

# **Ordinance No. V(2A)**

## **Bachelor of Technology**

### **(B.Tech.)**

**(Discipline: Electrical & Electronics Engineering)**



**Faculty of Engineering & Technology**

**SWAMI VIVEKANAND SUBHARTI UNIVERSITY,  
MEERUT**

**SWAMI VIVEKANAND SUBHARTI UNIVERSITY,  
MEERUT  
SUBHARTI INSTITUTE OF TECHNOLOGY AND  
ENGINEERING  
ORDINANCE No. V (2A) RELATING TO  
BACHELOR OF TECHNOLOGY (B.Tech.) PROGRAMME  
(As per AICTE)  
(Effective from the Session – 2018-19)**

**General**

- This ordinance may be called “**Ordinance Relating to Bachelor of Technology (B.Tech)**” Programme.
- It shall come enforced with immediate effect from session 2018-19.
- This supersedes the previous Ordinance relating to Bachelor of Technology (B.Tech) Programme ordinance no. [V (2A)].
- The degree “Bachelor of Technology” acronym as B.Tech shall be of four years (eight semesters) in the branches of Engineering prevalent in the institute at a point of time based on Choice Based Credit System (CBCS) as per AICTE guidelines.

**CHAPTER – 1**

**1.1 Introduction**

Chhatrapati Shahuji Subharti Institute of Technology and Engineering is a constituent Institute of Swami Vivekanand Subharti University, Meerut has been established in 2005 with the vision we make every decision to support the career and personal development of our learners. Our curriculum, teaching and services demonstrate that we value the diverse profiles of our learners. The University boasts of highly qualified, dedicated and competent faculty from all walks of life, world class infrastructure, fully equipped Laboratories with latest state-of-the-art equipment and a huge library with recent knowledge resources including e-resources. Swami Vivekanand Subharti University providing a safe and healthy working environment for teaching and non-teaching employees, students, and visitors etc.

**1.2 Vision**

To become a dynamic, demand driven, quality conscious, efficient and innovative institute capable of becoming active partner in the techno-economic growth of the Nation and to provide world class technological education and research inputs to the society.

**1.3 Mission**

Strive to create centre of excellence in specialized areas of technology and enable its academic beneficiaries to become competent professionals capable of providing sustainable solutions to challenging problems of the society and industry.

#### **1.4 Programme Educational Objectives (PEOs):**

The Programme Educational Objectives of B.Tech. programmes are:

**PEO1.** To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms

**PEO2.** To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise

**PEO3.** To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, design and implementation skills

**PEO4.** To prepare graduates who will thrive to pursue life-long learning to fulfill their goals

#### **1.5 Programme Outcomes (POs):**

Engineering programmes are designed to prepare graduates to attain the following program outcomes:

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

**PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

**PO12. 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.

## **CHAPTER-2**

### **Eligibility for Admission**

- 2.1
- (i) An applicant is eligible for admission in the 1 Year of the B.Tech. programme provided that, he/she should be at least 17 years on 31 December of the year of admission. The upper age limit for taking admission in Under Graduate programme will be 30 years. (as per SVSU Letter No. U-07/SVSU/2016/374 dated 16.08.2016 )
  - (ii) An applicant should have passed intermediate examination or an equivalent examination from any recognized board/university with Physics, Mathematics as compulsory subjects, Chemistry/Bio-technology/Computer Science/Biology as one of the optional subjects.
  - (iii) The admission shall be considered purely on the basis of merit in the University entrance test and counseling conducted by the university. The applicant who have 45 % of marks (40 % for SC/ST) [as per AICTE norms\*] or more in the above mentioned three subjects and not less than 45 % marks (40 % for SC/ST) in the optional subjects will be considered for direct admission against seats, which might not have been filled up through the examination and counseling.
  - (iv) The applicant who has obtained a two/three year Engineering Diploma with Minimum (45 %) aggregate marks from a recognized Institute/University will be considered eligible for direct admission in the second year of the B.Tech programmes.
  - (v) The applicant having a three year B.Sc. degree with Mathematics with a minimum of 40 % marks in aggregate from a recognized university will be considered eligible for direct admission in the second year of the B.Tech programmes. Provided that the students belonging to B.Sc. Stream, shall clear the subjects Engineering Graphics/Engineering Drawing and Engineering Mechanics of the First Year Engineering Programme along with the Second year subjects.
  - (vi) Provided that the students belonging to B.Sc. Stream shall be considered only after filling the supernumerary seats in this category with students belonging to the Diploma Stream.

- 2.2** The B.Tech. programme is available in the following discipline:
- (i) Computer Science & Engineering
  - (ii) Information Technology
  - (iii) Electrical & Electronics Engineering
  - (iv) Electronics & Communication Engineering
  - (v) Mechanical Engineering
  - (vi) Civil Engineering
  - (vii) Food Technology
- 2.3** Selected candidates shall be allocated a discipline from those listed in clause 2.2 on the basis of merit, choice and counseling.
- 2.4** Request for change in discipline may be considered on the basis of merit in the entrance examination provided that the seat remains vacant after the last date for admission in B.Tech. programme.
- 2.5** After 2<sup>nd</sup> Semester, a student can apply for change of branch which shall be considered on the following grounds:
- (i) Availabilities of seats in branch as per sanctioned intake by AICTE.
  - (ii) The students should have passed 1<sup>st</sup> and 2<sup>nd</sup> Semester examination without any carry over paper.
  - (iii) The branch from which the students will be shifted must not fall below 75 % of its sanctioned intake.
- 2.6** The change of discipline shall be allowed only once during the programme.

### **CHAPTER-3**

#### **Teaching Course**

- 3.1** The programme will be of four years duration, divided in to eight semesters.
- 3.2** The duration of the B. Tech. programme for the candidates admitted in semester I will be four academic years (eight semesters).
- 3.3** The duration of the B. Tech. programme for the candidates admitted in semester III (lateral entry) will be three academic years (six semesters).
- 3.4** Annual academic calendar shall be published by the University.
- 3.5** There shall be normally 14 weeks of teaching in every semester.
- 3.6** Study & evaluation scheme is enclosed as an Annexure A1-A7.

## **CHAPTER-4**

### **Curriculum/Structure**

**4.1** The programme shall be spread over four academic years, spread over eight semesters comprising actual teaching for a minimum of 90 days in each semester.

**4.2** The programme focuses on the following aspects:

- (a) Competency
- (b) Entrepreneurship
- (c) Skill Enhancement
- (d) Value Added Courses
- (e) Extracurricular activities

### **4.3 Choice Based Credit System (CBCS) :**

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising Professional/Program Core Courses (PCC), Professional/Program Elective Courses (PEC), Engineering Science Courses (ESC), Basic Sciences Courses (BSC), Humanities and Social Sciences including Management Courses (HSMC) Mandatory Courses (MC) and Open Elective Courses (OEC). The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

#### **4.3.1 Structure of Undergraduate programs**

The four year B. Tech. programme compromise of courses divided in seven distinct areas, namely: Professional/Program Core Courses (PCC), Professional/Program Elective Courses (PEC), Engineering Science Courses (ESC), Basic Sciences Courses (BSC), Humanities and Social Sciences including Management Courses (HSMC) Mandatory Courses (MC) and Open Elective Courses (OEC). All the courses offered in first year B. Tech. programs are categorized as 'Common Courses' for all the academic programs. Credits assigned and curricular components of the B. Tech. curriculum are given in Annexure A1-A7.

#### **Professional/Program Core Courses (PCC)**

The departmental core consists of courses considered essential for a chosen Engineering/Science discipline including, Engineering design, Seminar, Industrial Training and Project (PROJ).

### **Professional/Program Elective Courses (PEC)**

The students are required to complete a specific number of elective courses. Every department offers a wide variety of elective courses to students providing them opportunity to discover their academic interest and enhancing their engagement in learning process.

### **Open Elective Courses (OEC)**

The Open Electives courses are offered by different academic departments to the students of all disciplines. A wide range of elective courses is available with each branch. When a student opts elective courses offered in his/her program it will be termed as OE.

### **Humanities and Social Sciences including Management Courses (HSMC)**

The Humanities, Social Sciences and Management Courses consist of courses considered essential for a B.Tech. program to inculcate the essence of technical writing, communication skills, economics and analysis, management and professional ethics & human values.

### **Basic Sciences Courses (BSC)**

The Applied Sciences and Mathematics Courses consist of courses considered essential for a B.Tech. program to build the foundation for learning of engineering core courses.

### **Engineering Science Courses (ESC)**

The students are required to complete a minimum number of Allied engineering courses (majority of them taught as common courses) offered by engineering departments other than his/her parent department. These courses expose the student with wide spectrum knowledge of allied engineering domain connected to the main engineering stream of the course of study of the students of concerned departments.

### **Mandatory Courses (MC)**

The mandatory courses considered essential for a B.Tech. programme to inculcate the essence of Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Knowledge Tradition etc.

#### **4.4 Induction Program**

Three weeks duration Induction program for students to be offered right at the start of the first year. These activities are listed under following 7 heads:

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self development
6. Nature and Environment
7. Innovation

**4.5** The academic calendar shall be as follows:-

<b>I , III , V, VII Semester (Odd)</b>	Session - 1st Aug. to 30th Nov Exam - 1st Dec. to 20th Dec.
<b>II, IV, VI, VIII Semester (Even)</b>	Session - 1st Jan. to 10th May Exam - 1st May to 20th May

## CHAPTER-5

### Attendance

- 5.1 The students are expected to attend all the classes and should not have less than 75 % attendance in theory as well as in practical classes, wherever held, to become eligible to appear for the university examination. Short fall in attendance can, however be condoned in deserving cases to the extent of 10 % by the Principal. If the short fall is more than 10 % but not more than 15 %, the Principal may recommend deserving cases to the Vice Chancellor for condo-nation. The order of the Vice Chancellor in this regard shall be final.

## CHAPTER-6

### Examination

All Courses offered by SITE will have an evaluation system within two components as:

1. Continuous Comprehensive Assessment (CCA) accounting for 30% of the final grade that a student gets in a course, and
2. End-Semester Examination (ESE) accounting for the remaining 70% of the final grade that the student gets in a course.

**A student will have to pass both the components i.e. CCA and ESE separately to become eligible to be declared successful in a course.**

### 6.1 Continuous Comprehensive Assessment (CCA)

#### **Award of Sessional Marks:**

Sessional marks for theory subjects and practicals and shall be awarded as per the breakup of sessional marks given below:-

#### **(i) Theory Subjects :**

- |  |      |
|--|------|
| (a) Class test will comprise two mid-term test of equal weightage. | - 20 |
| <b>Marks</b>   |      |
| (b) Marks for regular class attendance                             | - 10 |
| <b>Marks</b>   |      |

#### **(ii) Practical :**

- |  |     |
|--|-----|
| (a) Two–mid-term viva-voce test of equal weightage.  | - 5 |
| <b>Marks</b>   |     |
| (b) Teacher’s assessment (including 5 marks for regular attendance) based on lab record attendance |     |
| - 10 Marks   |     |

- (iii)** Make-up test may be held for those students who fail to appear in any one of the mid-term class test due to genuine unavoidable reasons, provided prior permission was consented from the Principal.

(iv) A maximum of 10 marks in each subject shall be awarded for attending classes (theory/practical) as per the following norms:

Marks	85 % or more attendance	-	10
Marks	80 % or more but less than 85 % attendance	-	09
Marks	75 % or more but less than 80 % attendance	-	08
Marks	70 % or more but less than 75 % attendance	-	07
Marks	65 % or more but less than 70 % attendance	-	06
Marks	60 % or more but less than 65 % attendance	-	05
Marks	51 % or more but less than 60 % attendance	-	04
Marks	50 % attendance	-	01
Marks	Less than 50 % attendance	-	0

#### 6.2 **Award of General Proficiency Marks:**

The marks in General Proficiency shall be awarded on the following basis:-

(i) Co-curricular & Extra-curricular activities (games, sports, cultural and literary activities etc.)

**50%**

(ii) Discipline inside and outside the college campus (including 10 marks for regular attendance)

**50%**

6.3 The marks for seminar, industrial training and educational tour shall be awarded on the following basis:

(i) Write-up/Report 50%

(ii) Presentation 50%

#### 6.4 **END SEMESTER EXAMINATION (ESE)**

The remaining 70% of the final grade of the student in a course will be assessed on the basis of an end semester examination (ESE) that will be for three hours duration and will cover the entire syllabus of the course. The question papers for the ESE will be got set by the Controller of Examinations (COE) of the Swami Vivekanand Subharti University (SVSU) by a selected faculty panel.

6.5 The entire programme has to be completed within a maximum of seven years from the date of original admission in the programme by those students who are admitted in the first year and within six years by those admitted directly in the Second Year, [Vide clause 2.1 (iv, v)]

## CHAPTER-7

### Paper Setting

- 7.1 The work of setting the end semester examination papers and evaluation of scripts and conduct of the end semester practical examination shall be assigned to the course teachers as well as to outsiders, ordinarily in the ratio of 50:50 for internal and external valuation respectively.

### Results

- 7.2 The result shall be prepared at the end of each academic year of the programme by aggregating the marks obtained in the theory and practical examinations in all the semesters of the programme till date.
- (a) The minimum passing marks in each theory subject (including sessional marks) shall be 40% and 50% in aggregate. The minimum pass marks in a project/ Practical subject (including sessional marks if any), Seminars, Industrial Training and Educational Tour, Viva-Voce etc. shall be 50%.
  - (b) If a student obtained 40% marks in at least 50% of the papers (ignoring fractions) including project report, he/she will be provisionally promoted to the next year with carryover papers and will have to appear & obtain pass marks in carryover papers along with the subsequent regular examinations for the relevant semester.
  - (c) If a candidate fails in only one head/subject and having passed in all other head/subject of the given examination of the year than his/her deficiency of maximum five (05) marks may be fulfilled by grace marks after fulfilling the conditions given below:
- 7.3 If a candidate fails in only one head/subject and having passed in all other heads/subjects of the given examination of a **semester\*/year**, then his/her deficiency of marks may be fulfilled by grace marks under the following conditions:-
- (i) Grace marks is not a matter of right of the student but is the discretion of the University.
  - (ii) Provided that the candidate has appeared in the main examination of the concerned programme and falls short of pass marks by not more than five (05) marks in theory paper only. Benefit of above mentioned shall not be given to the candidate who had appeared in supplementary/special examination/carry over examination.
  - (iii) Further, benefit of grace marks may be given only to the candidate who will pass the entire concerned examination of the **semester\*/year** after awarding the grace marks and not for the purpose of promoting the student to next year with back papers or for improvement of division or percentage.

- (iv) If in a head/subject of an examination passing in Theory, Practical or sessional exams separately is mandatory, then the benefit of grace marks shall be given only in Theory examination of the University examination.
- (v) The award of grace marks permissible shall be on the basis of 1 grace mark for every 05 marks secured by an examinee over and above the minimum passing aggregate marks of all subjects of the year.

