical Machines-III	Theory	40	60	100	3	0	0	3
2.	BTEE-502	Electrical Machines-III Lab	Practical	40	60	100	0	0	2	1
3.	BTEE-503	Power Electronics	Theory	40	60	100	3	0	0	3
4.	BTEE-504	Power Electronics Lab	Practical	40	60	100	0	0	2	1
5.	BTEE-505	Power System-I (Transmission and Distribution)	Theory	60	40	100	3	0	0	3
6.	BTEE-506	Biomedical Instrumentation	Theory	40	60	100	3	0	0	3
7.	BTEE-507	Practice Training	Practical	60	40	100	0	0	0	2
8.	BTEE-508	Integrated Project- V	Practical	40	60	100	0	0	4	Q/NQ
9.	DBEA-501	Employability Skills Advance	Theory	40	60	100	3	0	0	3
Elective-I (Select any One)										
10.	BTEE-509	Microprocessor and Microcontroller	Theory	40	60	100	3	0	0	3
	BTEE-510	Signals and Systems	Theory	40	60	100	3	0	0	
	BTEE-511	Electrical Vehicle Technology	Theory	40	60	100	3	0	0	
Total										**22**

L- Lecture , T- Tutorial , P- Practical , C- Credit , Q-Qualified, NQ- Not Qualified

Course Code: BTEE-501

Title of the Course: Electrical Machines-III

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Illustrate constructional features of synchronous machines, winding details, induce EMF
CO2: Develop phasor diagram & examine steady state performance of synchronous machines, determine voltage regulation of an alternator
CO3: Explain transient behavior of synchronous machines & determination of time constant and equivalent circuit parameters under transient conditions.
CO4: Interpret parallel operation of alternators & determine various sequence reactances of synchronous machines

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	W	M	S	W	W	W	W	W
CO2	M	S	M	S	M	M	M	W	M	W	W	W
CO3	S	W	S	M	M	S	S	W	W	W	S	S
CO4	S	W	M	S	W	W	W	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	**General Aspects:** Construction and working principle of synchronous machines, Excitation systems, Production of sinusoidal electromotive force (EMF) and its equation, flux and magnetomotive force (MMF), phasor diagrams, cylindrical and salient pole rotors, pitch factor, distribution factor.	8
2	**Alternators:** Construction, Phasor diagram of cylindrical rotor alternator, ratings, armature reaction, determination of synchronous reactance; open-circuit and short- circuit characteristics, short-circuit ratio, short-circuit loss. Determination of voltage regulation: EMF, MMF and zero power factor method. Power flow through inductive impedance, Power-angle characteristics of cylindrical and salient pole synchronous machines, Two- reaction theory of salient pole machines, power factor control.	14
3	**Synchronous Motors:** Operating characteristics, power-angle characteristics, condition for maximum power, V-curves and inverted V-	11

	curves, methods of starting, synchronous motor applications, synchronous condenser, Hunting, damper windings, Hysteresis motors.	
4	**Parallel Operation of Alternators:** Conditions for synchronization of single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing.	12

Total -45

Recommended Books

1. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers,2010.
2. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electrical Machinery', 6thEdn., McGraw Hill,2005
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines', 4thEdn., Tata McGraw Hill,2011.
4. M.G. Say, 'Alternating Current Machines', 5thEdn., Sir Isaac Pitman and SonsLtd.,2004.
5. S. SarmaMulukutla and Mukesh K. Pathak, 'Electric Machines', 3rdIndian Reprint, CENGAGE Learning, 2009.

E-Books and online learning material

1. https://www.pdfdrive.com/electrical-machines-e41259165.html (2014)
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108108076/lec39.pdf
3. https://nptel.ac.in/content/syllabus_pdf/108105131.pdf

Online Courses and Video Hour(s)

1. https://swayam.gov.in/nd1_noc19_ee69/
2. https://www.youtube.com/watch?v=hevcqgjjpQ0

Course Code: BTEE-502

Title of the Course: Electrical Machines-III Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Acquire skills to operate induction machines.
CO2: Start, control the speed and determine the efficiency of synchronous Motors in various ways and to perform testing on machines.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	M	M	W	W	M	M	W	S
CO2	S	S	S	M	M	W	M	W	S	S	M	S

Experiments

1. To determine voltage regulation of three phase alternator by direct loading.

2. To find regulation of a three-phase alternator by synchronous impedance method (EMF method)

3. To determine voltage regulation of three phase alternator by ZPF method.

4. To determine sub transient direct axis (X_d'') and quadrature axis (X_q") synchronous reactance of an alternator.

5. To determine direct axis (X_d) and quadrature axis (X_q) synchronous reactance of a three phase synchronous machine by slip test.

6. To study the effect of variation of field current upon the stator current and power factor of a synchronous motor at various load and draw V-curves and invert V-curves.

7. To determine symmetrical impedances of a synchronous machine.

8. To perform parallel operation of two alternators.

Course Code: BTEE-503

Title of the Course: Power Electronics

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Acquire knowledge of switching characteristics of various Power Semiconductor devices and able to design and simulate their base/gate drive circuits
CO2: Analyze different controlled rectifier circuits and computing their performances.
CO3: Analyze different dc-dc converter circuits (isolated and non-isolated type) and computing their performances.
CO4: Analyze and Design single phase and three phase Voltage Source Inverter circuit topology and computing their performances.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	S	S	S	M	W	W	W	W	M	M
CO2	M	S	M	M	W	M	M	W	M	W	W	S
CO3	M	S	M	M	W	M	M	W	M	W	W	S
CO4	M	S	S	M	W	M	M	W	M	W	W	S

Unit	Course Outlines	Hour(s)
1	**Introduction:** Thyristor family and SCR, Constructional features of SCR, its static and dynamic characteristics, turn-on and turn-off methods and firing circuits, Ratings and protection of SCR'S, series and parallel operation, commutation circuits.	9
2	**Phase Controlled Converters:** Principle of phase control, single phase and three phase converter circuits with different types of loads, dual converters and their operation. **DC Choppers:** Principle of chopper operation, control strategies, types of	9

	choppers, step up and step down choppers, voltage, current and load-commutated choppers.	
3	**Inverters:** Single phase Voltage source bridge inverters, Modified Mc-Murray half bridge inverter, series inverters, three phase bridge inverters with 180^0 and 120^0 modes. Single phase PWM inverters, Current source inverters.	9
4	**AC Voltage Controllers:** Types of single-phase voltage controllers, single-phase voltage controller with R and RL type of loads. **Cycloconverters:** Principle of operation, single phase to single phase step up and step down Cycloconverters, three phase to single phase cycloconverters.	9

Total -45

Recommended Books

1. G.K. Dubey, S.R. Doradla, A. Joshi, R.N.K. Sinha, 'Thyristorised Power Controllers', New Age International (P) Limited, Publishers,2004.
2. M. Rashid, 'Power Electronics', Prentice Hall of India Private Ltd.,2006.
3. P.S. Bimbhra, 'Power Electronics', Khanna Publishers,2004.
4. Bimal Bose, 'Power Electronics and Motor Drives', Academic Press,2006.
5. C. Rai Harish, 'Power Electronics and Industrial Applications', 1st Edn., CBS Publishers & Distributors Pvt Ltd.,2018.

E-Books and online learning material

1. https://easyengineering.net/power-electronics-by-bimbhra/
2. https://www.pdfdrive.com/power-electronics-devices-circuits-and-applications-d187559996.html
3. https://www.pdfdrive.com/power-electronics-circuit-analysis-and-design-e158276112.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108/105/108105066/
2. https://nptel.ac.in/courses/108102145/
3. https://nptel.ac.in/courses/108101038/

Course Code: BTEE-504

Title of the Course: Power Electronics Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Verify the characteristics of SCR and UJT and triggering pulses for them.
CO2: Visualize and analyze the performance of various converter circuits and to control the speed of motors using thyristors.

CO/PO Mapping
(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	W	M	M	S	M	M	W	W	M	M	W	M
CO2	S	S	S	M	S	W	M	W	S	S	M	S

Experiments

1. To obtain V-I characteristics of SCR and measure latching and holding currents.
2. To plot V-I Characteristics of UJT.
3. To obtain triggering wave forms for SCR using R and RC firing circuits.
4. To obtain output voltage waveforms of single phase half wave controlled rectifier for R-L load.
5. To obtain output voltage wave forms for single phase full-wave controlled rectifiers with resistive and inductive loads.
6. To simulate three phase bridge rectifier and draw load voltage and load current waveform for resistive and inductive loads.
7. To study different types of chopper circuits and obtain waveforms for at least one of them.
8. To simulate single phase inverter using different modulation techniques and obtain load voltage and load current waveform for different types of loads.
9. To simulate single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
10. To study single phase cycloconverter.
11. To study speed control of induction motor using thyristor.
12. To study speed control of DC motor using thyristor.

Course Code: BTEE-505

Title of the Course: Power System- I (Transmission and Distribution)

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Able to understand the structure of power and distribution systems.
CO2: Analyze performance and operating characteristics of transmission lines and underground cables.
CO3: Select and design overhead line insulators and transmission lines.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	S	S	W	M	W	W	W	W	M	M
CO2	M	S	M	M	S	M	M	W	M	W	W	S
CO3	W	S	S	M	W	S	M	W	M	W	W	S

Unit	Course Outlines	Hour(s)
1	Distribution Systems: DC 2-wire and 3-wire systems, AC single phase, three phase and 4- wire systems, and comparison of copper efficiency. Distribution Systems: primary and secondary distribution systems, concentrated and uniformly distributed loads on distributors; one and both ends, ring distribution, sub mains and tampered mains.	12
2	Overhead Transmission Lines: Materials and types of conductors, line parameters; calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, generalized ABCD constants and equivalent circuits of short, medium and long lines. Line performance: regulation and efficiency of short, medium and long lines, series and shunt compensation.	11
3	Overhead Line Insulators and Mechanical Design of Transmission Lines: Type, string efficiency, voltage distribution in string of suspended insulators, grading ring, preventive maintenance. Different types of towers, sag-tension calculations, Corona-losses, radio and audio noise, transmission line–communication line interference	11
4	Underground Cables: classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure,	11

	comparison with overhead transmission lines.	

Total -45

Recommended Books

1. D.P. Kothari and I. J. Nagrath, 'Power System Engineering', Tata McGraw Hill,2007.
2. J.B. Gupta, 'Transmission and Distribution of Electrical Power', Katson Books,2013.
3. C.L. Wadhwa, 'Electric Power Systems', 7th Edn., New Age InternationalPublishers,2016.
4. J. Grainger John and Jr. W.D. Stevenson, 'Power System Analysis', McGraw Hill,1994.

E-Books and online learning material

1. https://www.pdfdrive.com/electric-power-generation-transmission-and-distribution-e17897598.html (2016)
2. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-02(TB)(ET)%20((EE)NPTEL).pdf

Online Courses and Video Hour(s)

1. http://www.nptelvideos.in/2012/11/power-sys-generation-transmission.html
2. https://swayam.gov.in/nd1_noc20_ee39/preview

Course Code: BTEE-506

Title of the Course: Biomedical Instrumentation

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: To differentiate and analyse the biomedical signal sources.
CO2: To elucidate cardiovascular system and related measurement
CO3: To acquire basic knowledge of design, its application and maintenance of different biomedical instruments.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	W	S	S	W	W	M	W	S	M	M	M
CO2	S	S	M	M	S	M	M	W	M	W	M	S
CO3	M	W	M	M	M	M	W	W	W	W	W	M

Unit	Course Outlines	Hour(s)
1	Human Body Subsystems: Brief description of neural, muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities. Transducers and Electrodes: Principles and classification of transducers for Biomedical applications, Electrode theory, different types of electrodes, Selection criteria for transducers and electrodes	9
2	Biopotentials: Electrical activity of excitable cells, ENG, EMG, ECG, ERG, EEG. Neuron potential. Cardio Vascular System measurements: Measurement of blood pressure, blood flow, cardiac output, cardiac rate, Heartsounds, Electrocardiograph, phonocardiograph, Plethysmograph, Echocardiograph.	9

3	Patient Care, Monitoring and Safety Measures: Elements of Intensive care monitoring basic hospital systems and components, physiological effect of electric current shock hazards from electrical equipment, safety measures, Standards & practices.	9
4	Computer Applications and Biotelemetry: Real time computer applications, data acquisition and processing, remote data recording and management.	9

Total -36

Recommended Books

1. Leslie Cromwell, et Al, " Biomedical Instrumentation and Measurements", Prentice Hall, India
2. R S Khandpur, "A Hand Book of Biomedical Instrumentation", Tata McGraw Hill

E-Books and online learning material

1. https://www.pdfdrive.com/biomedical-instrumentation-and-measurements-e186986101.html
2. https://www.pdfdrive.com/analysis-and-application-of-analog-electronic-circuits-to-biomedical-instrumentation-e188365010.html
3. https://www.pdfdrive.com/medical-devices-and-human-engineering-the-biomedical-engineering-handbook-fourth-edition-e165981005.html

Course Code: BTEE-507

Title of the Course: Practice Training

L	T	P	Credits
0	0	0	2

Course Outcomes:

CO1: Gain practical experience of the corporate environment.

CO2: Identify areas for future learning and skill development.

CO3: .Learn professional and corporate behavior and ethics

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	M	M	M	W	W	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S

Course Code: BTEE-508

Title of the Course: Integrated Project -V

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code: DBEA-501

Title of the Course: Employability Skills Advance

L	T	P	Credits
3	0	0	3

Course Outcomes:

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

Course Code: BTEE-509

Title of the Course: Microprocessor and Microcontroller

L	T	P	Credits
3	1	0	4

Course Outcomes:

CO1: Learn basic concepts, organization of 8085 microprocessor.
CO2: Understand the 8085 microprocessor and its interfacing with I/O devices.
CO3: Know the architecture and instruction set of 8051 Microcontroller.
CO4: Understand C and assembly language programming

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W	W	W	W	W	W	W	W	W	M
CO2	M	M	M	W	W	W	M	W	W	W	M	W
CO3	W	W	M	M	W	W	W	W	W	W	W	M
CO4	M	S	S	M	S	M	W	W	S	M	S	S

Unit	Course Outlines	Hour(s)
1	**Introduction to Microprocessors:** Types of computers, Microprocessor evolution and types, Central Processing Unit (CPU) operation and terminology, idea of 8-bit, 16-bit, 32-bit and 64- bit Microprocessors from Intel, Motorola and Zilog and their comparisons.	9
2	**Introduction to 8-bit Microprocessor:** 8085 Microprocessor architecture, classification of instructions, Instruction format, and overview of the 8085 instruction set.	9

3	**8051 Microcontroller Architecture**: Introduction to MCS -51 Family microcontrollers, Architectural block Diagram, Pin diagram and Pin Functions, General Purpose and Special Function Registers, Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory.	9
4	**Introduction to Program Development Tools (IDE):** Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.	9

Total -36

Recommended Books

1. Microprocessor Architecture, Programming and application with 8085 by Gaonkar, 6th edition, 2013
2. Fundamentals of Microprocessor and Microcontrollers by B. Ram,DhanpatRai Publications ,2008
3. K. Udaya Kumar, B. S. Umashankar, "The 8085 Microprocessor Architecture, Programming and Interface", Pearson, 2016
3. Brey, Barry B.Bray, The INTEL Microprocessors 8086/88, 80186, 286, 386, 486, Pentium Pro Processors, Architecture, Programming and Interfacing, 8th Edition, Prentice Hall, 2009
5. Udayashankara V. and Mallikarjunaswamy M.S., 8051 Microcontroller Hardware, Software and Applications, TataMcGraw Hill Education Pvt. Ltd., (2010)

E-Books and online learning material

1. https://easyengineering.net/microprocessor-and-microcontroller-system-by-godse/
2. https://www.pdfdrive.com/microprocessors-and-microcontrollers-interfacing-programming-and-e59855514.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108105102/
2. https://nptel.ac.in/courses/106108100/
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105102/lec7.pdf

Course Code: BTEE-510

Title of the Course: Signals and Systems

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Represent any arbitrary signals in terms of complete sets of orthogonal functions and understand the principles of impulse functions, step function and signum function.
CO2: Express periodic signals in terms of Fourier series and aperiodic signals in terms of Fourier transform.
CO3: Know the concepts of probability of occurrence of random events.
CO4: Analyze various types of noise in the system.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	S	W	M	W	W	W	W	W	M
CO2	S	M	W	S	M	W	M	W	M	M	M	S
CO3	S	S	W	M	W	M	W	W	W	W	M	M
CO4	W	S	M	S	W	S	S	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	**Introduction:** Classification of Signals and Systems, Linear time invariant systems, Convolution, Representation of signals in terms of impulses, Signal Representation using Fourier Series, Complex and Exponential Fourier Series, Fourier Series Representation of Periodic Signals, Properties of Fourier series, Parseval's theorem.	9
2	**Signal Analysis**: Aperiodic Signal Representation using Fourier Transforms, Fourier Transforms of Periodic Power Signals, Signal Transmission through Linear Networks,	9

	Convolution Theorem and its graphical interpretation, Sampling Theorem, Correlation, Autocorrelation.	
3	**Probability:** Introduction to Probability Theory, Definition of Probability of Random Events, Joint and Conditional Probability, Cumulative Distribution Function (CDF), Probability Density Functions (PDF) and Statistical Averages of random variables, introduction to random processes.	9
4	**Noise:** Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise, Equivalent input noise, Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure, Experimental determination of Noise Figure.	9

Total -36

Recommended Books

1. V. Oppenheim Alan, 'Signals and Systems', Prentice Hall, 1997.
2. S. Haykins and B.V. Veen, 'Signals and Systems', John Wiley and Sons,2007.
3. M.J. Roberts, 'Fundamentals of Signals and Systems', SIE Edn., McGraw Hill Education,2007.
4. B.P. Lathi, 'Linear Systems and Signals', Oxford University Press,2009.
5. Sanjay Sharma, 'Signals and Systems', Katson Publishers,2013.
6. Rajeswari K. Raja, Rao B. Visvesvara, 'Signals and Systems', PHI Pvt.Ltd.,2014.