7.4 Awarding of Grace Marks shall be done as given below:-

Aggregate Marks Obtained over & above minimum passing marks	Permissible Grace Marks
1-5	1
6-10	2
11-15	3
16-20	4
21-25	5

Total number of Grace Marks given to the student will be marked with astrick (\*) at the bottom of the mark sheet.

\* Grace Mark in semester examination will be considered hereinafter.

A student not covered by clause 7.2 (a) to (c) above shall have the following options to complete his/her programme -

- (i) He/ she may take admission on payment of full annual programme fee and repeat the entire year of study. He /She shall be treated as a regular student.  
Or
- (ii) He /She may pay only University exam fee for the End Semester Examination and appear in the End Semester University exams directly. He /She shall not be allowed to attend classes and the Sessional marks obtained earlier shall be retained. Or
- (iii) He /She may pay half of the annual programme fee and attend classes. The sessional marks obtained by him/her earlier shall be retained. There will not be any requirement of minimum attendance for appearing in the University examination

7.5 A student will not be promoted to the next academic year if the carryover papers are more than 50% at one point of time.

### **Evaluation under Grading Assessment**

7.6 The minimum Grade/ Grade Point required to pass each paper in a semester examination under CBCS shall be Grade D/ Grade Point 4 in each theory paper/ Practical/Project (wherever applicable) in External Examination and Internal Assessment separately.

### **Calculation Criteria**

7.7 To implement the following grading system, the colleges/campuses shall use the following UGC recommended 10 point grading system:

Marks (%)	Letter Grades	Grade Points (G)
85-100	A++ (Outstanding)	10
75 to < 85	A+ (Excellent)	9
70 to <75	A (Very Good)	8
65 to <70	B+ (Good)	7
60 to <65	B (Above Average)	6
50 to <60	C (Average)	5
40 to <50	D (Pass)	4
0 to <40	F (Fail)	0
	AB (Absent)	0

**7.8 Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)**

$$(S_i) = \sum (C_i \times G_i) / \sum C_i,$$

where  $C_i$  is the number of credits of the  $i^{\text{th}}$  programme and  $G_i$  is the grade point scored by the student in the  $i^{\text{th}}$  programme.

$$CGPA = \sum (C_i \times S_i) / \sum C_i$$

where  $S_i$  is the SGPA of the  $i^{\text{th}}$  semester and  $C_i$  is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts

**CHAPTER-8**  
**Power to Modify**

- 8.1** In the event of any emergent situation, if any deviation is considered necessary, the Vice-Chancellor is authorized to modify the ordinance. Subjected to subsequent ratification by the executive council.



**SWAMI VIVEKANAND  
SUBHARTI UNIVERSITY, MEERUT**



**EVALUATION SCHEME & SYLLABUS**

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**B.TECH.**

**(ELECTRICAL & ELECTRONICS ENGG.)**

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**W.E.F. SESSION 2018-19**

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**SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING**  
**SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT**  
**STUDY & EVALUATION SCHEME**  
**B.Tech<sup>1st</sup> Year/<sup>1st</sup> Semester (Common to all branches)**  
**w.e.f academic Session 2018-19**

SEMESTER I														
S. No.	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BAS-101/ BAS-102</b>	Physics/ Chemistry	BSC-1/ BSC-2	3	1	0	20	10	30	-	70	-	100	4
2	<b>BAS-103</b>	Mathematics I	BSC-3	3	1	0	20	10	30	-	70	-	100	4
3	<b>BEEE-101/ BCSE-101</b>	Electrical Engg./ Programming For Problem Solving	ESC-1/ ESC-2	3	1	0	20	10	30	-	70	-	100	4
4	<b>BME-151/ BME-152</b>	Engineering Graphics & Design/ Workshop Practices	ESC-3/ ESC-4	1	0	4	-	-	-	15	-	35	50	3
5	<b>BAS-151/ BAS-152</b>	Physics Lab/ Chemistry Lab	BSC-1/ BSC-2	0	0	3	-	-	-	15	-	35	50	1.5
6	<b>BEEE-151/ BCSE-151</b>	Electrical Engineering Lab/ Programming for Problem Solving Lab	ESC-1/ ESC-2	0	0	2	-	-	-	15	-	35	50	1
<b>Total</b>												<b>450</b>	<b>17.5</b>	

**B.Tech.<sup>1st</sup> Year/<sup>2nd</sup> Semester (Common to all branches)**  
**w.e.f academic Session 2018-19**

SEMESTER II														
S No	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BAS-201/ BAS-202</b>	Physics/ Chemistry	BSC-1/ BSC-2	3	1	0	20	10	30	-	70	-	100	4
2	<b>BAS-203</b>	Mathematics II	BSC-4	3	1	0	20	10	30	-	70	-	100	4
3	<b>BEEE-201/ BCSE-201</b>	Electrical Engg./ Programming For Problem Solving	ESC-1/ ESC-2	3	1	0	20	10	30	-	70	-	100	4
4	<b>BME-251 / BME-252</b>	Engineering Graphics & Design/ Workshop Practices	ESC-3/ ESC-4	1	0	4	-	-	-	15	-	35	50	3
5	<b>BHU- 201</b>	Professional English	HSMC-1	2	0	0	20	10	30	-	70	-	100	2
6	<b>BAS-251/ BAS-252</b>	Physics Lab/ Chemistry Lab	BSC-1/ BSC-2	0	0	3	-	-	-	15	-	35	50	1.5
7	<b>BEEE-251/ BCSE-251</b>	Electrical Engineering Lab/ Programming for Problem Solving Lab	ESC-1/ ESC-2	0	0	2	-	-	-	15	-	35	50	1

8	BHU- 251	English Lab	HSMC-1	0	0	2	-	-	-	15	-	35	50	1
<b>Total</b>													<b>600</b>	<b>20.5</b>

**SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING**  
**SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT**  
**STUDY & EVALUATION SCHEME**  
**B.Tech.2<sup>nd</sup> Year/3<sup>rd</sup> Semester (Electrical and Electronics Engg.)**  
**w.e.f academic Session 2018-19**

<b>SEMESTER III</b>														
S. No	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	BEEE-301	Analog Electronics	PCC-1	3	1	0	20	10	30	-	70	-	100	3
2	BEEE-302	Electrical Machines-I	PCC-2	3	0	0	20	10	30	-	70	-	100	3
3	BEEE-303	Electrical Circuit Analysis	PCC-3	3	1	0	20	10	30	-	70	-	100	4
4	BEEE-304	Electromagnetic Fields	PCC-4	3	1	0	20	10	30	-	70	-	100	4
5	BME-301	Engg. Mechanics	ESC-1	3	1	0	20	10	30	-	70	-	100	4
6	BEEE-351	Analog Electronics Lab	PCC-5	0	0	2	-	-	-	15	-	35	50	1
7	BEEE-352	Electrical Machines Lab -I	PCC-6	0	0	2	-	-	-	15	-	35	50	1
8	BMC-301-BMC-305	Mandatory course-1	MC-1	2	0	0	20	10	30	-	70	-	100	0
<b>TOTAL</b>													<b>700</b>	<b>20</b>

**B.Tech2<sup>nd</sup> Year/4<sup>th</sup> Semester (Electrical and Electronics Engg.)**  
**w.e.f academic Session 2018-19**

<b>SEMESTER IV</b>														
S. No.	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	BEEE-401	Digital Electronics	PCC-7	3	0	0	20	10	30	-	70	-	100	3
2	BEEE-402	Electrical Machines-II	PCC-8	3	0	0	20	10	30	-	70	-	100	3
3	BEEE-403	Power Electronics	PCC-9	3	0	0	20	10	30	-	70	-	100	3
4	BEEE-404	Signals and Systems	PCC-10	2	1	0	20	10	30	-	70	-	100	3
5	BAS-401	Mathematics-III	ESC-2	3	1	0	20	10	30	-	70	-	100	4
6	BAS-404	Biology	ESC-3	2	1	0	20	10	30	-	70	-	100	3
7	BEEE-451	Digital Electronics Lab	PCC-11	0	0	2	-	-	-	15	-	35	50	1
8	BEEE-452	Electrical Machines Lab -II	PCC-12	0	0	2	-	-	-	15	-	35	50	1
9	BEEE-453	Power Electronics Lab	PCC-13	0	0	2	-	-	-	15	-	35	50	1
10	BMC-401-BMC-405	Mandatory course-2	MC-2	2	0	0	20	10	30	-	70	-	100	0
<b>TOTAL</b>													<b>850</b>	<b>22</b>

**List of Mandatory Courses (Non-Credit)**

- BMC-301/BMC-401/BMC-501: Constitution of India  
BMC-302/BMC-402/BMC-502: Universal Human Values -1 (during Induction Program)  
BMC-303/BMC-403/BMC-503: Environment Science  
BMC-304/BMC-404/BMC-504: Essence of Indian Knowledge Tradition  
BMC-305/BMC-405/BMC-505: Learning an art form (during Induction Program)

**SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING**  
**SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT**  
**STUDY & EVALUATION SCHEME**  
**B.Tech.3<sup>rd</sup> Year/5<sup>th</sup> Semester (Electrical and Electronics Engg.)**  
**w.e.f academic Session 2018-19**

SEMESTER V														
S. No	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BEEE-501</b>	Power System-I	PCC-14	3	0	0	20	10	30	-	70	-	100	3
2	<b>BEEE-502</b>	Control Systems	PCC-15	3	0	0	20	10	30	-	70	-	100	3
3	<b>BEEE-503</b>	Microprocessors	PCC-16	3	0	0	20	10	30	-	70	-	100	3
4	<b>BEEE-511- BEEE-529</b>	Professional Elective Course -1	PEC-1	3	0	0	20	10	30	-	70	-	100	3
5	<b>BEEE-001- BEEE-003</b>	Open Elective Course -1	OEC-1	3	0	0	20	10	30	-	70	-	100	3
6	<b>BEEE-551</b>	Power System Lab - I	PCC-17	0	0	2	-	-	-	15	-	35	50	1
7	<b>BEEE-552</b>	Control Systems Lab	PCC-18	0	0	2	-	-	-	15	-	35	50	1
8	<b>BEEE-553</b>	Microprocessors Lab	PCC-19	0	0	2	-	-	-	15	-	35	50	1
9	<b>BHU-501- BHU-532</b>	Slot for HSMC course	HSMC-2	3	0	0	20	10	30	-	70	-	100	3
<b>TOTAL</b>												<b>750</b>	<b>21</b>	

**B.Tech. 3<sup>rd</sup> Year/6<sup>th</sup> Semester (Electrical and Electronics Engg.)**  
**w.e.f academic Session 2018-19**

SEMESTER VI														
S. No	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BEEE-601</b>	Power System-II	PCC-20	3	0	0	20	10	30	-	70	-	100	3
2	<b>BEEE-611- BEEE-629</b>	Professional Elective Course -2	PEC-2	3	0	0	20	10	30	-	70	-	100	3
3	<b>BEEE-611- BEEE-629</b>	Professional Elective Course -3	PEC-3	3	0	0	20	10	30	-	70	-	100	3
4	<b>BEEE-004- BEEE-006</b>	Open Elective Course -2	OEC-2	3	0	0	20	10	30	-	70	-	100	3
5	<b>BEEE-651</b>	Power System Lab - II	PCC-21	0	0	2	-	-	-	15	-	35	50	1
6	<b>BEEE-652</b>	Measurements and Instrumentation Lab	PCC-22	2	0	2	-	-	-	15	-	35	50	3
7	<b>BEEE-653</b>	Electronics Design Lab	PCC-23	1	0	4	-	-	-	15	-	35	50	3
8	<b>BHU-601- BHU-632</b>	Slot for HSMC course	HSMC-3	3	0	0	20	10	30	-	70	-	100	3
<b>TOTAL</b>												<b>650</b>	<b>22</b>	
Summer Internship			During Summer Vacations / Non-credit course (4-6 week)											

**SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING  
SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT  
STUDY & EVALUATION SCHEME  
B.Tech.4<sup>th</sup>Year/7<sup>th</sup> Semester (Electrical and Electronics Engg.)  
w.e.f academic Session 2018-19**

SEMESTER VII														
S. No	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BEEE-711- BEEE-729</b>	Professional Elective Course -4	PEC-4	3	0	0	20	10	30	-	70	-	100	3
2	<b>BEEE-711- BEEE-729</b>	Professional Elective Course -5	PEC-5	3	0	0	20	10	30	-	70	-	100	3
3	<b>BEEE-007- BEEE-009</b>	Open Elective Course -3	OEC-3	3	0	0	20	10	30	-	70	-	100	3
4	<b>BEEE-010- BEEE-012</b>	Open Elective Course -4	OEC-4	3	0	0	20	10	30	-	70	-	100	3
5	<b>BEEE-751</b>	Project -I	PROJ	0	0	6	-	-	-	50	-	100	150	3
	<b>BEEE-752</b>	Summer Internship	PROJ	0	0	2	-	-	-	50	-	-	50	0
6	<b>BHU-701- BHU-732</b>	Slot for HSMC course	HSMC -4	3	0	0	20	10	30	-	70	-	100	3
<b>TOTAL</b>												<b>700</b>	<b>18</b>	

**B.Tech.4<sup>th</sup>Year/8<sup>th</sup> Semester (Electrical and Electronics Engg.)  
w.e.f academic Session 2018-19**

SEMESTER VIII														
S. No.	Course Code	Course Title	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	AT	Total	PS	TE	PE		
1	<b>BEEE-811- BEEE-829</b>	Professional Elective Course -6	PEC-6	3	0	0	20	10	30	-	70	-	100	3
2	<b>BEEE -013- BEEE-015</b>	Open Elective Course -5	OEC-5	3	0	0	20	10	30	-	70	-	100	3
3	<b>BEEE -016- BEEE-017</b>	Open Elective Course-6	OEC-6	3	0	0	20	10	30	-	70	-	100	3
4	<b>BEEE-851</b>	Project -II	PROJ	0	0	16	-	-	-	100	-	200	300	8
<b>TOTAL</b>												<b>600</b>	<b>17</b>	

**B.Tech. (Electrical and Electronics Engg.) TOTAL CREDITS – 158**

## COURSE TYPE NOMENCLATURE

Course Code	Definitions
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Electives courses
MC	Mandatory courses
PROJ	Project
CCA	Continuation Comprehensive Assessment
ESE	End Semester Examination
L	Lecture
T	Tutorial
P	Practical
CT	Class Test
AT	Attendance
PS	Practical Sessional
TE	Theory Exam
PE	Practical Exam