E-Books and online learning material

1. https://www.scribd.com/document/266137872/sanjay-sharma-pdf
2. https://www.pdfdrive.com/signals-systems-and-transforms-e31318320.html
3. https://www.pdfdrive.com/signals-and-systems-electrical-engineering-e17936001.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/117101055/
2. https://nptel.ac.in/courses/108104100/
3. https://nptel.ac.in/courses/117104074/

Course Code: BTEE-511

Title of the Course: Electrical Vehicle Technology

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: To understand about basics of hybrid electric vehicle
CO2: To understand about drives and control
CO3: Select battery, battery indication system for EV applications
CO4: Design of batteries and energy storages and vehicle power electronics and also introduces plug-in hybrid electric vehicles battery charger for an EV

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	W	M	W	M	W	M	W
CO2	M	M	W	W	S	M	W	W	W	M	W	S
CO3	S	W	W	W	W	W	M	W	S	W	S	S

Unit	Course Outlines	Hour(s)
1	Introduction to Hybrid Electric Vehicle: Review of Conventional Vehicle: Introduction to Hybrid Electric Vehicles: Types of EVs, Hybrid Electric Drive-train, Tractive effort in normal driving	9
2	Vehicles: Types of EVs, Hybrid Electric Drive-train, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor	9
3	Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell	9

	based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system, Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle	
4	Business: E-mobility business, electrification challenges, Business- E-mobility business, electrification challenges, Connected Mobility and Autonomous Mobility- case study E-mobility Indian Roadmap Perspective.	9

Total -36

Recommended Books

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.
3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012
4. Tariq Muneer and Irene IllescasGarcía, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017
5. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester VI

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-601	Electrical Machines-IV	Theory	40	60	100	3	0	0	3
2.	BTEE-602	Electrical Machines-IV Lab	Practical	40	60	100	0	0	2	1
3.	BTEE-603	Power System-II (Switchgear and Protection)	Theory	40	60	100	3	0	0	3
4.	BTEE-604	Generation and Economics of Electric Power	Theory	40	60	100	3	0	0	3
5.	BTEE-605	Power Plant Engineering	Theory	40	60	100	3	0	0	3
6.	BTEE-606	Research Methodology	Theory	40	60	100	3	0	0	3
7.	BTEE-607	Integrated Project-VI	Practical	40	60	100	0	0	4	Q/NQ
Elective-II (Select any One)										
8.	BTEE-608	Electrical Power Utilization	Theory	40	60	100	3	0	0	3
	BTEE-609	Digital Control System	Theory	40	60	100	3	0	0	
	BTEE-610	Substation Equipment & Design	Theory	40	60	100	3	0	0	
Total										**19**

L- Lecture , T- Tutorial , P- Practical , C- Credit , Q-Qualified, NQ- Not Qualified

Course Code: BTEE-601

Title of the Course: Electrical Machines-IV

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Understand operation and constructional details of Induction machines.
CO2: Understand all basic concepts of AC generators and single phase motors.
CO3: Acquire knowledge about testing and speed control of AC machines
CO4: Learn about the various special purpose machines and their applications

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	S	W	M	S	W	W	W	W	W
CO2	S	M	M	S	M	M	M	W	M	W	W	W
CO3	M	S	S	M	S	S	S	W	W	W	S	S
CO4	S	W	M	S	W	W	W	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	**Three Phase Induction Motors**: Constructional features, Production of rotating field in space distributed three-phase winding, Principle of operation, Concept of slip, rotor frequency, current, torque and power output, Types of induction motors, Analogy between induction motor and transformer, no load and blocked rotor test, Circle diagram, Equivalent circuit parameters, Phasor diagram, Torque-slip characteristics, Effect of rotor circuit resistance, Crawling and Cogging, Cage motors (double cage and deep bar motor).	18
2	**Starting Methods and Speed Control:** Starting methods of squirrel cage and slip ring induction motor, Different speed control methods, effect of voltage injection in rotor circuit of slip ring induction motor. **Induction Generator:** Isolated and Grid mode operation, method of	12

	excitation, performance characteristics of three-phase self-excited induction generator, introduction to doubly fed induction generator.	
3	**Single Phase Motors**: Introduction, Double revolving field theory, types of single phase motors (Split phase, capacitor start, capacitor run, capacitor start and run) and their characteristics, shaded pole motor: working principle and characteristics. Reluctance motor: construction, principle of operation and applications.	10
4	**Special Purpose Motors:** Stepper Motor: construction, principle of operation and applications. Linear Induction Motor: construction, principle of operation and applications. Universal Motor: construction, principle of operation and applications.	5

Total -45

Recommended Books

1. A.E. Fitzgerald, C. Kingsley and S.D. Umans, 'Electric Machinery', 6th Edn., McGraw Hill,2005
2. E.H. Langsdorff, 'Principles of A.C. Machines', McGraw Hill, 2010.
3. I.J. Nagrath and D.P. Kothari, 'Electrical Machines', 4th Edn., Tata McGraw Hill,2011.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers,7th edition,2011
5. M.G. Say,' Alternating Current Machines', 5th Edn., Sir Isaac Pitman and Sons Ltd.,2004.

E-Books and online learning material

1. http://www.montefiore.ulg.ac.be/~geuzaine/ELEC0431/4_Asynchronous.pdf

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108106072/
2. https://nptel.ac.in/courses/108105131/

Course Code: BTEE-602

Title of the Course: Electrical Machines-IV Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Acquire skills to operate induction machines.
CO2: Start, control the speed and determine the efficiency of induction Motors in various ways and to perform testing on machines.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	S	M	M	W	W	M	M	W	S
CO2	S	S	S	M	M	W	M	W	S	S	M	S

Experiments
1. Load test on three phase squirrel cage Induction motor
2. Speed control of three phase slip ring Induction Motor
3. Load test on single phase Induction Motor
4. Study of DC & AC Starters
5. To perform no load and blocked rotor test on a three phase induction motor and determine the equivalent circuit parameters.
6. To perform load test on three phase induction motor to obtain the performance characteristics.
7. Different Method of Starting Of Three-Phase Squirrel Cage Induction Motor and Their Comparison. [DOL, Auto-Transformer, Star-Delta].
8. Speed control of three-phase Slip Ring Induction Motor by rotor resistance control.
9. To perform load test on single phase induction motor to obtain the performance characteristics.
10. Determination of equivalent circuit parameter of a single phase induction motor.

Course Code: BTEE-603

Title of the Course: Power System-II (Switchgear and Protection)

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Able to understand the basic components of power system protection system
CO2: Analyze performance and operating characteristics of substation, isolator, fuses, relays and circuit breakers.
CO3: Select and design protection system of Bus bar, Generator and Transformer

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	S	M	S	M	W	W	W	W	M	M
CO2	M	S	M	M	W	M	M	W	M	M	W	S
CO3	M	M	S	S	W	M	M	W	M	W	W	S

Unit	Course Outlines	Hour(s)
1	**Introduction to Components of Protection System:** Need for Protective System, Nature and Causes of Faults, Types and Effects of Faults, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Basic Principle of Protective System, Components and Classification of Protective System, Brief Idea of Instrument Breakers, Relays and related Terminologies. **Substation, Isolator and Fuses:** Functions, Types, Classification, Main Equipment, Layout, Bus-bar Arrangement of Substation. Operation, Types and Rating of Isolators. Types, Rating and Characteristics of Fuses.	9
2	**Circuit Breakers:** Circuit Breaker Ratings, Arc Initiation and their Interruption Methods, Arc Quenching Theories, Re-striking voltage, Recovery Voltage, RRRV, Plain Break Oil Circuit Breaker, Minimum Oil Circuit Breaker, Air Circuit Breaker, Air Blast Circuit Breaker, Vacuum Circuit breaker and SF^6 Circuit Breaker. **Protective Relays:** Introduction, Classification, Constructional Features; and Characteristics of Electromagnetic, Induction, Thermal, Over-current relays, Directional Over Current Relay, Distance relays, Comparison between Distance Relays	9
3	**Feeder or Transmission Line Protection**: Over current Protection by Time Graded System, Current Graded and Time- Current Graded System, Protection of Parallel Feeder, Protection of Ring Mains, Over Current Earth Fault Protection, Distance Protection of Transmission lines, Differential and Percentage Differential	9

	Protection, Pilot Relaying Protection of Feeder. **Bus-Bar Protection:** Differential Protection of Bus Bars	
4	**Transformer Protection:** Over current protection, percentage differential protection, incipient faults in transformers, inter-turn fault, protection against over fluxing. **Generator Protection:** Various faults and abnormal operating conditions, protection against unbalanced loading, over speeding, loss of excitation, loss of prime mover.	9

Total -36

Recommended Books

1. C.L. Wadhwa, 'Electrical Power System', New Age International (P)Ltd, 2012
2. D.N. Badri Ram, D.N. Vishakarma, 'Power System Protection andSwitchgear',2nd edition, 2017
3. B.R. Gupta, 'Power System Analysis and Design', S. Chand & Company (P)Ltd, 2005
4. Sunil S. Rao, 'Switchgear Protection and Power Systems', KhannaPublishers,14th edition,2019

E-Books and online learning material

1. https://www.pdfdrive.com/protection-and-switchgear-e33507365.html
2. https://www.pdfdrive.com/switchgear-and-protective-devices-e33427028.html
3. https://swayam.gov.in/nc_details
4. https://nptel.ac.in/courses/108101039/

Course Code: BTEE-604

Title of the Course: Generation and Economics of Electric Power

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Plot the power /Energy demand in the form of graph.
CO2: Explain the importance of economic aspects in power generation.
CO3: Acquire knowledge about the effects of power factor in setting up the tariff and its improvement.
CO4: Gain the knowledge about co-ordinate operation of Hydro and Steam power plants.

CO/PO Mapping
(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	W	M	W	W	W	W	W	W	M	M
CO2	S	M	W	W	M	M	M	W	M	M	W	S
CO3	S	S	M	S	S	S	S	W	S	S	S	S
CO4	M	S	S	W	W	M	M	W	M	W	M	S

Unit	Course Outlines	Hour(s)
1	**Loads and Load Curves:** Types of load (fixed voltage loads, resistive loads, Inductive motor loads, mechanical load), effect of load on supply voltage, maximum demand, group diversity factor, peak diversity factor, types of load, chronological load curves, load- duration curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.	9
2	**Power Plant Economics:** Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation, tariffs and power factor improvement, objectives of tariff making, different types of	9

	tariff (domestic, commercial, agricultural and industrial loads). Need for power factor improvement, power factor improvement using capacitors, determination of economic power factor.	
3	**Selection of Plant:** Plant location, plant size, number and size of units in plants, economic comparison of alternatives based on annual cost, rate of return, present worth and capitalized cost methods. Economic operation of steam plants, methods of loading turbo- generators, input- output curve, heat rate, incremental cost	9
4	**Hydro-Thermal Co-ordination:** Advantages of combined working of Run-off River plant and steam plant, reservoir hydro plants and thermal plants, long-term operational aspects, scheduling methods. Cogeneration: Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.	9

Total -36

Recommended Books

1. D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw Hill,2008.

2. S.C. Arora and S. Dom Kundwar, 'A Course in Power Plant Engineering', 6th Revised Edn.,Dhanpat Rai,2012.

3. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill,2014.

4. B.R. Gupta, 'Generation of Electrical Energy', S. Chand,2017.

E-Books and online learning material

1. https://www.pdfdrive.com/optimal-scheduling-of-hydro-and-hydrothermal-power-systems-e122149000.html
2. https://www.pdfdrive.com/electric-power-generation-transmission-and-distribution-third-edition-e163243543.html
3. https://nptel.ac.in/content/syllabus_pdf/112107291.pdf

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108102047/
2. http://home.engineering.iastate.edu/~jdm/ee553/HydroThermal.pdf
3. https://www.slideshare.net/ASHIRBADBARIK1/hydrothermal-scheduling-79159831

Course Code: BTEE-605

Title of the Course: Power Plant Engineering

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Discuss the layout of thermal power plant and working principle of various types of boilers.
CO2: Explain the working of diesel and gas turbine power plant along with optimization technique
CO3: Gain knowledge on various types of nuclear reactors used in nuclear power plant
CO4: Summarize the principles and working of various energy power plants and environmental issues of power plants

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	S	W	W	W	M	W	W	W	M	S
CO2	S	M	S	S	S	W	M	W	W	W	W	M
CO3	S	W	W	W	W	M	W	W	W	W	W	S
CO4	M	W	W	S	M	S	S	W	M	W	S	M

Unit	Course Outlines	Hour(s)
1	**Steam Generators, Condensers and Turbines**: Classification of steam generators, Types of condensers, effect of air in condensers, steam nozzles, types of steam turbine efficiencies. **Steam Power Plant:** Classification, Operation, Description of Rankin cycle, coal handling system, combustion system, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.	9
2	**Hydro-Electric Power Plants:** Hydrological cycle, Hydrograph, Flow duration curve, Classification of hydro plants, Selection of water turbines for	9

	hydro power plant.	
3	**Gas Turbine:** Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Plant layout, applications. **Nuclear Power Plants:** Nuclear physics, Binding energy, Radioactive decay. Fertile material, Mass defect, Nuclear reactions type and application, Generation of nuclear energy by fission, Nuclear reactors. Safety measures, Future of nuclear power.	9
4	**Diesel Power Plants:** Classifications of IC Engines and their performance, four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Cetane number, knocking, super charging, operation and layout of diesel power plant.	9

Total -36

Recommended Books

1. Chakrabarti, Soni, Gupta and Bhatanagar, 'A Textbook on Power System Engineering', DhanpatRai& Co.,2013.
2. M.M. EI-Wakil, 'Power Plant Technology', 2nd Reprint, Tata McGraw Hill Edn.,2010.
3. R.K. Rajput, 'Power Plant Engineering', 4th Edn.,Luxmi Publications,2010.
4. P.C. Sharma, 'Power Plant Engineering', Kataria and Sons,2009.

E-Books and online learning material

1. http://fondationsonatel.com/docs/lgdmky7.php?smhj=power-plant-engineering-by-arora-pdf-free-download
2. https://www.pdfdrive.com/power-plant-engineering-e11596700.html (2013)
3. https://www.pdfdrive.com/power-plant-engineering-e6453483.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112107216/
3. https://nptel.ac.in/content/syllabus_pdf/112107291.pdf

Course Code: BTEE-606

Title of the Course: Research Methodology

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Able to select and define appropriate research problem and Parameters.
CO2: Able to select the data from different methods.
CO3: Able to organize and conduct research in a more appropriate manner.
CO4: Able to understand and apply statistical.

CO/PO Mapping
(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	S	M	M	M	W	W	M	S	M
CO2	S	S	S	S	M	M	M	W	W	M	S	M
CO3	S	S	M	S	M	M	M	W	W	M	S	M
CO4	S	S	M	S	S	M	M	W	W	M	S	M

Unit	Course Outlines	Hour(s)
1	Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research.	9
2	Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis	9
3	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Accepts of method validation	9
4	Observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.	9
		Total = 36

Recommended Books:

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, NewDelhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', HimalayaPublishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education NewDelhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age InternationalPublishers.
7. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th Edition, by John W. Creswell.

E-Books and online learning material

1. https://www.pdfdrive.com/
2. modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf
3. https://www.free-ebooks.net/
4. http://e-library.net/free-ebook.htm

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/121/106/121106007/
2. https://nptel.ac.in/courses/107108011/
3. https://nptel.ac.in/courses/109105115/

Course Code: BTEE-607

Title of the Course: Integrated Project –VI

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Apply knowledge and skills learned in the labs to solve real life problems.
CO2: Enhance the technical skills required for the industry.
CO3: Identify areas for future learning and skill development.

CO/PO Mapping

(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	S	W	W	W	W	M	W	W	W
CO2	S	S	M	S	W	W	W	W	M	W	W	W
CO3	S	S	W	S	W	W	W	W	M	W	W	W

Course Code: BTEE-608

Title of the Course: Electrical Power Utilization

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Get knowledge about D.C and A.C electric motor drive characteristics and select them for particular traction systems.
CO2: Explore and control various electric heating and welding methods and processes.
CO3: To calculate illumination requirements.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W	S	W	M	W	W	W	W	M	M
CO2	M	S	W	M	M	M	M	W	M	M	W	S
CO3	W	S	S	M	S	S	S	W	S	S	S	S

Unit	Course Outlines	Hour(s)
1	Electrical Traction: Introductions, different traction systems, various systems of electric traction. Locomotives, comparison between A.C and D.C systems of railway electrification, Types of speed and speed-time curves, examples. Mechanics of train movement, tractive effort, power, output, examples., Energy output from driving axles, energy output using simplified speed-time curves, Traction motors and their characteristics, starting and speed control of D.C series and shunt motors, examples, Starting and speed control of A.C series and 3-phase induction motors	10
2	Illumination**:** Nature of light, definitions, Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapor, CFL and LED lamps and their working, comparison, Glare, and its remedy	9
3	Electrical Heating and Welding: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of the building. Electric welding, resistance and arc welding, control devices and welding equipment	9
4	Electrolytic Process: Fundamental principles, extraction, refining of metals and electroplating. Factors affecting the electrodeposition process, power supply for the electrolytic process.	8

Total- 36

Recommended Books

1. Deb Tanmoy, 'Utilization of Electric Power and Traction', Ane Books-New Delhi,2012.
2. R.K. Rajput, 'Utilization of Electrical Energy', Luxmi Publications Pvt. Ltd.,2006.
3. J.B. Gupta, 'Utilization of Electric Power & Electric Traction', S.K. Kataria and Sons, Katson Books,2013.
4. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New age International Pvt. Ltd., Publishers,2005.