### PROFESSIONAL CORE COURSES (PCC)

#### [ELECTRICAL AND ELECTRONICS ENGINEERING]

Sr. No	Course Code	Course Title
1	BEEE-301	Analog Electronics
2	BEEE-302	Electrical Machines-I
3	BEEE-303	Electrical Circuit Analysis
4	BEEE-304	Electromagnetic Fields
5	BEEE-351	Analog Electronics Lab
6	BEEE-352	Electrical Machines Lab -I
7	BEEE-401	Digital Electronics
8	BEEE-402	Electrical Machines-II
9	BEEE-403	Power Electronics
10	BEEE-404	Signals and Systems
11	BEEE-451	Digital Electronics Lab
12	BEEE-452	Electrical Machines Lab -II
13	BEEE-453	Power Electronics Lab
14	BEEE-501	Power System-I (Apparatus and Modelling)
15	BEEE-502	Control Systems
16	BEEE-503	Microprocessors
17	BEEE-551	Power System Lab - I
18	BEEE-552	Control Systems Lab
19	BEEE-553	Microprocessors Lab
20	BEEE-601	Power System-II (Operation and Control)
21	BEEE-651	Power System Lab - II
22	BEEE-652	Measurements and Instrumentation Lab
23	BEEE-653	Electronics Design Lab

**PROFESSIONAL ELECTIVE COURSES (PEC)**  
**[ELECTRICAL AND ELECTRONICS ENGINEERING]**

S. No.	Course Code	Course Title
1	BEEE-511/611/711/811	Wind and Solar Energy Systems
2	BEEE-512/612/712/812	Line Commutated and Active Rectifiers
3	BEEE-513/613/713/813	Electrical Drives
4	BEEE-514/614/714/814	Electrical and Hybrid Vehicles
5	BEEE-515/615/715/815	Electrical Machine Design
6	BEEE-516/616/716/816	Power System Protection
7	BEEE-517/617/717/817	HVDC Transmission Systems
8	BEEE-518/618/718/818	Power Quality and FACTS
9	BEEE-519/619/719/819	High Voltage Engineering
10	BEEE-520/620/720/820	Electrical Energy Conservation and Auditing
11	BEEE-521/621/721/821	Industrial Electrical Systems
12	BEEE-522/622/722/822	Power System Dynamics and Control
13	BEEE-523/623/723/823	Digital Control Systems
14	BEEE-524/624/724/824	Digital Signal Processing
15	BEEE-525/625/725/825	Computer Architecture
16	BEEE-526/626/726/826	Electromagnetic Waves
17	BEEE-527/627/727/827	Computational Electromagnetics
18	BEEE-528/628/728/828	Control Systems Design
19	BEEE-529/629/729/829	Advanced Electric Drives

**OPEN ELECTIVES COURSES (OEC)**  
**[ELECTRICAL AND ELECTRONICS ENGINEERING]**

S. No.	Course Code	Subject
01	BEEE-001	<b>Electrical Materials</b>
02	BEEE-002	Modern Manufacturing Processes
03	BEEE-003	Strength of Materials
04	BEEE-004	<b>Analog and Digital Communication</b>
05	BEEE-005	Embedded Systems
06	BEEE-006	Mechatronics
07	BEEE-007	<b>Electronic Devices</b>
08	BEEE-008	Big Data Analysis
09	BEEE-009	Automobile Engineering
10	BEEE-010	<b>VLSI Circuits</b>
11	BEEE-011	Internet of Things
12	BEEE-012	Wavelet Transforms
13	BEEE-013	<b>Computer Networks</b>
14	BEEE-014	Data Structures and Algorithms
15	BEEE-015	Bio-Instrumentation
16	BEEE-016	<b>Image Processing</b>
17	BEEE-017	Power Plant Engineering

**HUMANITIES, SOCIAL SCIENCE INCLUDING MANAGEMENT COURSES  
(HSMC)**

<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>
1	BHU-501/BHU-601/BHU-701	Humanities, Social Science including Management Courses
2	BHU-502/BHU-602/BHU-702	Foundational Course in Humanities (Development of Societies/ Philosophy)
3	BHU-503/BHU-603/BHU-703	Education, Technology and Society
4	BHU-504/BHU-604/BHU-704	History of Science and Technology in India
5	BHU-505/BHU-605/BHU-705	Nyaya Logic Epistemology
6	BHU-506/BHU-606/BHU-706	Political and Economic Thought for a Humane Society
7	BHU-507/BHU-607/BHU-707	State, Nation Building and Politics in India
8	BHU-508/BHU-608/BHU-708	Psychological Process
9	BHU-509/BHU-609/BHU-709	Positive Psychology
10	BHU-510/BHU-610/BHU-710	Application of Psychology
11	BHU-511/BHU-611/BHU-711	Sociology, Society and Culture
12	BHU-512/BHU-612/BHU-712	Epochal Shift
13	BHU-513/BHU-613/BHU-713	Values and Ethics
14	BHU-514/BHU-614/BHU-714	Ethics and Holistic Life
15	BHU-515/BHU-615/BHU-715	Folk and Vernacular Expressive Tradition and Popular Culture
16	BHU-516/BHU-616/BHU-716	Universal Human Conduct
17	BHU-517/BHU-617/BHU-717	Gender Culture and Development
18	BHU-518/BHU-618/BHU-718	Introduction to Women's and Gender Studies
19	BHU-519/BHU-619/BHU-719	Advance Course in Peace Research
20	BHU-520/BHU-620/BHU-720	Contemporary India in Globalized Era: Challenges of Democracy and Development
21	BHU-521/BHU-621/BHU-721	Making Indian Culture: Epistemic Traditions, Literature and Performative Arts
22	BHU-522/BHU-622/BHU-722	Universal Human Values 2: Understanding Harmony
23	BHU-523/BHU-623/BHU-723	Human Relations at Work
24	BHU-524/BHU-624/BHU-724	Sanskrit Bhasa
25	BHU-525/BHU-625/BHU-725	Language and Communication
26	BHU-526/BHU-626/BHU-726	Language and Linguistics
27	BHU-527/BHU-627/BHU-727	Understanding Society and Culture through Literature
28	BHU-528/BHU-628/BHU-728	Fundamentals of Linguistics
29	BHU-529/BHU-629/BHU-729	Elements of Literature
30	BHU-530/BHU-630/BHU-730	Humanities and Multiple Dimensions of Ecology
31	BHU-531/BHU-631/BHU-731	Film Appreciation
32	BHU-532/BHU-632/BHU-732	Law and Engineering

## YEAR I, SEMESTER-I & II

### Branch/Course: Common to all branches of Engineering/B.Tech

BAS-101/BAS-201	Physics	L	T	P	4 Credits
		3	1	0	

#### Course Objective:

To equip the student with a strong understanding of the fundamentals of physics so as to enable him/her to apply it to his/her field of study. This course should enable the student to

1. Explain the behaviour of the physical world around him/her.
2. Apply the concepts of physics in his/her field of study.
3. Relate the concepts of physics to the advancement of technology.
4. Understand and relate the different phenomena in the world.
5. Approach problems, predict their results in advance, and solve them in quantitative and qualitative manner.
6. Gain a broader understanding of other sciences.

#### Syllabus:

##### Unit-1 Relativistic Mechanics:

[8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein's mass energy relation, Relativistic relation between energy and momentum, Mass less particle.

##### Unit-2 Electromagnetic Field Theory:

[8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell's equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

##### Unit-- 3 Quantum Mechanics:

[8]

Black body radiation, Stefan's law, Wien's law, Rayleigh-Jeans law and Planck's law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

**Unit-- 4 Wave Optics:** [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications. Fraunhofer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh's criterion of resolution, Resolving power of grating.

**Unit—5 Fibre Optics & Laser:** [10]

**Fibre Optics:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres.

**Laser:** Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein's coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

**Course Outcomes:**

1. To solve the classical and wave mechanics problems.
2. To develop the understanding of laws of thermodynamics and their application in various processes.
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory.
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams.

**Reference Books:**

1. Concepts of Modern Physics – Aurthur Beiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics – Brijlal & Subramanian (S. Chand )
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

<b>BAS-151/BAS-251</b>	<b>Physics Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>1.5 credits</b>
		<b>0</b>	<b>0</b>	<b>3</b>	

**List of Experiments:**

Any ten experiments (at least four from each group).

**Group A**

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5. To measure attenuation in an optical fiber.
6. To determine the wavelength of He-Ne laser light using single slit diffraction.

7. To study the polarization of light using He-Ne laser light.
8. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
9. To determine the coefficient of viscosity of a given liquid.
10. To determine the value of acceleration due to gravity (g) using compound pendulum.

### Group B

1. To determine the energy band gap of a given semiconductor material.
2. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
10. To measure high resistance by leakage method.

### Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta ( KrishnaPrakashan Meerut)

### Course Outcomes:

1. To determine the wavelength of sodium light by Newton's ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel's bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

<b>BAS-102/ BAS-202</b>	<b>Chemistry</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>4 Credits</b>
		<b>3</b>	<b>1</b>	<b>0</b>	

**Course Objectives:** To impart the knowledge of applications of chemical sciences in the field of engineering and technology.

#### **Unit 1 Atomic and Molecular Structure:**

**[08]**

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

#### **Unit 2 Spectroscopic techniques and Applications:**

**[08]**

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

**Unit -3 Electrochemistry****[08]**

Nernst Equation and application, relation of EMF with thermodynamic functions ( $\Delta H$ ,  $\Delta F$  and  $\Delta S$ ). Lead storage battery.

**Corrosion**; causes, effects and its prevention.

**Phase Rule** and its application to water system.

**Unit -4 Water Analysis;****[08]**

Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method).

**Fuels**: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeter and Dulong's methods).

**Unit -5 Polymer****[08]**

Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene). General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

**Course Outcomes:**

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

**Reference Books:**

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry By Fre W., Billmeyer

<b>BAS-152 / BAS-252</b>	<b>Chemistry-I Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>1.5 Credits</b>
		<b>0</b>	<b>0</b>	<b>3</b>	

**LIST OF EXPERIMENTS**

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

**NOTE:** Choice of any 10 experiments from the above. Institute can change any 02 experiments from the aforesaid experiments.

**Course Outcomes:**

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

<b>BAS-103</b>	<b>Mathematics-I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>4 Credits</b>
		<b>3</b>	<b>1</b>	<b>0</b>	

**Objectives:** By the end of the first year, all students will be expected to be able to recognise, even in unfamiliar circumstances, and then use the following: • applied mathematics and classical physics (mechanics & heat); • mass and energy balances; • description of fluid motion; • dynamics of steady fluid motion; • one-phase flow in pipes; • basic definitions of T, Q, W, U, H & S; • first & second laws of thermodynamics; • heat & mass transfer rate equations; • heat & mass transfer coefficients; • 1-D heat & mass transfer problems; • heat exchangers

**UNIT-1: Matrices**

[08]

Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix

**UNIT- 2: Differential Calculus- I**

[08]

Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (nth order derivatives), Leibnitz theorem and its application, Envelope, Involute and Evolute, Curve tracing: Cartesian and Polar co-ordinates.

**UNIT- 3: Differential Calculus-II**

[08]

Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

**UNIT-4: Multivariable Calculus-I**

[08]

**Multiple integration:** Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities).

### **UNIT- 5: Vector Calculus**

**[08]**

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem ( without proof) and their applications.

### **COURSE OUTCOMES**

1. Remember the concept of matrices and apply for solving linear simultaneous equations.
2. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle's , Lagrange's and Cauchy mean value theorem and Leibnitz theorems .
3. Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.
4. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
5. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

### **Text Books:-**

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

### **Reference Books-**

- 1.E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
- 2.Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
- 3.Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
- 4.D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- 5.Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- 6.Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
9. Engineering Mathematics – I. Reena Garg, 2018.

BEEE-101/ BEEE-201	<b>Basic Electrical Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>4 Credits</b>
		<b>3</b>	<b>1</b>	<b>0</b>	

**Objectives:** The expected student learning outcomes of this goal are to graduate engineers who have: a) the ability to apply science, engineering science, and mathematics to solve engineering problems. b) the ability to put their engineering and design skills into practice. c) the ability to use industrial-quality laboratory equipment and engineering software for analysis, testing, design, and communication. d) the ability to design systems, components, and processes that satisfy predetermined constraints. e) the ability to put engineering problems, put them in solvable form, and develop and evaluate alternative solutions

**Detailed contents:**

**UNIT 1: DC Circuits [08]**

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

**UNIT - 2: Steady- State Analysis of Single Phase AC Circuits [10]**

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor.

Three phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT - 3 : Transformers [08]**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT –4 : Electrical machines [08]**

**DC machines:** Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems).

**Three Phase Induction Motor:** Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only).

**Single Phase Induction motor:** Principle of operation and introduction to methods of starting, applications.

**Three Phase Synchronous Machines:** Principle of operation of alternator and synchronous motor and their applications.

## **UNIT –5 : Electrical Installations**

[06]

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption and savings, battery backup.

### **COURSE OUTCOMES**

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behaviour of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

### **Text Books:**

1. Ritu Sahdev, “Basic Electrical Engineering”, Khanna Publishing House.
2. S. Singh, P.V. Prasad, “Electrical Engineering: Concepts and Applications” Cengage.
3. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill.
4. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill.

### **Reference Books:**

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Pearson India.

<b>BEEE-151/ BEEE-251</b>	<b>Electrical Engg. Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>1 credit</b>
		<b>0</b>	<b>0</b>	<b>2</b>	

### **LIST OF EXPERIMENTS**

**Note: A minimum of ten experiments from the following should be performed.**

1. Verification of Kirchhoff's laws.
2. Verification of Superposition and Thevenin's Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor.
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit.
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer.

10. Determination of efficiency of a dc shunt motor by load test.
11. To study running and speed reversal of a three phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

### **COURSE OUTCOMES**

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behaviour of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

<b>BCSE-101/ BCSE-202</b>	<b>Programming for Problem Solving</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>4 Credits</b>
		3	1	0	

**Objectives:** Students will try to learn: 1 The concept of various components. 2 The concepts that underpin the disciplines of analog and digital electronic logic circuits. 3 Various Number system and Boolean algebra. 4 Design and implementation of combinational circuits.

#### **Unit – 1 : (Introduction to Programming) [08]**

**Introduction to components of a computer system:** Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker. **Idea of**

**Algorithm:** Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

**Programming Basics:** Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

#### **Unit – 2 : (Arithmetic expressions & Conditional Branching) [08]**

**Arithmetic expressions and precedence:** Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

**Conditional Branching:** Applying if and switch statements, nesting if and else, use of break and default with switch.

#### **Unit –3 : (Loops & Functions) [08]**

**Iteration and loops:** use of while, do while and for loops, multiple loop variables, use of break and continue statements. **Functions:** Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

**Unit –4 : (Arrays & Basic Algorithms) [08]**

**Arrays:** Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, passing arrays to functions.

**Basic Algorithms:** Searching & Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

**Unit – 5 :( Pointer& File Handling) [08]**

**Pointers:** Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation)

**File handling:** File I/O functions, Standard C pre-processors, defining and calling macros, command-line arguments.

**COURSE OUTCOMES**

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

**Text books:**

1. Schum's Outline of Programming with C by Byron Gottfried, McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
7. Let Us C By Yashwant P. Kanetkar.
8. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
9. Programming in C by Kochan Stephen G. Pearson Education – 2015.
10. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
11. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication.
12. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
13. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
14. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

<b>BCSE-151/ BCSE-252</b>	<b>Programming for Problem Solving Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>1 Credit</b>
		<b>0</b>	<b>0</b>	<b>2</b>	

### List of Programs:-

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula  $C/5 = (F-32)/9$ .
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:  
Between 90-100%-----Print 'A'  
80-90%-----Print 'B'  
60-80%-----Print 'C'  
Below 60%-----Print 'D'
11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of a mxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.
29. Define a structure data type TRAIN\_INFO. The type contain Train No.: integer type  
Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME  
Start station: string End station: string The structure type Time contains two integer members:  
hour and minute. Maintain a train timetable and implement the following operations:
- List all the trains (sorted according to train number) that depart from a particular section.
  - List all the trains that depart from a particular station at a particular time.
  - List all the trains that depart from a particular station within the next one hour of a given time.
  - List all the trains between a pair of start station and end station.
30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not.
32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

### COURSE OUTCOMES

- To write programs for arithmetic and logical problems.
- To translate the algorithms to programs & execution (in C language).
- To write programs for conditional branching, iteration and recursion.
- To write programs using functions and synthesize a complete program using divide and conquer approach.
- Write programs using arrays, pointers and structures.