E-Books and online learning material

1. https://www.pdfdrive.com/electric-utilities-and-energyelectric-utilities-power-primer-e3926644.html
2. https://www.smartzworld.com/notes/utilization-of-electrical-energy-pdf-notes-uee-pdf-notes/
3. https://www.sciencedirect.com/topics/engineering/electric-power-utilization

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108105060/
2. https://www.pdfdrive.com/utilization-of-electrical-energy-iv-btech-i-semester-mrskwahab-e34332918.html

Course Code: BTEE-609

Title of the Course: Digital Control System

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Develop the mathematical model of the system.
CO2: Know how to find Z – transform and Modified Z – transform of transfer functions and to solve various systems
CO3: Gain the knowledge on basic concepts of stability and analyze the stability of the system.
CO4: Design digital control systems with digital controllers

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	S	M	M	M	W	W	W	W	W	M
CO2	M	S	W	S	W	W	M	W	M	M	M	S
CO3	S	S	W	M	M	M	W	W	W	W	M	M
CO4	W	W	S	S	S	S	S	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	**Introduction:** Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. **Signal Conversion and Processing:** Digital signals and coding, data conversion and quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold and polygonal hold	9
2	**Z-Transforms**, Applications of z-Transforms to Difference equations, Modified z- Transforms, transfer functions, Block diagrams, signal flow graphs: Introduction, Pulse Transfer function, and z-Transfer function, Discrete Data System with cascaded elements separated by a sampler and not separated by a sampler. Closed loop systems, characteristic equation in discrete domain, causality and physically realizable systems; The Sampled signal flow graph.	9
3	**Time Response:** Comparison of continuous data and discrete data, Steady state error analysis of digital control systems, correlation between time response and root locations in s-plane and z-plane, Root loci for digital control systems, Effects of adding poles and zeros to open loop transfer function, discrete data systems: Stability tests of discrete data systems: Bilinear transformation method, extension of RH criterion, Jury's Stability Test.	9

	Frequency – Domain Analysis: Polar plot of GH (z), Nyquist stability criterion, Bode plot, Gain Margin and Phase margin, Nicholas chart, Band width considerations, sensitivity analysis	
4	**State Space Techniques:** Review of continuous data systems, state equations of discrete data systems with sample and hold devices, state diagrams of digital systems, Decomposition of discrete data transfer function, state variable analysis of response between sampling instants,	12

Total -45

Recommended Books

1. B.C. Kuo, Digital Control Systems, Oxford University Press,1995.
2. K. Ogata, 'Discrete Time Control Systems', 2nd Edn., Pearson,2015.
3. K. Ogata, 'Digital Control Engineering', Prentice Hall, Englewood Cliffs,1995
4. M. Gopal, 'Digital Control and State Variable Methods', TataMcGraw-Hill, 2009
5. K. Ogata, 'Discrete Time Control Systems', Pearson Education, Singapore, ThomsonPress India,2014

E-Books and online learning material

1. https://www.pdfdrive.com/discrete-time-control-system-design-with-applications-e176035665.html
2. https://www.pdfdrive.com/control-systems-engineering-sixth-edition-e17317677.html
3. https://www.pdfdrive.com/digital-control-and-state-variable-methods-e38195713.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108103008/
2. https://swayam.gov.in/nd1_noc19_ee42/

Course Code: BTEE-610

Title of the Course: Substation Equipment and Design

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Use equipment in substations and their design considerations.
CO2: Know the use of different types of transformers used in substations.
CO3: Understand about importance of reactive power and its management by use of capacitor banks.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	W	S	S	S	M	M	W	W	W	M	S
CO2	S	M	W	M	W	W	M	W	M	M	W	M
CO3	S	W	W	W	M	M	W	W	W	W	S	S

Unit	Course Outlines	Hour(s)
1	**Substation:** Introduction, classification and layout of substation, Single Bus bar, Mesh Substation, Factors affecting layout of substation, types of bus bars, Substation equipment specifications, testing of substation Equipment. **Power Transformer:** Introduction and Working Principle of Power Transformer, Classification and their types, important characteristics of Transformer Oil.	9
2	**Earthing:** Introduction and purpose of Earthing, tolerable limits of body currents, soil resistivity, earth resistance and its measurement, tolerable and actual step and touch voltage, types of Earthing, Design of Earthing grid, impulse Behavior of Earthing system, grounded and ungrounded neutral system,Types, Methods and selection of grounding neutral.	9
3	**Reactive Power Management:** Introduction to Reactive Power & its Importance in Power System, Sources of Generation & Absorption of Reactive Power, Reactive Power Compensation & its Advantages, Various types of Reactive Power Compensation and its Calculation, Static Synchronous Compensator, Unified Power Flow Controller. **Capacitor Banks: -** Need for Reactive Compensation, Power Factor Improvement and its Benefits, Purpose of Installation of Capacitor Bank, Protection of Capacitor Bank and Pre-Commissioning Checks and tests, Series and Shunt Compensators, Rating and operation of Shunt Capacitor	9

	banks.	
4	**Station Battery and Charging Equipment:** Introduction, Variable Load Battery and System Tester, Testing of Battery Charger and Battery, Types of Batteries, Basic Charging Methods. **Computer Applications in Substation Engineering**: Introduction, System Components, Communication Infrastructure and Methods, Trends in SCADA, Remote Terminal Unit, MODEM.	9

Total -36

Recommended Books

1. R.S. Dahiya and VinayAttri, 'Sub Station Engineering, Design, Concepts and Computer Application', S.K. Kataria& Sons,2013.
2. S. Rao, 'Electrical Substation Engineering and Practice', Khanna Publishers,1992.
3. P.S. Satnam and P.V. Gupta, 'Substation Design and Equipment', DhanpatRai Publications,2013.
4. Mcdonald John D., 'Electric Power Substations Engineering', 3rd Edn., CRC Press,2012.

E-Books and online learning material

1. https://www.pdfdrive.com/engineering-supply-erection-and-commissioning-of-3311-kv-gis-sub-stations-with-33kv-and-e123435432.html
2. https://www.pdfdrive.com/cable-entries-earthings-sub-stations-e41824505.html
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108107112/lec2.pdf

Online Courses and Video Hour(s)

1. https://swayam.gov.in/nd1_noc19_ee61/
2. https://nptel.ac.in/courses/108107112/

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester VII

Sr. No.	Course Code	Course Name	Course Type	Internal	External	Total	L	T	P	C
1.	BTEE-701	Power System Analysis and Design	Theory	40	60	100	3	0	0	3
2.	BTEE-702	High Voltage Engineering & EHVAC	Theory	40	60	100	3	0	0	3
3.	BTEE-703	Programming in MATLAB	Practical	40	60	100	0	0	2	1
4.	BTEE-704	Integrated Project-VII	Practical	40	60	100	0	0	4	Q/NQ
5.	DBWS-701	Effective Workplace Skills++	Theory	40	60	100	3	0	0	3
6.	DBST-101	Science, Technology and Society	Theory	40	60	100	3	0	0	3
7.	DBCE-101	Community Engagement	Practical	40	60	100	0	0	2	1
Elective- III (Select any One)										
8.	BTEE-705	Energy Auditing & Management	Theory	40	60	100	3	0	0	3
	BTEE-706	Digital Signal Processing	Theory	40	60	100	3	0	0	
	BTEE-707	Automation and Industrial Internet of Things	Theory	40	60	100	3	0	0	
Elective-IV (Select any One)										
9.	BTEE-708	Non-Conventional Energy Sources	Theory	40	60	100	3	0	0	3
	BTEE-709	Industrial Automation	Theory	40	60	100	3	0	0	
	BTEE-710	Flexible AC Transmission System Devices	Theory	40	60	100	3	0	0	
Total										**20**

L- Lecture, T- Tutorial, P- Practical, C- Credit, Q-Qualified, NQ- Not Qualified

Course Code: BTEE-701

Title of the Course: Power System Analysis and Design

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Develop per unit system models of synchronous machines, transformers, transmission lines and static loads for power system studies.
CO2: Perform load flow studies by using bus admittance matrix and to do fault analysis by bus impedance matrix.
CO3: Compare features of Gauss-Siedel, Newton-Raphson and Fast decoupled methods of load flow analysis.
CO4: Analyze the effect of small and large disturbances on power system stability.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	M	S	M	W	W	W	M	W	M
CO2	W	S	M	S	S	W	M	W	M	W	S	W
CO3	M	S	W	S	M	S	S	W	W	M	M	S
CO4	M	S	M	M	W	M	M	W	M	W	M	M

Unit	Course Outlines	Hour(s)
1	**System Modelling:** System modelling of synchronous machines, transformers, transmission lines and loads, Per Unit (p.u.) representation of power system, Single line diagram of electrical networks, p.u. single phase impedance diagrams corresponding to single line diagram, formulation of Bus Admittance Matrix and Bus Impedance Matrix for power system studies.	9
2	**Load Flow Studies:** Data for the load flow studies, Bus types, Formulation of power flow equations, Iterative solutions of load flow equations by the Gauss-Seidel and Newton- Raphson methods, Algorithms and flow charts of these methods, Line flows and line losses calculations. Introduction to Decoupled and Fast Decoupled method.	9
3	**Fault Analysis:** Transients on transmission line, Short circuit of synchronous machine, Selection of circuit breakers, Construction of sequence networks of power systems. Analysis of Unsymmetrical LG (line to ground), LL (line to line), LLG (line line ground) faults using symmetrical components	9
4	**Power System Stability:** Steady state stability, Dynamics of a synchronous machine, Power angle equation, Transient stability, Equal area criterion, Numerical solution of swing equation, Factors effecting	9

	transient stability.	