BME-151-/BME-251	Engineering Graphics & Design	L	T	P	3 Credits
		1	0	4	

#### Unit- 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales.

Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

#### Unit- 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.

Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

#### Unit- 3: Isometric Projections [08]

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conversions.

#### **Unit- 4: Computer Graphics**

**[08]**

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects: Isometric Views of lines, Planes, Simple and compound Solids];

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command: orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling:

#### **Unit- 5: Demonstration of a simple team design project**

**[08]**

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

#### **Course Outcomes**

- 1: Understanding of the visual aspects of engineering design
- 2: Understanding of engineering graphics standards and solid modelling
- 3: Effective communication through graphics
- 4: Applying modern engineering tools necessary for engineering practice
- 5: Applying computer-aided geometric design
- 6: Analysis of Isometric views
- 7: Creating working drawings

**Suggested Text/ Reference Books:**

- (i) Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
- (ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
- (iii) Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
- (iv) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House
- (v) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
- (vi) (Corresponding set of) CAD Software Theory and User Manuals.

<b>BME-152-/BME-252</b>	<b>Workshop Practices</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>3 Credits</b>
		<b>1</b>	<b>0</b>	<b>4</b>	

**LIST OF EXPERIMENTS****Machine shop:**

1. Study of machine tools in particular Lathe machine
2. Demonstration of different operations on Lathe machine
3. Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting.
4. Study of Quick return mechanism of Shaper.

**Fitting shop:**

1. Preparation of T-Shape Work piece as per the given specifications.
2. Preparation of U-Shape Work piece which contains: Filing, Sawing, Drilling, Grinding.
3. Practice marking operations.

**Carpentry:**

1. Study of Carpentry Tools, Equipment and different joints.
2. Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

**Electrical & Electronics**

1. Introduction to House wiring, different types of cables. Types of power supply, types of motors, Starters, distribution of power supply, types of bulbs, parts of tube light, Electrical wiring symbols.
2. Soldering and desoldering of Resistor in PCB.
3. Soldering and desoldering of IC in PCB.
4. Soldering and desoldering of Capacitor in PCB

**Welding:**

1. Instruction of BI standards and reading of welding drawings.
2. Butt Joint
3. Lap Joint
4. TIG Welding

## 5. MIG Welding

### **Casting:**

- 1 . Introduction to casting processes

### **Smithy**

1. Sharpening any arc and edge.
2. Preparing small arc and edge,
3. Repair of agricultural implements and power plough, use of power hammer etc

### **Plastic Moulding & Glass Cutting**

1. Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes.
2. Demo of mould preparation.
3. Practice – Preparation of mould.
4. Glass cutting.

### **COURSE OUTCOMES**

1. Study and practice on machine tools and their operations.
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
3. Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping.
4. Welding and soldering operations.
5. Apply basic electrical engineering knowledge for house wiring practice.

### **Text Books:**

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapooanT.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008

<b>BAS-203</b>	<b>Mathematics -II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>4 Credits</b>
		<b>3</b>	<b>1</b>	<b>0</b>	

### **Unit- 1: Ordinary Differential Equation of Higher Order [10]**

Linear differential equation of nth order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

### **Unit- 2: Multivariable Calculus-II [08]**

Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

### **Unit- 3: Sequences and Series [08]**

Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

### **Unit- 4: Complex Variable – Differentiation [08]**

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

### **Unit- 5: Complex Variable –Integration [08]**

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouville's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy

Residue theorem, Evaluation of real integrals of  $\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta$  and  $\int_{-\infty}^{\infty} f(x) dx$ .

### **COURSE OUTCOMES**

1. Understand the concept of differentiation and apply for solving differential equations.
2. Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3. Understand the concept of convergence of sequence and series. Also evaluate Fourier series
4. Illustrate the working methods of complex functions and apply for finding analytic functions.
5. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals.

### **Text Books:-**

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger , Advance Engineering Mathematics , Narosa Publishing - House, 2002.

### **Reference Books:-**

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.

5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-Tata McGraw-Hill

6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.

9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.

10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.

11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.

12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi

<b>BHU-201</b>	<b>Professional English</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>2 Credits</b>
		<b>2</b>	<b>0</b>	<b>0</b>	

**CO 1 To understand of basics engineering**

**CO 2 To study the** Components of Technical Writing

**CO3 To understand Basic Technical Writing Skills**

**CO 4 To study** Presentation Strategies & Oral Communications

**Unit- 1 Basics of Technical English** [08]

Technical English: Definition; Extent& Coverage; Dimensions; Reading; Skimming; Scanning; Churning & Assimilation; Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc; Technical Communication; Approaches: Brevity; Objectivity; Simplicity; Utility & Clarity. **Listening:** Active; Passive; Thinking strategies: Positive & Logical thinking; Speaking: Essentials Nuances & Modes of Speech Delivery.

**Unit- 2- Components of Technical Writing** [08]

Vocabulary Building: Select words; Concept of word formation; Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Synonyms; Antonyms; Abbreviations. Homophones. One word substitutes; Requisites of Sentences.

**Unit- 3 Basic Technical Writing Skills** [08]

Forms: Business writing: Principle; Purchase & Sales Letters; Drafts; Official Writing: Official Letter; D.O. Letter; Notices; Agenda; Minutes of Meeting; Sentence Structure; Phrases & Clauses in sentences; Coherence; Unity; Emphasis in Writing; Devices; Use of Writing methods in Documents; Techniques of writing.

**Unit- 4 Common Grammatical Errors & Technical Style** [08]

Subject-verb agreement; Correct usage: Noun; Pronoun; Agreement; Modifiers; Articles; Prepositions; Cliches; Redundancies; Technical Style: Features; Choice of words; Sentences: Descriptive; Narrative; Expository; Defining & Classifying; Length of paragraph; Writing of Introduction & Conclusion.

### **Unit- 5 Presentation Strategies & Oral Communications**

**[08]**

Analysis of locale; Audience; Modulating Style & Content; Speaking with confidence; Kinesics; Paralinguistic features of Voice-Dynamics: Pitch; Intonation; Stress & Rhythm; Conversation & dialogues; Communication at work-place; etc.

### **COURSE OUTCOMES:**

1. Students will be enabled to **understand** the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
2. Students would be able to **create** substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will **apply** it at their work place for writing purposes such as Presentation/official drafting/administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to **evaluate** the correct & error-free writing by being well-versed in rules of English grammar & cultivate relevant technical style of communication & presentation at their work place & also for academic uses.
5. Students will **apply** it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence.

### **Text Books:**

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.

### **Reference Books:**

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
4. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd., New Delhi.
5. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
6. English Grammar & Composition by Wren & Martin, S.Chand& Co. Ltd., New Delhi.
7. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
8. Personality Development, Harold R. Wallace &L. Ann Masters, Cengage Learning, New Delhi.

9. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.
10. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
11. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
12. Spoken English- A manual of Speech and Phonetics by R.K.Bansal&J.B.Harrison, Orient Blackswan, 2013, New Delhi.
13. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi

<b>BHU-251</b>	<b>English Lab</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>1 CREDITS</b>
		<b>0</b>	<b>0</b>	<b>2</b>	

### **List of Experiments:**

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical on a model Audio-Visual Usage.

### **Reference Books**

1. Bansal R.K. & Harrison: Phonetics in English, Orient Longman, New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
3. L.U.B. Pandey & R.P. Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

### **Course Outcomes:**

1. Acquire knowledge about the various principles of communication, understand its various stages and the role of audience and purpose, deal with the barriers that affect communication in a professional set up.
2. Understand the different channels that are functional at the work place.
3. Learn the importance of verbal and non-verbal communication in the professional world along with its uses.
4. Learning the uses and application of RP to improve pronunciation.

5. Understanding the importance of intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.

## YEAR II, SEMESTER-III & IV

<b>BEEE-301</b>	<b>Analog Electronics</b>	<b>3L:1T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyse various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

### **UNIT 1: Diode circuits (4 Hours)**

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

### **UNIT 2: BJT circuits (8 Hours)**

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

### **UNIT 3: MOSFET circuits (8 Hours)**

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

### **UNIT 4: Differential, multi-stage and operational amplifiers (8 Hours)**

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

### **UNIT 5: Linear applications of op-amp (8 Hours)**

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

### **UNIT 6: Nonlinear applications of op-amp (6 Hours)**

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators.

Precision rectifier, peak detector. Monoshot.

### **Text/References:**

- S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.

- J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
- J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
- P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
- P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

<b>BEEE-302</b>	<b>Electrical Machines-I</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### **Course Outcomes:**

At the end of this course, students will demonstrate the ability to

CO-1: Analyze the various principles & concepts involved in Electromechanical Energy conversion.

CO-2: Demonstrate the constructional details of DC machines as well as transformers, and principle of operation of brushless DC motor, Stepper and DC Servo motors.

CO-3: Evaluate the performance and characteristics of DC Machine as motor and as well as generator.

CO-4: Evaluate the performance of transformers, individually and in parallel operation.

CO-5: Demonstrate and perform various connections of three phase transformers.

### **UNIT I**

**Pre- Requisites: Magnetic Materials, BH characteristics**

**Principles of Electro-mechanical Energy Conversion:** Introduction, Review of magnetic system, Energy in Magnetic system, Force and torque in magnetic field system, Energy balance equation, Energy conversion via electrical field, Energy in a singly excited system, Determination of the Force and Torque from energy and co-energy, Generation of EMF in Machines, Torque in machine with cylindrical air gap.

### **UNIT II**

**Pre- Requisites: Principle & Construction, Classification and circuit model, EMF equation of generator and torque equation of motor**

**DC Machines:** Armature winding (Concentrated and Distributed), Winding Factor, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators, Applications.

### **UNIT III**

**DC Machines (Contd.):** Performance characteristics of DC motors, Starting of DC motors; 3 point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward Leonard method); Efficiency and Testing of DC machines (Hopkinson's and Swinburne's Test), Applications, Introduction to Brushless DC Motor, stepper motor and DC Servo motor and their applications.

### **UNIT IV**

**Pre- Requisites: Construction & Principle, Ideal and practical transformer, equivalent circuit & phasor diagram, losses in transformers.**

**Single Phase Transformer:** Efficiency and voltage regulation, all day efficiency, Excitation phenomenon and harmonics in transformers. Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test. Auto Transformer- Single phase and three phase autotransformers, Volt-amp relation, Copper saving in autotransformer Efficiency, Merits & demerits and applications.

### **UNIT V**

**Pre- Requisite: Three-phase connections – Star/Delta.**

**Three Phase Transformers:** Construction, Three phase transformer, phasor groups and their connections, open delta connection, three phase to 2 phase and their applications, Three winding transformers. Parallel operation of single phase and three phase transformers and load sharing.

**Text Books:**

1. IJ Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

**Reference Books:**

1. H. Cotton, "Electrical Technology", CBS Publication.
2. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
3. PS Bimbhra, " Generalized Theory.

<b>BEEE-303</b>	<b>Electrical Circuit Analysis</b>	<b>3L:1T:0P</b>	<b>4 credits</b>
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**Course Outcomes:**

At the end of this course, students will demonstrate the ability to

CO -1: Apply the knowledge of basic circuit law, nodal and mesh methods of circuit analysis and simplify the network using Graph Theory approach.

CO- 2: Analyze the AC and DC circuits using Kirchoff's law and Network simplification theorems.

CO -3: Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods.

CO- 4: Demonstrate the concept of complex frequency and analyze the structure and function of one and two port network. Also evaluate and analysis two-port network parameters.

CO -5: Synthesize one port network and analyze different filters.

**UNIT I**

**Graph Theory:**

**Pre- Requisites: Basic circuit law, Mesh & Nodal analysis.**

Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non-Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

**Unit II**

**AC Network Theorems (Applications to dependent & independent sources):**

**Pre- Requisites: Concepts of DC Network Theorems, Electrical Sources & Basic circuit law.** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem, Tellegen's Theorem.

**Unit III**

**Transient Circuit Analysis:**

**Pre- Requisites: Laplace Transform & Concept of Initial conditions.**

Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

## Unit IV

### Network Functions:

**Pre- Requisites: Concept of basic circuit law, parallel, series circuits.**

Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions. Two Port Networks- Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Interconnections of two port networks, Ladder and Lattice networks: T & II representation, terminated two Port networks, Image Impedance.

## Unit V

### (a) Network Synthesis:

**Pre- Requisites: Laplace Transform, Concept of immittance functions.**

Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

### (b) Filters

**Pre- Requisites: Concept of Passive & active elements.**

Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. ME Van Valkenburg, "Network Analysis", Prentice Hall of India.
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill.
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.

<b>BEEE-304</b>	<b>Electromagnetic Fields</b>	<b>3L:1T:0P</b>	<b>4 credits</b>
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**Course Outcomes:** At the end of the course, students will demonstrate the ability

- To understand the basic laws of electromagnetism.
- To obtain the electric and magnetic fields for simple configurations under static conditions.
- To analyse time varying electric and magnetic fields.
- To understand Maxwell's equation in different forms and different media. To understand the propagation of EM waves.

### UNIT 1: Review of Vector Calculus (6 hours)

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

### UNIT 2: Static Electric Field (6 Hours)

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

### UNIT 3: Conductors, Dielectrics and Capacitance (6 Hours)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance,

Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

#### **UNIT 4: Static Magnetic Fields (6 Hours)**

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

#### **UNIT 5: Magnetic Forces, Materials and Inductance (6 Hours)**

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

#### **UNIT 6: Time Varying Fields and Maxwell's Equations (6 Hours)**

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

#### **UNIT 7: Electromagnetic Waves (6 Hours)**

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

##### **Text / References:**

- M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
- Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
- Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
- G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
- W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
- W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.

<b>BME-301</b>	<b>Engg. Mechanics</b>	<b>3L:1T:0P</b>	<b>4 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the concepts of co-ordinate systems.
- Analyse the three-dimensional motion.
- Understand the concepts of rigid bodies.
- Analyse the free-body diagrams of different arrangements.
- Analyse torsional motion and bending moment.