Total -36

Recommended Books

1. D.P. Kothari, I.J. Nagrath, "Modern Power System Analysis", 4th Edition,2011
2. M.A.Pai,'ComputerTechniquesinPowerSystemAnalysis',TataMcGrawHill,NewDelhi, 2014.
3. J.J.GraingerandW.D.Stevenson,'PowerSystemAnalysis',TataMcGrawHill,NewDelhi, 2017.
4. X.-F. Wang et al., "Modern Power Systems Analysis".Springer,2008

E-books and online learning material

1. https://www.pdfdrive.com/modern-power-systems-analysis-power-electronics-and-power-systems-e184195439.html
2. https://nptel.ac.in/course.html
3. https://swayam.gov.in/nc_details

Course Code: BTEE-702

Title of the Course: High Voltage Engineering & EHVAC

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Explain that how over-voltages arise in a power system, and protection against these over-voltages.
CO2: Understand the basic physical phenomenon occurring in various breakdown processes in solid,
liquid and gaseous insulating materials.
CO3: Know about generation and measurement of D. C., A.C., & Impulse voltages.
CO4: Know about H. V. testing of equipment and insulating materials, as per the standards.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	M	M	S	S	W	W	W	W	M	M
CO2	S	S	M	M	M	S	M	W	M	M	W	S
CO3	M	S	S	S	M	M	M	W	M	W	W	S
CO4	M	M	S	M	S	M	S	W	S	M	M	S

Unit	Course Outlines	Hour(s)
1	**Breakdown in liquid and solid Insulating materials:** Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.	9
2	**Generation of High Voltages :** Generation of high voltages, generation of high D.C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators	9
3	**Preliminaries:** Necessity of EHV AC transmission, advantages and problems, power handling capacity and line losses, mechanical consideration	9
4	**Voltage Gradients of Conductors:** Electrostatics, field of sphere gap, field of line charges and properties, charge, potential relations for multi-conductors, surface voltage gradient on conductors, distribution of voltage gradient on sub conductors of bundle, Electrostatic field, calculation of electrostatic field of EHV/AC lines, effect on humans, animals and plants, electrostatic induction in un-energized circuit of double-circuit line, electromagnetic interference, No load voltage conditions and charging current.	9

Total -36

Recommended Books

1. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', McGraw Hill Education, 2013.
2. C.L. Wadhwa, 'High Voltage Engineering', New Age International Publishers, 2007.
3. E. Kuffel, W.S. Zaengl and J. Kuffel, 'High Voltage Engineering Fundamentals',Newnes Publication,2000.
4. R. Arora and W. Mosch, 'High Voltage and Electrical Insulation Engineering', John Wiley & Sons,2011.

E-books and online learning material

1. https://www.pdfdrive.com/high-voltage-engineering-by-clwadhwa-e55608879.html
2. https://www.pdfdrive.com/high-voltage-engineering-fundamentals-e14526035.html
3. https://nptel.ac.in/courses/108104048/
4. https://www.btechguru.com/courses--nptel--high-voltage-engineering--ee-video-lecture--ee10014w.html

Course Code: BTEE-703

Title of the Course: Programming in MATLAB

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: Understand the main features of the MATLAB/SCILAB program development environment to enable their usage in the higher learning.
CO2: To do various programming operations in MATLAB and develop Simulink models in SIMULINK

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	M	S	M	S	M	M	M	M	S
CO2	M	S	S	S	S	W	M	W	S	S	S	S

Experiments

1. Introduction to Fundamentals of MATLAB Programming.
2. To perform Arithmetic and logic operations in MATLAB.
3. To perform branch and loop operations in MATLAB.
4. To use basic built-in function of Matrices in MATLAB.
5. To develop a user defined function file in MATLAB.
6. To plot 2-D & 3-D graphs in MATLAB, such as plots, subplots, logarithmic plots and multiple plots etc.
7. To plot 3-phase AC supply voltage in MATLAB.
8. To develop MATLAB program to calculate ABCD parameters
9. Introduction to commonly used blocks of SIMULINK
10. To develop Simulink model to show series resonance phenomena of transmission line and to plot voltage & current waveforms and frequency vs impedance graph.
11. To develop Simulink model to show parallel resonance phenomenon and plot voltage & current waveforms and frequency vs admittance graph.
12. To develop a Simulink model of symmetrical three phase power system supplying a three phase balanced load and to display the three phase voltage, current, active and reactive power.
13. To develop Simulink model of three phase transformer and to display the primary and secondary voltages and currents.
14. To develop Simulink model for speed control of dc motors.

Note: At least ten experiments should be performed in semester.

Recommended Books

1. Tyagi Agam Kumar, 'Matlab and Simulink for Engineers', Oxford Publishers,**2012**.
2. S. Swapna Kumar, S.V.B. Lenina, 'MATLAB Easy Way of Learning', PHI,**2016**.
3. Stephen J. Chapman, 'MATLAB Programming for Engineers', Cengage Learning,**2015**.

Course Code: BTEE-704

Title of the Course: Integrated Project-VII

L	T	P	Credits
0	0	4	-

Course Outcomes:

CO1: Undertake short research projects in a team under the direction of members of the faculty
CO2: Impart skills in preparing detailed report describing the project and results.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	W	S	M	S	M	S	W	S	M	M	S
CO2	S	W	M	S	M	S	M	W	S	S	S	S

The assignment to normally include:
1. Survey and study of published literature on the assigned project 2. Working out a preliminary Approach to the Problem related to the assigned project; 3. Conducting preliminaryAnalysis/Modelling/Simulation/Experiment/Design/Feasibility; 4. Preparing a Written Report on the Study conducted for presentation to the Department; 5. Final Seminar, as oral Presentation before a departmental committee

Course Code: DBWS-701

Title of the Course: Effective Workplace Skills++

L	T	P	Credits
3	0	0	3

Course Outcomes:

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

Course Code: DBST-101

Title of the Course: Science, Technology and Society

L	T	P	Credits
2	0	2	3

Course Outcomes:

CO1: Understand the three basic theoretical trends that problematized production of scientific knowledge; Sociology of Scientific Knowledge (SSK), Postcolonial Studies of Science and Feminist Studies of Science.
CO2: Understand technology-society interface from a wide range of theoretical standpoints such as social shaping of technology, social constructionist and actor network theoretical perspectives.
CO3: Understand science and technology are socially and culturally embedded activities.

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	S	W	M	W	S	M	S	S
CO2	S	M	M	S	S	W	M	W	S	M	M	S
CO3	S	M	M	S	S	W	M	W	S	M	M	S

Unit	Course Outlines	Hour(s)
1	**Sociology of Scientific Knowledge** What is the relationship between science and the social?– Conventional view of philosophers and historians of science-Sociology of Science (Karl Manheim-Robert K. Merton)-Social Function of Science-(Joseph Bernal)-The Radical Science Movement-the Kuhnian intervention-Science as a social activity: Strong Programme-Laboratory Studies/ethnography of science-Actor Network Theory (Bruno Latour)-communicating science to peers- scientific controversies-public engagement with S&T-the changing configuration of science- mode II knowledge production	12

2	**Feminist and Postcolonial Studies of Science** Women in Science-Gender and Science-Has feminism changed science?-feminist epistemology-Eurocentrism-the Enlightenment-racism and science-colonial science-human body and science-Craniology and comparative anatomy in the 19th century-eugenics-caste and gender in Indian science	12
3	**Technology** – Society Interface i.Techno science and the Interpenetration of Science & Technology Questioning of the traditional boundary between science (knowing) and technology (doing)—how science and technology together shape the ways in which knowledge is constructed---Technological Determinism, Power and the Politics of Knowledge Production ii. Technology in Context: Perspectives in STS Studies This section examines various perspectives on Technology in STS studies A) Social Shaping of Technology B) Social Construction of Technology C) Actor Network Theory D) Transition in Socio-Technical Systems: Multi-Level Perspective E) Critical Theory of Technology iii.Gender and Technology How gender influences technologies and the social organization of scientific and technical workspaces---technologies constructed as masculine and feminine—technologies as both 'liberating' and 'limiting' women---contributions of Cynthia Cockburn & Donna Haraway iv. Public Engagement with Technology Contributions of Trench, Lewenstein, Jasanoff & Vishvanathan---governance and ethical issues in the context of emerging technologies-----constructing risk….role of State, civil society organizations and industry---regulatory dilemmas of transnational capitalism and influence of local contexts—democratisation and 'up-stream' public engagment with technology	12