**UNIT-I: Two-dimensional force systems:** Basic concepts, Laws of motion, Principle of transmissibility of forces, transfer of a force to parallel position, resultant of a force system, simplest resultant of two dimensional concurrent and non-concurrent force systems, distribution of force systems, free body diagrams, equilibrium and equations of equilibrium. Friction: Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction.

**UNIT-II: Beam:** Introduction, shear force and bending moment, different equations of equilibrium, shear force and bending moment diagram for statically determined beams. Trusses: Introduction, simple truss and solution of simple truss, methods of F-joint and methods of sections.

**UNIT-III: Centroid and moment of inertia:** Centroid of plane, curve, area, volume and composite bodies, moment of inertia of plane area, parallel axis theorem, perpendicular axis theorem, principle moment of inertia, mass moment of inertia of circular ring, disc, cylinder, sphere, and cone about their axis of symmetry.

**UNIT-IV: Kinematics of rigid body:** Introduction, plane motion of rigid body, velocity and acceleration under translational and rotational motion, relative velocity. Kinetics of rigid body: Introduction, force, mass and acceleration, work and energy, impulse and momentum, D'Alembert's principle and dynamic equilibrium.

**UNIT-V: Simple stress and strain:** Introduction, normal and shear stresses, stress-strain diagrams for ductile and brittle material, elastic constants, one-dimensional loading of members of varying cross sections, strain energy. Pure bending of beams: Introduction, simple bending theory, stress in beams of different cross sections. Torsion: Introduction, torsion of shafts of circular cross sections, torque and twist, shear stress due to torque.

**Books and References:**

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010).
3. A Textbook of Engineering Mechanics, R.K. Bansal, Laxmi Publications.
4. Engineering Mechanics, R.S. Khurmi, S.Chand Publishing.
5. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons (1993).
6. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3 rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
7. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, (1998).
8. Engineering mechanics by Irving H. Shames, Prentice-Hall.

### **BEEE-351: Analog Electronic Circuits Laboratory (0:0:2 – 1 credit)**

**Course Outcome:** At the end of course, Student will be able to:

1. To obtain the characteristics of the PN junction diode.
2. To understand the application of the zener diode.
3. To obtain the input and output characteristics of Transistor in CB and CE Configuration.
4. To understand the operation of half wave and full wave rectifiers without filters.
5. To understand the operation of half-wave and full-wave rectifiers with filters.
6. To obtain the FET Characteristics.
7. To obtain the frequency response of CC and CE Amplifier.
8. To obtain the frequency response of common source FET Amplifier.
9. To obtain the frequency response of common gate FET Amplifier

#### **ANALOG ELECTRONICS:**

Note: Select at least any five out of the following:

1. To Plot V-I characteristics of junction diode and zener diode.
2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge rectifiers.
3. To Plot input / output characteristics for common base transistor.
4. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.
5. To determine voltage gain, current gain, input impedance and output impedance of common emitter amplifier.
6. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C coupled common emitter amplifier.
7. To design R-C Phase shift / Wein Bridge oscillator and verify experimentally the frequency of oscillation.
8. To study transistor as a switch and determine load voltage and load current when the transistor is ON.

#### **ANALOG IC & DIGITAL ELECTRONICS:**

Note: Select at least any five out of the following:

9. To study application of Operational Amplifier as summer integrator and voltage comparator
10. To study operation of Op-Amp based astable and monostable multivibrators.
11. To study operation IC 555 based astable and monostable multibrators.
12. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.
13. To study operation of Adder / Subtractor using 4 bit / 8 bit IC 7483.
14. To study operation of (a) J K Master – slave flip – flop using IC 7476 (b) Modulo N counter using programmable counter IC74190.
15. To verify experimentally output of A/D and D/A converters.
16. To study regulation of unregulated power supply using IC 7805/7812 voltage regulator and measure the load and line regulations

**BEEE-352: Electrical Machines Laboratory– I (0:0:2 – 1 credit)**

**Course Outcome :** At the end of this course, students will be able to

- Understand the concept of efficiency and the short circuit impedance of a three-phase transformer from no-load test, winding resistance, short circuit test, and load test.
- Understand the effect of unbalanced loading on a three-phase transformer with different connections, and the effects and limitations of each connection.
- Study series and parallel connections of three-phase transformers

1 To obtain magnetization characteristics of a d.c. shunt generator

2 To obtain load characteristics of a d.c. shunt generator and compound generator (a)

Cumulatively compounded (b) Differentially compounded

3 To obtain efficiency of a dc shunt machine using Swinburn's test

4 To perform Hopkinson's test and determine losses and efficiency of DC machine

5 To obtain speed-torque characteristics of a dc shunt motor

6 To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control

7 To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/ Static Ward –Leonard method.

8 To study polarity and ratio test of single phase and 3-phase transformers

9 To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using C.C. and S.C. tests.

10 To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.

11 To obtain 3-phase to 2-phase conversion by Scott connection.

12 To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O.

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<b>BEEE-401</b>	<b>Digital Electronics</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Apply concepts of Digital Binary System and implementation of Gates.
- Analyze and design of Combinational logic circuits.
- Analyze and design of Sequential logic circuits with their applications
- Implement the Design procedure of Synchronous & Asynchronous Sequential Circuits.
- Apply the concept of Digital Logic Families with circuit implementation.

UNIT I- Digital System And Binary Numbers: Number System and its arithmetic, Signed binary numbers, Binary codes, Cyclic codes, Hamming Code, the map method up to five variable, Don't care conditions, POS simplification, NAND and NOR implementation, Quine McClusky method (Tabular method).

UNIT II- Combinational Logic: Combinational Circuits: Analysis Procedure, Design procedure, Binary adder-subtractor, Decimal adder, Binary multiplier, Magnitude comparator, Multiplexers, Demultiplexers, Decoders, Encoders.

UNIT III- Sequential Logic And Its Applications: Storage elements: latches & flip flops, Characteristic Equations of Flip Flops, Flip Flop Conversion, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters: Johnson & Ring Counter.

UNIT IV- Synchronous & Asynchronous Sequential Circuits: Analysis of clocked sequential circuits with state machine designing, State reduction and assignments, Design procedure. Analysis procedure of Asynchronous sequential circuits, circuit with latches, Design procedure, Reduction of state and flow table, Race-free state assignment, Hazards.

UNIT V- Memory & Programmable Logic Devices: Digital Logic Families: DTL, DCTL, TTL, ECL & CMOS etc., Fan Out, Fan in, Noise Margin; RAM, ROM, PLA, PAL; Circuits of Logic Families, Interfacing of Digital Logic Families, Circuit Implementation using ROM, PLA and PAL; CPLD and FPGA.

Text Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press.
3. RP Jain, "Modern Digital Electronics", Tata McGraw Hill Publication.

<b>BEEE-402</b>	<b>Electrical Machines – II</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyse performance characteristics of ac machines.

### **Unit – I: Synchronous Machine-I**

Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O.C.& S.C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque coefficient.

### **Unit – II: Synchronous Machine-II**

Two reaction theory, Power flow equations of cylindrical and salient pole machines, Operating characteristics. Synchronous Motor-Starting methods, Effect of varying field current at different loads, V- curves, Hunting & damping, Synchronous condenser.

### **Unit – III: Three phase Induction Machine-I**

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque-slip characteristics, No-load & blocked rotor tests, Efficiency, Induction generator & its applications

### **Unit – IV: Three phase Induction Machine-II**

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed control (with and without emf injection in rotor circuit)

### **Unit – V: Single phase Induction Motor**

Double revolving field theory, Equivalent circuit, No-load and blocked rotor tests, Starting methods, Repulsion motor, Universal motor, Brushless DC Motors

### **Text Books:**

1. D.P. Kothari & I.J. Nagrath, "Electric Machines", Tata Mc GrawHill
2. Smarajit Ghosh, "Electric Machines", Pearson
3. Fitzgerald, A.E., Kingsley and S.D. Umans, "Electric Machinery", McGraw Hill.
4. P.S. Bimbhra, "Electrical Machinery", Khanna Publisher

### **ReferenceBooks:**

5. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers

<b>BEEE-403</b>	<b>Power Electronics</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters.

**Unit-I** - Power semiconductor devices their symbols and static characteristics, Characteristics and specifications of switches, types of power electronic circuits Operation, steady state and switch characteristics & switching limits of Power Transistor Operation and steady state characteristics of Power MOSFET and IGBT

Thyristor–Operation V-I characteristics , two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC.

**Unit-II**- Power Semiconductor Devices (Contd.)

Protection of devices. Series and parallel operation of thyristors Commutation techniques of thyristor.

DC-DC Converters:

Principles of step-down chopper, step down chopper with R-L load Principle of step-up chopper, and operation with RL load, classification of choppers

**Unit-III**- Phase Controlled Converters

Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode.

Single phase fully controlled and half controlled bridge converters. Performance Parameters

Three phase half wave converters Three phase fully controlled and half controlled bridge converters, Effect of source impedance Single phase and three phase dual converters

**Unit-IV**- AC Voltage Controllers

Principle of On-Off and phase controls Single phase ac voltage controller with resistive and inductive loads Three phase ac voltage controllers (various configurations and comparison only) Single phase transformer tap changer. Cyclo Converters Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo converters, output voltage equation

**Unit-V**- Inverters

Single phase series resonant inverter, Single phase bridge inverters, Three phase bridge inverters Voltage control of inverters Harmonics reduction techniques, Single phase and three phase current source inverters

**Text Books:**

1. M.H.Rashid, "Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3<sup>rd</sup> Edition, 2004.
2. M.D.Singhand K.B .Khanchandani, "Power Electronics" TataMCGrawHill,2005

3. V.R.Moorthy, “Power Electronics: Devices, Circuits and Industrial Applications” Oxford University Press, 2007.

#### Reference Books:

1. M.S.Jamil Asghar, “Power Electronics” Prentice Hall of India Ltd., 2004
2. Chakrabarti & Rai, “Fundamentals of Power Electronics & Drives” Dhanpat Rai & Sons.
3. Ned Mohan, T.M.Undeland and W.P.Robbins, “Power Electronics: Converters, Applications and Design”, Wiley India Ltd, 2008.
4. S.N. Singh, “A Text Book of Power Electronics” Dhanpat Rai & Sons

<b>BEEE-404</b>	<b>Signals and Systems</b>	<b>2L:1T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Represent the various types of signals & systems and can perform mathematical operations on them.
- Analyze the response of LTI system to Fourier series and Fourier transform and to evaluate their applications to network analysis.
- Analyze the properties of continuous time signals and system using Laplace transform and determine the response of linear system to known inputs.
- Implement the concepts of Z transform to solve complex engineering problems using difference equations.
- Develop and analyze the concept of state-space models for SISO & MIMO system.

#### UNIT I

**Pre- Requisites:** Differential Equations.

**Introduction to Continuous Time Signals and Systems:** Introduction to continuous time and discrete time signals, Classification of signals with their mathematical representation and characteristics. Transformation of independent variable, Introduction to various type of system, basic system properties.

**Analogous System:** Linear & Rotational mechanical elements, force-voltage and force-current analogy, modeling of mechanical and electro-mechanical systems: Analysis of first and second order linear systems by classical method.

#### UNIT II

**Pre- Requisites:** Fourier Series & Fourier Transform

Fourier Transform Analysis: Exponential form and Compact trigonometric form of Fourier series, Fourier symmetry, Fourier transform: Properties, application to network analysis. Definition of DTFS, and DTFT, Sampling Theorem.

#### UNIT III

**Pre- Requisites:** Laplace Transform

Laplace Transform Analysis: Review of Laplace Transform, Properties of Laplace Transform, Initial & Final value Theorems, Inverse Laplace Transform, Convolution Theorem, Impulse response, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform to complex waveforms

#### UNIT IV

**Pre- Requisites:** Matrix Calculations.

State – Variable analysis: Introduction, State Space representation of linear systems, Transfer function and state Variables, State Transition Matrix, Solution of state equations for

homogeneous and non-homogeneous systems, Applications of State – Variable technique to the analysis of linear systems.

## UNIT V

**Pre- Requisite:** Z-Transforms.

Z – Transform Analysis: Concept of Z – Transform & ROC, Z – Transform of common functions,

Inverse Z – Transform, Initial & Final value Theorems, Applications to solution of difference equations, Properties of Z-transform.

### Text Books:

1. Oppenheim, Wilsky, Nawab, “Signals & Systems”, PHI
2. Anand Kumar, “Signals & Systems”, PHI
3. Choudhary D. Roy, “Network & Systems”, Wiley Eastern Ltd.

### Reference Books:

1. David K. Cheng; “Analysis of Linear System”, Narosa Publishing Co
2. BP Lathi, “Linear Systems & Signals” Oxford University Press, 2008.
3. IJ Nagrath, S.N. Saran, “Signals and Systems”, TataMc.Graw Hill, 2001.
4. ME Van-Valkenberg; “ Network Analysis”, Prentice Hall of India

<b>BAS-401</b>	<b>Mathematics-III (Probability and Statistics)</b>	<b>3L:1T:0P</b>	<b>4 credits</b>
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**CO1 To understand the concept of Probability**

**CO2 To analysis and study the statistics**

### UNIT 1: Basic Probability (12 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

### UNIT 2: Continuous Probability Distributions (4 hours)

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

### UNIT 3: Bivariate Distributions (4 hours)

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

### UNIT 4: Basic Statistics (8 hours)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

### UNIT 5: Applied Statistics (8 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

### UNIT 6: Small samples (4 hours)

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

### Text / References:

1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
3. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
4. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
5. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
6. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
7. T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

<b>BAS- 404</b>	<b>Biology</b>	<b>2L:1T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** After studying the course, the student will be able to:

- Describe how biological observations of 18<sup>th</sup> Century that lead to major discoveries.
- Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological  
Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
- Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
- Classify enzymes and distinguish between different mechanisms of enzyme action.  
Identify DNA as a genetic material in the molecular basis of information transfer.  
Analyse biological processes at the reductionistic level
- Apply thermodynamic principles to biological systems. Identify and classify microorganisms.

### UNIT 1: Introduction (2 hours)

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

### UNIT 2: Classification (3 hours)

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

### **UNIT 3: Genetics (4 hours)**

Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”. Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

### **UNIT 4: Biomolecules (4 hours)**

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

### **UNIT 5: Enzymes (4 Hours)**

Purpose: To convey that without catalysis life would not have existed on earth.

Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

### **UNIT 6: Information Transfer (4 hours)**

Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

### **UNIT 7: Macromolecular analysis (5 hours)**

Purpose: To analyse biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

### **UNIT 8: Metabolism (4 hours)**

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of  $K_{eq}$  and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis of glucose

from CO<sub>2</sub> and H<sub>2</sub>O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.

### **UNIT 9. Microbiology (3 hours)**

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

### **Text / References:**

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2014.
2. .E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. .D. L. Nelson and M. M. Cox, "Principles of Biochemistry", W.H. Freeman and Company, 2012.
4. .G. S. Stent and R. Calendar, "Molecular Genetics", Freeman and company, 1978.
5. L. M. Prescott, J. P. Harley and C. A. Klein, "Microbiology", McGraw Hill Higher Education, 2005.

### **BEEE-451: Digital Electronics Laboratory (0:0:2 – 1 credit)**

Course Outcomes: Knowledge Level, KL Upon the completion of the course, the student will be able to:

CO 1 Understanding of Digital Binary System and implementation of Gates.

CO2 Design the Sequential circuits with the help of combinational circuits and feedback element.

CO3 Design data selector circuits with the help of universal Gates.

CO4 Design the counters with the help of sequential circuit and basic Gates.

CO5 Implement the projects using the digital ICs and electronics components.

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.

2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.

4. Implementation and verification of Decoder using logic gates.

5. Implementation and verification of Encoder using logic gates.

6. Implementation of 4:1 multiplexer using logic gates.

7. Implementation of 1:4 demultiplexer using logic gates.

8. Implementation of 4-bit parallel adder using 7483 IC.

9. Design, and verify the 4-bit synchronous counter.
10. Design, and verify the 4-bit asynchronous counter.
11. Implementation of Mini Project using digital integrated circuit's and other components.

**BEEE-452: Electrical Machines Laboratory– II (0:0:2 – 1 credit)**

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Characteristics of induction and synchronous machines are studied using direct and indirect methods.
- Regulation of three phase alternator is predetermined using optimistic, pessimistic and accurate method are done.
- Saliency nature of synchronous machine is studied.
- Performance of single-phase induction motor is obtained.

**Note: The minimum 8experiments are to be performed from the following, out of which there should be at least two software based experiments.**

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
  - (i) Torque-speed characteristics
  - (ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by Keeping V/f ratio constant
5. To study speed control of three phase induction motor by varying supply voltage.
6. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii)MMF method.
7. To determine V-curves and inverted V-curves of a three phase synchronous motor.
8. To determine  $X_d$  and  $X_q$  of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.
9. To study synchronization of an alternator with the infinite bus by using:
  - (i) dark lamp method (ii) two bright and one dark lamp method

**Software based experiments (Develop Computer Program in 'C' language or use MATLAB or other commercial software)**

10. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.

11. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
12. To determine speed-torque characteristics of at here phase induction motor by(i) keeping v/f ratio Constant (ii) increasing frequency at the rated voltage.
13. Draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
- 14.To determines steady state performance of a three phase induction motor using equivalent circuit.

### **BEEE-453: Power Electronics Laboratory (0:0:2 – 1 credit)**

**Course Outcomes:** Ability to construct test platforms and analyze power electronic circuits.

**Note: The minimum of 10 experiments is to be performed out of which at least three should be software based.**

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with(i) resistive load(ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cyclo-converter
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
9. To study operation of IGBT/MOSFET chopper circuit
10. To study MOSFET/IGBT based single-phase series-resonant inverter.
11. To study MOSFET/IGBT based single-phase bridge inverter.

### **SOFTWARE BASED EXPERIMENTS (PSPICE/MATLAB)**

12. To obtain simulation of SCR and GTO thyristor.
13. To obtain simulation of Power Transistor and IGBT. To obtain simulation of single phase fully controlled bridge rectifier and draw load voltage and load current wave form for inductive load.
14. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current wave forms for inductive load.
15. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in output voltage and load current.

### YEAR III, SEMESTER-V & VI

BEEE-501	Power Systems-I	L:T:P-3:0:0	Credit: 3
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the concepts of power systems.
- Understand the various power system components. Evaluate fault currents for different types of faults.
- Understand the generation of over-voltages and insulation coordination.
- Understand basic protection schemes.
- Understand concepts of HVDC power transmission and renewable energy generation.

#### Unit-I

##### **Power System Components:**

Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, busbar, circuit breaker and isolator Supply System Different kinds of supply system and their comparison, choice of transmission voltage .Transmission Lines: Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect.

#### Unit-II

##### **Over Head Transmission Lines:**

Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading

#### Unit-III

##### **Corona and Interference:**

Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference. Electrostatic and electromagnetic interference with communication lines

##### **Overhead line Insulators:**

Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.

#### Unit-IV

##### **Mechanical Design of transmission line:**

Catenary curve, calculation of sag& tension, effects of wind and ice loading, sag template, vibration dampers insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.

#### Unit-V

##### **Neutral grounding:**

Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices.

##### **Electrical Design of Transmission Line:**

Design consideration of EHV transmission lines, choice of voltage, number of circuits, conductor configuration, insulation design, and selection of ground wires.

##### **EHVAC and HVDC Transmission:**

Introduction to EHVAC and HVDC transmission and their comparison, use of bundle conductors, kinds of DC links, and incorporation of HVDC into AC system

**Text Books:**

1. W.D. Stevenson, "Element of Power System Analysis", Mc Graw Hill,
2. C.L.Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition
3. Asfaq Hussain, "Power System", CBS Publishers and Distributors,
4. B.R.Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.

**Reference Books:**

1. M.V. Deshpandey, "Elements of Power System Design", Tata Mc Graw Hill,
2. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons,
3. S.L.Uppal, "Electric Power", Khanna Publishers

<b>BEEE-502</b>	<b>Control Systems</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems. Design simple feedback controllers.
- Ability to analyze systems using transfer function and state space models
- Ability to design controllers and compensators using conventional techniques

**Unit-I**

**The Control System:**

Open loop & closed control ; servo mechanism, Physical examples. Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback

**Unit-II**

**Time Response analysis:**

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices

**Unit-III**

**Control System Components:**

Constructional and working concept of ac servo motor, synchros and steppe rmotor Stability and Algebraic Criteria concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.

Root Locus Technique: The root locus concepts, construction of root loci

**Unit-IV**

**Frequency response Analysis:** Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots Stability in Frequency Domain: gain margin and phase margin, constant M&N circles

## Unit-V

### Introduction to Design:

The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain.

Review of state variable technique:

Review of state variable technique, conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing.

### Text Book:

1. Nagrath&Gopal, "ControlSystemEngineering", 4thEdition, NewAgeInternational.
2. K.Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C.Kuo&FaridGolnaraghi, "AutomaticControlSystem" WileyIndiaLtd, 2008.
4. D. Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

### Reference Books:

1. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" NewAgeInternational, 2006.
3. R.T.Stefani, B.Shahian, C.J.Savantand G.H.Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. N.C.Jagan, "ControlSystems", B.S.Publications, 2007.

<b>BEEE-503</b>	<b>Microprocessors</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**COURSE OUTCOMES:** At the end of this course, students will be able to:

- Understand the architecture of 8085 and 8051
- Impart the knowledge about the instruction set
- Understand the basic idea about the data transfer schemes and its applications
- Develop skill in simple program writing for 8051 & 8085 and applications
- The program enables the students to develop strong competencies in Physics and its applications in a technology-rich, interactive environment.
- The program motivates students to develop strong skills in research, analysis and interpretation of complex information.

## UNIT-I:

### Introduction to Digital Computer and Microprocessor:

**Digital Computers:** General architecture and brief description of elements, instruction execution, instruction format, and instruction set, addressing modes, programming system, higher level languages.

**Buses and CPU Timings:** Bus size and signals, machine cycle timing diagram, instruction timing, processor timing.

**Microprocessor and Microprocessor Development Systems:** Evolution of Microprocessor, Microprocessor architecture and its operations, memory, inputs-outputs (I/Os), data transfer schemes interfacing devices, architecture advancements of microprocessors, typical microprocessor development system.

## UNIT-II:

### 8-bit Microprocessors.

**8085 microprocessor:** pin configuration, internal architecture.

Timing & Signals: control and status, interrupt: ALU, machine cycles,

**Instruction Set of 8085:**

**Addressing Modes:** Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing.

Instruction format, op-codes, mnemonics, no. of bytes, RTL, variants, no. of machine cycles and Tstates, addressing modes.

**Instruction Classification:** Data transfer, arithmetic operations, logical operations, branching operation, machine control; Writing assembly Language programs, Assembler directives.

### **UNIT-III:**

#### **16-bit Microprocessors:**

##### **Architecture:**

Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes

##### **Instruction Set of 8086**

**Addressing Modes:** Instruction format: [20] Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control.

**Interrupts:** Hardware and software interrupts, responses and types.

### **UNIT-IV**

**Fundamental of Programming:** development of algorithms, flowcharts in terms of structures, (series, parallel, if-then-else etc.)

**Assembler Level Programming:** memory space allocation (mother board and user program) Assembler level programs (ASMs)

### **UNIT-V**

#### **Peripheral Interfacing:**

I/O programming: Programmed I/O, Interrupt Driven I/O, DMA I/O interface: serial and parallel communication, memory I/O mapped I/Os. Peripheral Devices: 8237 DMA controller, 8255- Programmable peripheral interface, 8253/8254 Programmable timer/counter. 8259 programmable Interrupt Controller.

#### **Text Books:**

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.

#### **Reference Books:**

5. Brey, Barry B. "INTEL Microprocessors" Prentice Hall ( India)
6. ADitya P Mathur, "Introduction to Microprocessor" Tata Mc Graw Hill
7. M. Rafiqzaman, "Microprocessors- Theory and applications" PHI
8. B. Ram, "Advanced Microprocessor & Interfacing" Tata McGraw Hill
9. Renu Singh & B.P.Singh, "Microprocessor and Interfacing and applications" New Age International
10. Hall D.V., "Microprocessors Interfacing" Tata Mc Graw Hill
11. Liu and Gibson G.A., "Microcomputer Syst

## **BEEE-551: Power Systems-I Laboratory (0:0:2 – 1 credit)**

**Course Outcome: At the end of the session students will be able to:**

- **Understand practical application of MATLAB in switchgear system.**
- **Understand practical aspects of the working of various types of relays.**

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

### **(A) Hardware Based:**

1. To determine direct axis reactance ( $x_d$ ) and quadrature axis reactance ( $x_q$ ) of a salient pole alternator.
  2. To determine negative and zero sequence reactances of an alternator.
  3. To determine sub transient direct axis reactance ( $x_d$ ) and sub transient quadrature axis reactance ( $x_q$ ) of an alternator
  4. To determine location of fault in a cable using cable fault locator
  5. To study ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
  6. To study the suspension type insulator.
  7. To study and design the string type insulator for 11 KV transmission line.
  8. To study operation of oil testing set.
  9. Simulation Based Experiments (using MATLAB or any other software)
  10. To determine transmission line performance.
  11. To obtain steady state, transient and sub-transient short circuit currents in an alternator
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1. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
  2. To study the IDMT over current relay and determine the time current characteristics
  3. To study percentage differential relay
  4. To study Impedance, MHO and Reactance type distance relays.
  5. To obtain formation of Y-bus and perform load flow analysis
  6. To perform symmetrical fault analysis in a power system
  7. To perform unsymmetrical fault analysis in a power system



## **BEEE-552: Control Systems Laboratory (0:0:2 – 1 credit)**

**Course Outcomes:** At the end of this student Will be able to understand and apply basic science, circuit theory, theory control theory signal processing and apply them to electrical engineering problems.

**Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.**

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P,PI and PID temperature controller for a oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output V/ S input characteristics
7. To determine speed-torque characteristics of an ac servo motor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study PID Controller for simulation proves like transportation lag.

### **Software based experiments (Use MATLAB, LABVIEW software etc.)**

- 11.To determine time domain response of a second order system for step input and obtain performance parameters.
- 12.To convert transfer function of a system into state space for mand vice-versa.
- 13.To plot root locus diagram of an open loop transfer function and determin e range of gain 'k' fir stability.
- 14.To plot a Bode diagram of an open loop transfer function.
- 15.To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

## **BEEE-553: Microprocessor Laboratory (0:0:2 – 1 credit)**

**Course Outcome:** At the end of this course, students will be able to:

- Execution of different programs for 8086 in Assembly Level Language using MASM Assembler.
- Interfacing various I/O Devices like stepper motor, key board, ADC AND DAC TO 8086.
- 3.Execution of different programs in 8051. etc they will learn assembly language programming and interfacing various peripherals to processor and controller with this knowledge they can design diff microprocessor based mini & main project.

### **A. Study Experiments:**

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor

### **B. Programming based Experiments (any four)**

4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from 0F to 0C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and division)

### **C. Interfacing based Experiments (any four)**

10. To obtain interfacing of RAM chip to 8085/8086 based system
11. To obtain interfacing of keyboard controller
12. To obtain interfacing of DMA controller
13. To obtain interfacing of PPI
14. To obtain interfacing of UART/USART
15. To perform microprocessor based stepper motor operation through 8085 kit
16. To perform microprocessor based traffic light control
17. To perform microprocessor based temperature control of hot water.

<b>BEEE-601</b>	<b>Power Systems – II</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- To model and analyze the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under balanced and unbalanced conditions.
- To model and analyze the stability of power system when it is subjected to a fault.

### **Unit-I**

#### **Representation of Power System Components:**

Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit System

Symmetrical components:

Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

Symmetrical fault analysis:

Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions.

### **Unit-II**

#### **Unsymmetrical faults:**

Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance.

Formation of Z bus using singular transformation and algorithm, computer method for short circuit calculations.

### **Unit-III**

#### **Load Flows:**

Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Siedel and Newton- Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

### **Unit-IV**

#### **Power System Stability:**

Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

### **Unit-V**

#### **Traveling Waves:**

Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipments and line against traveling waves.

**Text Books:**

1. W.D. Stevenson, Jr. "Elements of Power System Analysis", Mc Graw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Chakraborty, Soni, Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T.K. Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press, 2007

**Reference Books:**

1. L.P. Singh, "Advanced Power System Analysis & Dynamics", New Age International
2. Hadi Sadat, "Power System Analysis", Tata Mc Graw Hill.
3. D. Das, "Electrical Power Systems" New Age International, 2006.
4. J.D. Glover, M.S. Sharma & T.J. Overbye, "Power System Analysis and Design" Thomson, 2008.
5. P.S.R. Murthy "Power System Analysis" B.S. Publications, 2007.
6. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata McGraw Hill
7. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.

**BEEE-651: Power Systems-II Laboratory (0:0:2 – 1 credit)****Course Outcome: At the end of the session students will be able to:**

- Understand practical application of MATLAB in switchgear system.
- Understand practical aspects of the working of various types of relays.

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

**(B) Hardware / Simulation Based:**

1. To determine fault current for L-G fault at the terminals of an alternator at very low excitation.
2. To determine fault current for L-L fault at the terminals of an alternator at very low excitation.
3. To determine fault current for L-L-G fault at the terminals of an alternator at very low excitation.
4. To determine fault current for L-L-L fault at the terminals of an alternator at very low excitation.
5. To study the IDMT over current relay and determine the time current characteristics
6. To study percentage differential relay
7. To study Impedance, MHO and Reactance type distance relays.
8. To obtain formation of Y-bus and perform load flow analysis by Newton-Raphson method.
9. To obtain formation of Y-bus and perform load flow analysis by fast decoupled method.
10. To obtain formation of Y-bus and perform load flow analysis by Gauss Seidel method.
11. To perform symmetrical fault analysis in a power system
12. To perform unsymmetrical fault analysis in a power system

<b>BEEE-652</b>	<b>Measurements and Instrumentation</b>	<b>2L:0T:2P</b>	<b>3 credits</b>
	<b>Laboratory</b>		

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Design and validate DC and AC bridges.
- Analyze the dynamic response and the calibration of few instruments
- Learn about various measurement devices, their characteristics, their operation and their limitations.
- Understand statistical data analysis.
- Understand computerized data acquisition.