Total = 36

Recommended Books

1. Anne Fausto-Sterling. 2002. "Gender, Race and Nation: The Comparative Anatomy of 'Hottentot' Women in Europe, 1815–17. In Kimberly Wallace-Sanders (ed.). Skin Deep, Spirit Strong: The Black Female Body in American Culture. Ann Arbor: The University of Michigan Press, pp. 66–95.
2. Bijker, Wiebe E. 1997. Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change. Cambridge, MA:MIT Press.
3. Bijker, Wiebe E. et al. 1989. The Social Construction of Technological Systems. Cambridge, MA: MIT Press. Bloor, David 1976. Knowledge and Social Imagery, second edition, London: Routledge and Kegan Paul.
4. Bourdieu, Pierre. 2004. Science of Science and Reflexivity. Cambridge: Polity Press. Bucchi, Massimiano. 1996. "When Scientists Turn to the Public: Alternative Routes in Science Communication." Public Understanding of Science 05: 375–394.

Course Code: DBCE-101

Title of the Course: Community Engagement

L	T	P	Credits
0	0	2	1

Course Outcomes:

CO1: To develop an appreciation of rural culture, life-style and wisdom amongst students.
CO2: To learn about the status of various agricultural and rural development programmes.
CO3: To understand causes for rural distress and poverty and explore solutions for the same
CO4: To apply class room knowledge of courses to field realities and there by improve quality of learning.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
CO's	Programme Outcomes (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M	W	M	M	M	W	W	M	M	S
CO2	M	S	M	S	W	M	W	W	M	W	S	M
CO3	S	W	W	M	S	S	S	W	S	W	S	S
CO4	S	W	W	W	M	M	M	W	S	M	M	S

Module	Course Outlines	Hour(s)
Appreciation of Rural Society	Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of‘ soul of India lies in villages’ (Gandhi),rural infrastructure	8
Understanding rural economy & livelihood	Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets	8
Rural Institutions	Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees),localcivil society, localadministration	8
Rural Development Programmes	History of rural development In India, current national programmes: Sarva Shiksha Abhiyan,Beti Bachao, Beti Padhao,Ayushman Bharat, Swatchh Bharat, PMA was Yojana, Skill India,Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc	8

Total-32

****Recommended** field-based practical activities:

1. Interaction with SHG women members, and study of their functions and challenges; planning for theirs kill building and livelihood activities
2. Visit MGNREGS projectsites, interact with beneficiaries and interview function aries at the work site
3. Field visit to Swachh Bharat projectsites,conduct analysis and initiate problem solving measures
4. Conduct Mission Antyo day a surveys to support under Gram Panchayat Development Plan (GPDP)
5. Interactive community exercise with local leaders, Panchayat functionaries, grass-roo tof icials and local institutions regarding village development plan preparation and resource mobilization
6. Visit RuralSchools/mid-day meal centres, study Academic and infrastructural resources and gaps
7. Participate in Gram Sabha meetings, and study community participation
8. Associate with Social audit exercises at the Gram Panchay at level ,and interact with programme beneficiaries
9. Attend Parent Teacher Association meetings, and interview school drop outs
10. Visit local Anganwadi Centre and observe the services being provided
11. Visit local NGOs, civil society organizations and interact with their staff and beneficiaries,
12. Organize awareness programmes, health camps, Disability camps and cleanliness

camps

13. Conducts oil healthtest, drinking water analysis, energy use and fuel efficiency surveys
14. Raise understanding of people impacts of climate change, building up community's disaster preparedness
15. Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
16. Formation of committees for common property resource management, village pond maintenance and fishing

Recommended Readings:

Books:

1. Singh,Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi,2015.
2. A Handbook on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj tudies,2002.
3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs/
4. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers,2016.

Journals:

1. Journals of Rural development,(published by NIRD & PR Hyderabad)
2. Indian Journal of Social Work,(by TISS ,Bombay)
3. Indian Journal of Extension Education (by Indian Society of Extension Education)
4. Journal of Extension Education (by Extension Education Society)
5. Kurukshetra (Ministry of Rural Development, GoI)
6. Yojana (Ministry of Information and Broadcasting GoI)

Course Code: BTEE-705

Title of the Course: Energy Auditing and Management

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Acquire the knowledge of basic principles of energy auditing, types and objectives, instruments used.
CO2: Make use of the first aid methods and concept of energy management and energy auditing.
CO3: Develop the energy price and utilize available resource in an optimal way.

CO/PO Mapping
(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W	M	W	W	M	W	W	W	M	S
CO2	S	M	M	S	S	W	M	W	M	M	W	M
CO3	M	W	S	W	W	M	W	W	W	W	W	S

Unit	Course Outlines	Hour(s)
1	**Energy Scenario:** Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features.	6
2	**Material and Energy Balance:** Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.	6
3	**Financial Management:** Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.	6
4	**Energy Management and 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 and energy substitution, Energy audit instruments	6

Total -24

Recommended Books

1. C.B. Smith, 'Energy Management Principles', PergamonPress, 2nd Edition , 2015
2. W.C. Turner, 'Energy Management Handbook', John Wiley and Sons, A WileyInterscience, 7th edition, 2012
3. Hirzel,Simon, "A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management",European Commission, 2016
4. https://www.pdfdrive.com/a-study-on-energy-efficiency-in-enterprises-energy-audits-and-energy-management-e124282152.html
5. https://nptel.ac.in/course.html

Course Code: BTEE-706

Title of the Course: Digital Signal Processing

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Understand the nature of discrete time signals and DFS computation
CO2: Understand DTFT, DFT and the fast computation of DFT using FFT algorithms and implement in real-time applications.
CO3: Design IIR Digital filters for the given specifications.
CO4: Design FIR Digital filters for the given specifications.
CO5: Design Real time systems using the multirate processing techniques and the DSP processors.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W	S	W	W	W	W	W	M	W	M
CO2	S	M	M	S	M	W	M	W	M	M	W	S
CO3	M	S	S	M	S	M	W	W	W	W	M	M
CO4	M	S	S	M	S	M	M	W	W	W	M	S
CO5	M	M	S	M	S	M	W	W	S	S	S	S

Unit	Course Outlines	Hour(s)
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 Nyquest rate. **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, Introduction to bilateral Z-transforms.	9
2	**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	9
3	**Digital Filter Structure:** Describing Equation, Structures for FIR Systems and Structure for IIR Systems. Representation of Structures using Signal Flow Graph.	12

	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, Finite Word-length Effects, Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	
4	**Applications of Digital Signal Processing:** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	6

Total -36

Recommended Books

1. Andreas Antoniou "Digital Filters: Analysis, Design, and Signal Processing Applications" Tata McGrowHill Edition 2018
2. S. Salivahan, A. Vallavaraj, Gnanpiya, 'Digital Signal Processing', Tata McGrawHill,2011
3. S.K. Mitra, 'Digital Signal Processing - A Computer based Approach', Tata McGrawHill,2013
4. https://nptel.ac.in/courses/108/106/108106151/
5. https://nptel.ac.in/courses/108/105/108105055/
6. http://dl.icdst.org/pdfs/files/025bf242e23c7ed259ea93f3cdfbb2f2.pdf

Course Code: BTEE-707

Title of the Course: Automation and Industrial Internet of Things

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Get a understanding of what all is required for IoT and industrial automation Components.
CO2: Understand the architecture, emerging industrial infrastructure and challenges involved in deployment of IIoT based industrial automation
CO3: Understand the concepts, programming and hardware design of Programmable Logic Controllers for smart automation and also discuss the network standards, interfacing and communication techniques.
CO4: Design and develop a suitable IIoT controller for automated system involving for smart manufacturing.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	S	M	S	M	W	W	W	W	M	M
CO2	M	S	M	M	W	M	M	W	M	M	W	S
CO3	M	M	S	S	W	M	M	W	M	W	W	S
CO4	S	W	S	M	S	M	W	M	W	W	M	M