**Lectures/Demonstrations:**

- Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.
- Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation,  $C_p$ ,  $C_{pk}$ .
- Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.
- Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors.
- Measurements of R, L and C.
- Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
- Digital Storage Oscilloscope.

**Experiments:**

- Measurement of a batch of resistors and estimating statistical parameters.
- Measurement of L using a bridge technique as well as LCR meter.
- Measurement of C using a bridge technique as well as LCR meter.
- Measurement of Low Resistance using Kelvin's double bridge.
- Measurement of High resistance and Insulation resistance using Megger.
- Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale. Bandwidth of measurement and sampling rate.
- Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
- Usage of DSO to capture transients like a step change in R-L-C circuit.
- Current Measurement using Shunt, CT, and Hall Sensor.

<b>BEEE-653</b>	<b>Electronics Design Laboratory</b>	<b>1L:0T:4P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of the course, students will demonstrate the ability to

- Understand the practical issues related to practical implementation of applications using electronic circuits.
- Choose appropriate components, software and hardware platforms.
- Design a Printed Circuit Board, get it made and populate/solder it with components. Work as a team with other students to implement an application.
- Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems, Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations. Group projects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.

#### **Text/Reference Books**

- S. Sedra and K. C. Smith, "Microelectronic circuits", Oxford University Press, 2007.
  - P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1997.
  - H.W.Ott, "Noise Reduction Techniques in Electronic Systems", Wiley, 1989.
  - W.C. Bosshart, "Printed Circuit Boards: Design and Technology", Tata McGraw Hill, 1983.
  - G.L. Ginsberg, "Printed Circuit Design", McGraw Hill, 1991.
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## YEAR IV, SEMESTER-VII & VIII

### Project/Internship

<b>BEEE-751</b>	<b>Project –I</b>	<b>0L:0T:6P</b>	<b>3 credits</b>
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The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a departmental committee.

<b>BEEE-752</b>	<b>Summer Industry Internship</b>
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Minimum of six weeks in an Industry in the area of Electrical Engineering. The summer internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship should be presented in the form of a report.

<b>BEEE-851</b>	<b>Project Work-II</b>	<b>0L:0T:16P</b>	<b>8 credits</b>
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The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

- In depth study of the topic assigned in the light of the Report prepared under EEP1;
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department.
- Final Seminar Presentation before a Departmental Committee.

## PROFESSIONAL ELECTIVE COURSES

<b>BEEE-511/ 611/ 711/ 811</b>	<b>Wind and Solar Energy Systems</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation.
- Understand the issues related to the grid-integration of solar and wind energy systems.

### **UNIT 1: Physics of Wind Power: (5 Hours)**

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

### **UNIT 2: Wind generator topologies: (12 Hours)**

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

### **UNIT 3: The Solar Resource: (3 Hours)**

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

### **UNIT 4: Solar photovoltaic: (8 Hours)**

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV UNIT, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

### **UNIT 5: Network Integration Issues: (8 Hours)**

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

### **UNIT 6: Solar thermal power generation: (3 Hours)**

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

**Text / References:**

- T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
  - G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
  - S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
  - H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
  
  - G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
  - J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.
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<b>BEEE-512/ 612/ 712/ 812</b>	<b>Line-Commutated and Active PWM Rectifiers</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Analyze controlled rectifier circuits.
- Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
- Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.

#### **UNIT 1: Diode rectifiers with passive filtering (6 Hours)**

Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current waveshape, effect of source inductance; commutation overlap.

#### **UNIT 2: Thyristor rectifiers with passive filtering (6 Hours)**

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape.

#### **UNIT 3: Multi-Pulse converter (6 Lectures)**

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

#### **UNIT 4: Single-phase ac-dc single-switch boost converter (6 Hours)**

Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

#### **UNIT 5: Ac-dc bidirectional boost converter (6 Hours)**

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

#### **UNIT 6: Isolated single-phase ac-dc flyback converter (10 Hours)**

Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factor operation, closed loop control structure.

**Text / References:**

- G. De, “Principles of Thyristorised Converters”, Oxford & IBH Publishing Co, 1988.
- J.G. Kassakian, M. F. Schlecht and G. C. Verghese, “Principles of Power Electronics”, Addison-Wesley, 1991.
- L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
- N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.
- R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science &
- Business Media, 2001.

<b>BEEE-513/613/ 713/813</b>	<b>Electrical Drives</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

1. Know the basic idea of operating principle, control and application of advance electrical machines.
2. Understand power electronic converters and their application in electrical motor drives
3. Understand common load models for electrical motor drives
4. learn control principles for electrical motor drives

**UNIT-I: Fundamentals of Electric Drive:** Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torque conventions and multi-quadrant operations Constant torque and constant power operation, Types of load, Load torque: components, nature and classification.

**UNIT-II: Dynamics of Electric Drive:** Dynamics of motor-load combination Steady state stability of Electric Drive Transient stability of electric Drive **Selection of Motor Power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty. Load equalization.

**UNIT-III: Electric Braking:** Purpose and types of electric braking, braking of dc, three phase induction and synchronous motors.

**Dynamics During Starting and Braking:** Calculation of acceleration time and energy loss during starting of dc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relations during braking, dynamics during braking.

**UNIT-IV: Power Electronic Control of DC Drives:** Single phase and three phase controlled converter fed separately excited dc motor drives (continuous conduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor. Supply harmonics, power factor and ripples in motor current Chopper control of separately excited dc motor and dc series motor.

**UNIT-V: Power Electronic Control of AC Drives: Three Phase induction Motor Drive:** Static Voltage control scheme, static frequency control scheme (VSI, CSI, and cyclo - converter based) static rotor resistance and slip power recovery control schemes.

**Three Phase Synchronous motor:** Self controlled scheme. **Special Drives:** Switched Reluctance motor, Brushless dc motor. Selection of motor for particular applications.

Text Books:

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S.K.Pillai, "A First Course on Electric Drives", New Age International.

Reference Books:

- 1 M.Chilkin, "Electric Drives", Mir Publishers, Moscow.
- 2 Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia, Pvt. Ltd. Singapore.
- 3 N.K. De and Prashant K.Sen, "Electric Drives", Prentice Hall of India Ltd.
- 4 V.Subrahmanyam, "Electric Drives: Concepts and Applications", Tata McGraw Hill.

<b>BEEE-514/614/ 714/ 814</b>	<b>Electrical and Hybrid Vehicles</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the models to describe hybrid vehicles and their performance.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.

**UNIT 1: Introduction (10 hours)**

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**UNIT 3: Electric Trains (10 hours)**

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**UNIT 4: Energy Storage (10 hours)**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

## **UNIT 5: Energy Management Strategies (9 hours)**

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

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### **Text / References:**

- C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
- S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
- M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
- T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

<b>BEEE-515/615 /715/815</b>	<b>Electrical Machine Design</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the construction and performance characteristics of electrical machines.
- Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
- Understand the principles of electrical machine design and carry out a basic design of an ac machine.
- Use software tools to do design calculations.

#### **UNIT 1: Introduction**

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

#### **UNIT 2: Transformers**

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

#### **UNIT 3: Induction Motors**

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

#### **UNIT 4: Synchronous Machines**

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

#### **UNIT 5: Computer aided Design (CAD):**

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

#### **Text / References:**

- A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
- M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
- S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
- K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.

- A. Shanmugasundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International, 1979.
  - K. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.
  - Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2D machine design package.
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<b>BEEE-516/616 / 716/816</b>	<b>Power System Protection</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.  
Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

**UNIT 1: Introduction and Components of a Protection System (4 hours)** Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers

**UNIT 2: Faults and Over-Current Protection (8 hours)**

Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination.

**UNIT 3: Equipment Protection Schemes(8 hours)**

Directional, Distance, Differential protection. Transformer and Generator protection. Bus bar Protection, Bus Bar arrangement schemes.

**UNIT 4: Digital Protection (8 hours)**

Computer-aided protection, Fourier analysis and estimation of Phasors from DFT. Sampling, aliasing issues.

**UNIT 5: Modeling and Simulation of Protection Schemes (8 hours)**

CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

**UNIT 6: System Protection (4 hours)**

Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and  $df/dt$  relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

#### **Text/References**

- J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
- Y. G. Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.
- G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.

- G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
- D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

<b>BEEE-517/617/ 717/817</b>	<b>HVDC Transmission Systems</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to \_\_\_\_\_

- Understand the advantages of dc transmission over ac transmission.
- Understand the operation of Line Commutated Converters and Voltage Source Converters.
- Understand the control strategies used in HVDC transmission system.
- Understand the improvement of power system stability using an HVDC system.

**UNIT 1: DC Transmission Technology (4 hours)**

Comparison of AC and DC Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVDC Systems. Components of a HVDC system. Line Commutated Converter and Voltage Source Converter based systems.

**UNIT 2: Analysis of Line Commutated and Voltage Source Converters (10 hours)**

Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links.

Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

**UNIT 3: Control of HVdc Converters: (10 hours)**

Principles of Link Control in a LCCHVdc system. Control Hierarchy, Firing Angle Controls– Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation.

**UNIT 3: Components of HVdc systems: (8 hours)**

Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes.

**UNIT 4: Stability Enhancement using HVdc Control (4 hours)**

Basic Concepts: Power System Angular, Voltage and Frequency Stability Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems.

### **UNIT 5: MTdc Links (4 hours)**

Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Introduction to Modular Multi-level Converters.

#### **Text/References:**

- K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.
- J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., 1983.
- E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.

<b>BEEE-518/ 618/ 718 /818</b>	<b>Power Quality and FACTS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
- Understand the working principles of FACTS devices and their operating characteristics.
- Understand the basic concepts of power quality.
- Understand the working principles of devices to improve power quality.

**UNIT 1: Transmission Lines and Series/Shunt Reactive Power Compensation (4 hours)**

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

**UNIT 2: Thyristor-based Flexible AC Transmission Controllers (FACTS) (6 hours)**

Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

**UNIT 3: Voltage Source Converter based (FACTS) controllers (8 hours)**

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

**UNIT 4: Application of FACTS (4 hours)**

Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using aSTATCOM.

**UNIT 5: Power Quality Problems in Distribution Systems (4 hours)**

Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.

### **UNIT 6: DSTATCOM (8 hours)**

Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.

### **UNIT 6: Dynamic Voltage Restorer and Unified Power Quality Conditioner (6 hours)**

Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control

Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.

#### **Text/References**

- N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
- K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
- T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
- R. C. Dugan, "Electrical Power Systems Quality", McGraw Hill Education, 2012.
- G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

<b>BEEE-519/619 /719/ 819</b>	<b>High Voltage Engineering</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course outcomes:** At the end of the course, the student will demonstrate

- Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
- Knowledge of generation and measurement of D. C., A.C., & Impulse voltages. Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.
- Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.

**UNIT-I: Electrostatic Field and Field Stress Control:** Electric field stresses, Numerical methods for Electric field computation, Finite Element Method, Charge simulation method.

**Conduction and Break Down in Gases:**

Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, and corona discharge.

**Break Down in Liquid Dielectrics:**

Conduction and breakdown in pure liquid and commercial liquid.

**Break Down in Solid Dielectrics:**

Intrinsic breakdown, electromechanical breakdown, breakdown of solid, dielectric and composite dielectrics.

**UNIT-II: Generation of High Voltages and Currents:**

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

**UNIT –III: Measurement of High Voltages and Currents:**

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

Insulation Coordination in Electric Power Systems:

Principle of Isolation Coordination in High-Voltage & Extra-High Voltage Power System.

**UNIT-IV: Non-Destructive Testing:**

Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

**High Voltage Testing:**

Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

**Text Books:**

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.

**Reference Books:**

3. E. Kuffel and W. S. Zaengal, "High Voltage Engineering", Pergamon Press.
4. M. P. Chaurasia, "High Voltage Engineering", Khanna Publishers
5. R. S. Jha, "High Voltage Engineering", DhanpatRai& sons
6. M. Khalifa, 'High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray, 'An Introduction to High Voltage Engineering' Prentice Hall of India

<b>BEEE-520 /620/ 720/ 820</b>	<b>Electrical Energy Conservation and Auditing</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the current energy scenario and importance of energy conservation. Understand the concepts of energy management.
- Understand the methods of improving energy efficiency in different electrical systems.
- Understand the concepts of different energy efficient devices.

#### **UNIT 1: Energy Scenario (6 Hours)**

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

#### **UNIT 2: Basics of Energy and its various forms (7 Hours)**

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

#### **UNIT 3: Energy Management & Audit (6 Hours)**

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

#### **UNIT 4: Energy Efficiency in Electrical Systems (7 Hours)**

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

### **UNIT 5: Energy Efficiency in Industrial Systems (8 Hours)**

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.

Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

### **UNIT 6: Energy Efficient Technologies in Electrical Systems (8Hours)**

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

#### **Text/Reference Books**

- Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
  - Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
  - S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
  - Success stories of Energy Conservation by BEE, New Delhi ([www.bee-india.org](http://www.bee-india.org))
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<b>BEEE-521/621 /721/ 821</b>	<b>Industrial Electrical Systems</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.
- Understand various components of industrial electrical systems.
- Analyze and select the proper size of various electrical system components.

### **UNIT 1: Electrical System Components (8 Hours)**

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

### **UNIT 2: Residential and Commercial Electrical Systems (8 Hours)**

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

### **UNIT 3: Illumination Systems (6 Hours)**

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

### **UNIT 4: Industrial Electrical Systems I (8 Hours)**

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

### **UNIT 5: Industrial Electrical Systems II (6 Hours)**

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

## **UNIT 6: Industrial Electrical System Automation (6 Hours)**

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

### **Text/Reference Books**

- S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
  - K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
  - S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
  - Web site for IS Standards.
  - H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.
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<b>BEEE- 522/622/722/822</b>	<b>Power System Dynamics and Control</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the problem of power system stability and its impact on the system.
- Analyze linear dynamical systems and use of numerical integration methods.
- Model different power system components for the study of stability. Understand the methods to improve stability.

#### **UNIT 1: Introduction to Power System Operations (3 hours)**

Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control.

#### **UNIT 2 : Analysis of Linear Dynamical System and Numerical Methods (5 hours)**

Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.

#### **UNIT 3 : Modeling of Synchronous Machines and Associated Controllers (12 hours)**

Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

#### **UNIT 4 : Modeling of other Power System Components (10 hours)**

Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, Wind Energy Systems.

#### **UNIT 5 : Stability Analysis (11 hours)**

Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs.

## **UNIT 6 : Enhancing System Stability (4 hours)**

Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures-Preventive Control. Emergency Control.