Unit	Course Outlines	Hour(s)
1	History and evolution of automation: Plants to Parts-Plant Layout-Types of automation- Data acquisition, storage and analytics-Real time analytics-Actuators-Types-Characteristics-Control of Actuators- Analog & Digital I/O Modules, SCADA System and RTU-IEDs- Analysis of Automated Flow Lines-material handling function- Automated Storage Systems- Product identification system: Barcode, RFID.	9
2	Evolution of IIoT- OT Components: Industrial control system, PLC, SCADA, DCS-IT Components: Hardware- Software- People ,Processes IIoT Adoption-Market statistics, early adopters, Roadmap- Business opportunities: Product + Service model-Development, deployment	9
3	Principles of interface, serial interface and its standards- parallel interfaces and buses- Characteristic features of industrial networks- Low level networks and their features-Field bus architecture- Use of field buses in industrial plants.	9
4	Functional Requirements, Configurations - Distributed Control Systems-IIoT in DCS- Industrial cloud platforms- Industrial Gateways-Commercial Gateways	9

	solutions from Intel, Cisco-Cloud based Gateway solutions- Industrial IoT security-Industrial IoT and Security-Standards and Best practices-Common vulnerabilities-Remote health monitoring of the plant-Attack surfaces- Cyber security for Industrial Control Systems. Automation, Control and IIoT Applications in Petroleum Refineries-Cement Plant – Thermal Power Plant – Pharmaceutical Industries – Steel plant- Water Treatment Plant-Automobile Industries-Smart Energy Management**.**	

Total -36

Recommended Books

1. M.P.Grover, "Automation, Production Systems and Computer Integrated Manufacturing" Pearson Education Limited, New Delhi, 2015.
2. Clarence W. De Silva, “Sensors and actuators : Control System Instrumentation” CRC Press, 2007
3. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things” Academic Press, 1st edition, June 2016.
4. Cuno Pfster, “Getting Started with the Internet of Things” Published by O’Reilly Media, Inc.2011.
5. Jose´Cecı´lio, and Pedro Furtado, “Wireless Sensors in Industrial Time-Critical Environments” Springer International Publishing, Switzerland 2014.
6. Tyson Macaulay and Bryan Singer “Cyber Security for Industrial Control Systems” CRC Press, 2011.

Course Code: BTEE-708

Title of the Course: Non-Conventional Energy Sources

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Create awareness among students about Non-Conventional sources of energy technologies
CO2: Students will get knowledge about utilization of renewable energy sources and solar energy.
CO3: They will learn about wind energy conversion and bio-mass energy conversion systems.
CO4: They will become aware about geothermal energy, energy from ocean and hydrogen energy sources.

CO/PO Mapping
(S-Strong Correlation, M- Medium Correlation, W-Weak Correlation

	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W	M	W	S	S	W	W	W	M	W
CO2	S	M	W	W	W	M	W	W	W	M	W	S
CO3	M	M	S	M	S	S	M	W	S	W	S	S
CO4	S	W	M	W	M	M	M	W	W	W	M	S

Unit	Course Outlines	Hour(s)
1	Introduction: Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation. Thermo-Electric Generators: Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect	9
2	MHD Generators: Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of Magneto-Hydro-Dynamic (MHD) generator, types of MHD material, conversion effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.	9
3	Photovoltaic Effect And Solar Energy: Photovoltaic effect, different types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.	9
4	Fuel Cells: Principle of action, Gibb's free energy, general description of fuel cells, types, construction, operational characteristics and application. Miscellaneous Sources: Geothermal system, hydro-electric plants, wind power, tidal energy, Bio-mass energy	9

Total -36

Recommended Books

1. G.D. Rai, 'Non-Conventional Sources of Energy', KhannaPublishers,2007
2. N.K. Bansal and M. Kleemann, M. Heliss, 'Renewable Energy Sources and Conversion Technology, Tata McGraw Hill,1990.
3. Mudryk K. & Werle S. , "Renewable Energy Sources: Engineering, Technology, Innovation, Springer, 2016

E-Books and online learning material

1. https://www.pdfdrive.com/renewable-energy-sources-engineering-technology-innovation-icores-2017-volume-in-springer-proceedings-in-energy-springer-d158438456.html
2. https://nptel.ac.in/course.html
3. https://swayam.gov.in/nc_details

Course Code: DBUEE-709

Title of the Course: Industrial Automation

L	T	P	Credits
3	0	0	3

Course Outcomes:

At the end of the course, students should be able to

CO1: Identify a suitable automation / control for specific application.

CO2: Describe the function and design of power controllers, circuit breakers and design field devices using latest technology.

CO3: Describe the concepts of Industrial automation and various control cases.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	M	M	M	W	W	W	W	W	W
CO2	S	W	S	W	S	W	W	W	M	M	M	S
CO3	S	M	W	W	M	M	M	W	W	W	M	M

Unit	Course Outlines	Hour(s)
1	**Introduction**: Need for automation, Architecture of Industrial Automation system. Introduction to Programmable Logic Controller (PLC), Supervisory Control and Data Acquisition (SCADA), Human machine interface (HMI) and Distributed Control System (DCS), Introduction to state load dispatch centre (SLDC), Industrial Data Networks.	12
2	**Field Devices:** Conventional and Smart Process Transmitters for Temperature, Pressure, Flow, Level, Power, power factor and pH Measurement, Final Control Elements, Pneumatic and electric actuators, Thyristor ,Power Controller, Introduction to DC and AC Servo Drives for motion control, Interfacing Field devices with I/O Sub Systems.	11
3	**Computer Aided Measurement and Control Systems:** Role of computers in measurement and control, Elements of computer aided measurement and control, Man-Machine Interface, computer aided process control hardware and software –Industrial Internet of things (IoT), Cloud computing, Cyber Security for Industrial automation.	12

4	**Case Studies:** Industrial automation for Traffic light control, Bottle filling application and Elevator control, DCS/SCADA in cement plant and thermal power plant **Standards:** introduction to different safety and quality standards.	10

Total hours: 45

Recommended Books

1. Bela G. liptak, 'Process Control and Optimization', 4th Edn., Taylor & Francis,2003.
2. S.K. Singh, 'Industrial Instrumentation', 2nd Edn., Tata McGraw Hill,2003.
3. C.D. Johnson, 'Process Control Instrumentation Technology', 8th Edn., Prentice Hall India,2006.

E-books and e-learning material

1. https://www.pdfdrive.com/industrial-automation-e20073411.html
2. https://www.pdfdrive.com/industrial-automation-e43065833.html
3. https://nptel.ac.in/courses/108105063/
4. https://swayam.gov.in/nd1_noc20_me39

Course Code: BTEE-710

Title of the Course: Flexible AC Transmission System

L	T	P	Credits
3	0	0	3

Course Outcomes:

CO1: Review the concept power electronics fundamentals.
CO2: Identify the various FACTS controller and its applications.
CO3: Predict the impact of FACTS controllers on AC transmission system.
CO4: Choose the appropriate FACTS controllers for reactive power compensation in AC transmission system to improve the quality of power.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation												
	Programme Outcomes (PO's)											
CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W	W	W	W	M	W	M	W	M	W
CO2	M	S	W	S	M	W	W	W	W	M	M	S
CO3	M	W	W	S	W	M	M	W	S	W	S	S
CO4	W	S	M	M	W	M	M	W	M	W	M	M

Unit	Course Outlines	Hour(s)
1	**Power Electronics Fundamentals:** Basic function of power electronics, Power semiconductor device for high power converters, Static power convertor structures, AC controller based structure, DC link convertor topologies, Convertor output and harmonic control.	9
2	**Power Transmission Control:** Fundamental of ac power transmission, Transmission problems and needs, the emergence of FACTS, FACTS control considerations, FACTS controllers.	9
3	**Shunt and Series Compensation:** Shunt SVC principles, Configuration and control, STATCOM, Configuration applications. Fundamental of series compensation using GCSC, TCSC and TSSC, Application of TCSC for different problems of power system, TCSC lay out, SSSC principle of operation.	9
4	**Unified Power Flow Controllers:** Basic operating principles and characteristics, independent active and reactive power flow control, control of UPFC, installation, applications, UPFC model for power flow studies, comparison of UPFC with the controlled series compensators and phase shifters	9

Total -36

Recommended Books

1. A. Ghosh and G. Ledwich, 'Power Quality Enhancement Using Custom Power Devices', Kluwer Academic Publishers,2005.
2. N.G. Hingorani and L. Gyragyi, 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission System', Standard Publishers and Distributors,2016.
3. Y.H. Sang and A.T. John, 'Flexible AC Transmission Systems', IEEE Press,2006.
4. R.M. Mathur and R.K. Verma, 'Thyristor Based FACTS Controllers for Electrical Transmission Systems', IEEE Press,2002.

E-Books and online learning material

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108107114/lec2.pdf
2. https://www.pdfdrive.com/understanding-facts-concepts-and-technology-of-flexible-ac-transmission-systems-e187420780.html
3. https://www.pdfdrive.com/understanding-facts-concepts-and-technology-of-flexible-ac-transmission-systems-e165222016.html

Online Courses and Video Hour(s)

1. https://nptel.ac.in/courses/108107114/

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Science

Department of Electrical Engineering

Program: B. Tech

Semester VIII

Sr. No.	Course Code	Course Name	Category	Internal	External	Total	L	T	P	C
1.	BTEE-801	Industrial Training	EEC	500	500	1000	-	-	-	24
Total				**500**	**500**	**1000**	**-**	**-**	**-**	**24**

L- Lecture , T- Tutorial , P- Practical , C- Credit , EEC- Employability Enhancement Course