### **Text/Reference Books**

- K.R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2002.
  - P. Kundur, "Power System Stability and Control", McGraw Hill, 1995.
  - P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.
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<b>BEEE- 523/623/723/823</b>	<b>Digital Control Systems</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Obtain discrete representation of LTI systems.
- Analyze stability of open loop and closed loop discrete-time systems. Design and analyze digital controllers.
- Design state feedback and output feedback controllers.
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#### **UNIT 1: Discrete Representation of Continuous Systems (6 hours)**

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

#### **UNIT 2: Discrete System Analysis (6 hours)**

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

#### **UNIT 3: Stability of Discrete Time System (4 hours)**

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

#### **UNIT 4: State Space Approach for discrete time systems (10 hours)**

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

#### **UNIT 5: Design of Digital Control System(8 hours)**

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

#### **UNIT 6: Discrete output feedback control (8 hours)**

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

#### **Text Books :**

- K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
- M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
- G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.
- B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

<b>BEEE- 524/624/724/82 4</b>	<b>Digital Signal Processing</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Analyze discrete-time systems using z-transform.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms. Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

### **Unit-I: Discrete-Time Signals and Systems:**

Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier Transform.

Implementation of discrete time systems:  
Structure for FIR system, Structure for IIR systems

### **Unit-II: Sampling of Continuous Time Signals:**

Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion

### **Unit-III: Transform Analysis of LTI Systems:**

Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, and linear systems with generalized linear phase

Discrete Fourier Transform:  
Discrete Fourier Transform, properties, linear convolution and circular convolution,

### **Unit-IV: Filter Design Techniques:**

Design of IIR filters using Impulse Invariant Response method and Bilinear Transformation method. Butterworth filters and chebyshev Filter's response, Design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters,

### **Unit-V: Efficient computation of the DFT:**

FFT algorithms- decimation in time and decimation in frequency, Goertzel algorithm, Implementation of the DFT using convolution,

**Introduction to wavelet transform:**

Wavelet comparison with Fourier transforms, Applications of Wavelet cosine transform, Discrete cosine transform (DCT).

**Text Books:**

1. S. Salivahanan, "Digital Signal Processing", McGraw Hill Education (India) Private Limited.
2. Oppenheim A.V., Schafer, Ronald W. & Buck, John R, "Discrete Time Signal processing", Pearson Education .

**Reference Books:**

3. Proakis, J.G. & Manolakis, D.G., " Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India.
4. Rabiner, L.R. and Gold B., "Theory and applications of DSP", Prentice Hall of India.
5. Oppenheim, Alan V. & Willsky, Alan S. , "Signals and Systems" , Prentice Hall of India, 2nd Edition
6. Johnson, J.R. , "Introduction to Digital Signal Processing", Prentice Hall of India.

<b>BEEE- 525/625/725/825</b>	<b>Computer Architecture</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the concepts of microprocessors, their principles and practices.
- Write efficient programs in assembly language of the 8086 family of microprocessors. Organize a modern computer system and be able to relate it to real examples.
- Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
- Implement embedded applications using ATOM processor.

#### **UNIT 1: Introduction to computer organization (6 hours)**

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

#### **UNIT 2: Memory organization (6 hours)**

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

#### **UNIT 3: Input – output Organization (8 hours)**

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

#### **UNIT 4: 16 and 32 microprocessors (8 hours)**

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

#### **UNIT 5: Pipelining(8 hours)**

Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

#### **UNIT 6: Different Architectures (8 hours)**

VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

#### **Text/Refence Books**

- V. Carl, G. Zvonko and S. G. Zaky, “Computer organization”, McGraw Hill, 1978.
- B. Brey and C. R. Sarma, “The Intel microprocessors”, Pearson Education, 2000.
- J. L. Hennessy and D. A. Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kauffman, 2011.

- W. Stallings, “Computer organization”, PHI, 1987.
  - P. Barry and P. Crowley, “Modern Embedded Computing”, Morgan Kaufmann, 2012.
  - N. Mathivanan, “Microprocessors, PC Hardware and Interfacing”, Prentice Hall, 2004.
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- Y. C. Lieu and G. A. Gibson, “Microcomputer Systems: The 8086/8088 Family”, Prentice Hall India, 1986.
  - J. Uffenbeck, “The 8086/8088 Design, Programming, Interfacing”, Prentice Hall, 1987.
  - B. Govindarajalu, “IBM PC and Clones”, Tata McGraw Hill, 1991.
  - P. Able, “8086 Assembly Language Programming”, Prentice Hall India.

<b>BEEE-526/626/726/826</b>	<b>Electromagnetic waves</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Analyse transmission lines and estimate voltage and current at any point on transmission line for different load conditions.
- Provide solution to real life plane wave problems for various boundary conditions. Analyse the field equations for the wave propagation in special cases such as lossy and low loss dielectric media.
- Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide. Understand and analyse radiation by antennas.

#### **UNIT 1: Transmission Lines (6 hours)**

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

#### **UNIT 2: Maxwell's Equations (6 hours)**

Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

#### **UNIT 3: Uniform Plane Wave (7 hours)**

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

#### **UNIT 4: Plane Waves at Media Interface (7 hours)**

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

#### **UNIT 5: Waveguides (7 hours)**

Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic (TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

**UNIT 6: Antennas (7 hours)**

Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

**Text/Reference Books**

- R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005.
- D. K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley, 1989.
- M. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 2007.
- C. A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2012.
- C. A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & Sons, 2005.

<b>BEEE- 527/627/727/827</b>	<b>Computational Electromagnetics</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the basic concepts of electromagnetics.
- Understand computational techniques for computing fields.
- Apply the techniques to simple real-life problems.

**UNIT 1: Introduction (6 hours)**

Conventional design methodology, Computer aided design aspects – Advantages. Review of basic fundamentals of Electrostatics and Electromagnetics. Development of Helmholtz equation, energy transformer vectors- Poynting and Slepian, magnetic Diffusion-transients and time-harmonic.

**UNIT 2: Analytical Methods (6 hours)**

Analytical methods of solving field equations, method of separation of variables, Roth's method, integral methods- Green's function, method of images.

**UNIT 3: Finite Difference Method (FDM) (7 hours)**

Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method- Uniqueness and convergence.

**UNIT 4: Finite Element Method (FEM) (7 hours)**

Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations.

**UNIT 5: Special Topics(7 hours)**

{Background of experimental methods-electrolytic tank, R-C network solution, Field plotting (graphical method)}, hybrid methods, coupled circuit - field computations, electromagnetic - thermal and electromagnetic - structural coupled computations, solution of equations, method of moments, Poisson's fields.

**UNIT 6: Applications (7 hours)**

Low frequency electrical devices, static / time-harmonic / transient problems in transformers, rotating machines, actuators. CAD packages.

**Text/Reference Books**

- P. P. Silvester and R. L. Ferrari "Finite Element for Electrical Engineers", Cambridge University press, 1996.
- M. N. O. Sadiku, "Numerical Techniques in Electromagnetics", CRC press, 2001.

<b>BEEE- 528/628/728/828</b>	<b>Control Systems Design</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand various design specifications.
- Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
- Design controllers using the state-space approach.

#### **UNIT 1: Design Specifications (6 hours)**

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

#### **UNIT 2: Design of Classical Control System in the time domain (8 hours)**

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

#### **UNIT 3: Design of Classical Control System in frequency domain (8 hours)**

Compensator design in frequency domain to improve steady state and transient response.

Feedback and Feed forward compensator design using bode diagram.

#### **UNIT 4: Design of PID controllers (6 hours)**

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

#### **UNIT 5: Control System Design in state space (8 hours)**

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

#### **UNIT 6: Nonlinearities and its effect on system performance (3 hours)**

Various types of non-linearities. Effect of various non-linearities on system performance.

Singular points. Phase plot analysis.

#### **Text and Reference Books :**

- N. Nise, "Control system Engineering", John Wiley, 2000.
- J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
- M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
- K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.

- B. C. Kuo, "Automatic Control system", Prentice Hall, 1995.
  - J. J. D'Azzo and C. H. Houpis, "Linear control system analysis and design (conventional and modern)", McGraw Hill, 1995.
  - R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.
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<b>BEEE-529/629/729/829</b>	<b>Advanced Electric Drives</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understand the operation of power electronic converters and their control strategies.
- Understand the vector control strategies for ac motor drives
- Understand the implementation of the control strategies using digital signal processors.

**UNIT 1: Power Converters for AC drives (10 hours)**

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

**UNIT 2: Induction motor drives (10 hours)**

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).

**UNIT 3: Synchronous motor drives (6 hours)**

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

**UNIT 4: Permanent magnet motor drives (6 hours)**

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

**UNIT 5: Switched reluctance motor drives (6 hours)**

Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

**UNIT 6: DSP based motion control (6 hours)**

Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

**Text / References:**

- B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
- P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
- H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
- R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press,

## OPEN ELECTIVE COURSES

<b>BEEE-001</b>	<b>ELECTRICAL MATERIALS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### LEARNING OBJECTIVE:

1. Use appropriate material for specified engineering concept and techniques.
2. realize new design opportunities with materials
3. understand the physics of semiconductor devices
4. understand how structure dictates properties
5. how electronic & physical properties are related

### UNIT – I

#### 1 Crystal Structure of Materials:

- A.** Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth
- B.** Energy bands in solids, classification of materials using energy band. (6)

### UNIT – II

#### Conductivity of Metals:

Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals (7)

### UNIT – III

#### Mechanism of Conduction in semiconductor materials:

Types of semiconductors, current carriers in semiconductors, Hall effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials. (6)

[19]

### UNIT – IV

#### Magnetic Properties of Material:

Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials. (7)

**LEARNING OUTCOME :** At the end of course, Student will be able to:

1. To Use the right material for the job
2. Understand the relation between properties, structure, and processing.
3. To appreciate the relationship between devices, their characteristics and their constituent materials

**Text Books :**

- 1 A.J. Dekker, "Electrical Engineering Materials" Prentice Hall of India
- 2 R.K. Rajput, "Electrical Engg. Materials," Laxmi Publications.
- 3 C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S.Chand & Co.

**References :**

- 4 Solymar, "Electrical Properties of Materials" Oxford University Press.
5. Ian P. Hones, "Material Science for Electrical and Electronic Engineering," Oxford University Press.
- 8 G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers.
- 9 T. K. Basak, "Electrical Engineering Materials" New age International.

<b>BEEE-002</b>	<b>MODERN MANUFACTURING PROCESSES</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Objectives:** To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

**UNIT-I Conventional Manufacturing processes:** Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

**UNIT-II Metal cutting:** Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, cutting tool materials, cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining. Additive manufacturing: Rapid prototyping and rapid tooling. Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

**UNIT-III Grinding & Super finishing: Grinding:** Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding. Centreless grinding. Super finishing: Honing, lapping and polishing.

**UNIT-IV Metal Joining (Welding):** Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing. Adhesive bonding. Weld decay in HAZ.

**UNIT-V Unconventional Machining Processes:** Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters. Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electrochemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining.

Course Outcomes: Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products.

**Books and References:**

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.
3. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA.
4. Materials and Manufacturing by Paul Degarmo.
5. Manufacturing Processes by Kaushish, PHI.
6. Principles of Foundry Technology, Jain, MCGRAW HILL INDIA
7. Production Technology by RK Jain. 8. Degarmo, Black & Kohser, Materials and Processes in Manufacturing.

<b>BEEE-004</b>	<b>Analog &amp; Digital Communication</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Course Objectives:**

- To introduce the concepts of communication systems engineering using wire and wireless medium
- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce optical and cellular communication concepts

**Unit- I**

Elements of communication system and its limitations Amplitude Modulation: Amplitude modulation and detection, Generation and detection of DSB-SC,SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, super heterodyne receiver, IF amplifiers, AGC circuits Frequency Division multiplexing

**Unit- II**

Angle Modulation:

Basic definitions Narrow band and wide band frequency modulation, transmission band width of FM signals Generation and detection of frequency modulation

Noise:

External noise, internal noise Noise calculations, signal to noise ratio Noise in AM and FM systems

**Unit- III**

Pulse Modulation:

Introduction, sampling process Analog Pulse Modulation Systems-Pulse Amplitude Modulation, Pulse width modulation and Pulse Position Modulation.

Waveform coding Techniques:

Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.

## **Unit- IV**

Digital Modulation Techniques:

Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, methods of generation of coherent and non-coherent, ASK, FSK and PSK, comparison of above digital techniques

## **Unit- V**

Time Division Multiplexing:

Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization

techniques Introduction to Information Theory:

Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, Shannon-Fano coding.

### **Course Outcomes:**

- Basic theories behind the various communication systems are studied.
- Features of the various communication systems are studied.

### **Text Books:**

1. Simon Haykin, "Communication Systems" John Wiley & Sons 4th Edition
2. G. Kennedy and B. Davis, "Electronic Communication Systems" 4th Edition, Tata McGraw Hill
3. Simon Haykin, "Digital Communications" John Wiley & Sons

### **Reference Books:**

1. B.P. Lathi, "Modern Analog & Digital Communication Systems" Oxford University Press.
2. Taub & Schilling, "Communication System: Analog and Digital" Tata McGraw Hill
3. R.P. Singh & S.D. Sapre, "Communication Systems Analog and Digital" Tata McGraw Hill.

<b>BEEE-005</b>	<b>EMBEDDED SYSTEMS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### **Learning Objective**

1. To enrich student about the embedded system design
2. To teach students about the operating system, design parameters of embedded system.
3. To enrich students about digital circuit design and enrich them about the single purpose processor and general purpose processor.
4. To enrich students about the microcontrollers and microprocessor architecture and their interfacing

### **UNIT-I**

Introduction: Embedded systems significance, design life cycle, tools introduction, hardware and software partitioning and co-design

Hardware Fundamentals for the embedded developers Digital circuit parameters Open collector outputs Tristate outputs I/O sinking and Sourcing, PLD's and its applications, Embedded Operating system, Design parameters of an embedded system and its, Watchdog Timers, Hardware design and development.

Custom Single Purpose Processors: Optimizing program, FSMD, Data path & FSM.

General purpose processors and ASIP's (Application Specific Instruction set Programming): Software and preparation of general purpose processors- Programmers View Development Environment-ASIPs Microcontrollers-DSP Chips.

### **UNIT-II & III**

Introduction to Microcontrollers and Micoprocessors, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architectures.

8051 Microcontrollers- Assembly language, architecture, registers, Addressing modes, Instruction set, I/O ports and memory organization Interrupts Timer/counter and serial communication.

### **UNIT-IV**

RTOS-Tasks, states, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes.

Advanced Processor-(only architectures) 80386, 80486 and ARM (References)

### **UNIT-V**

Communication basics, Microprocessor Interfacing I/O Addressing, Direct memory access, Arbitration, multilevel bus architecture, Serial protocols, Parallel protocols and wireless protocols.

Real world Interfacing: LCD, Stepping Motor, ADC, DAC, LED, Push Buttons, Key board, Latch Interconnection, PPI.

## Learning Outcome

At the end of the course students will be able to learn

1. Programming of microprocessors and microcontrollers.
2. Basic knowledge of hardware design for embedded system
3. The application and programming of LCD, DAC LED PPIs etc.

## Text Books:

1. Embedded System Design-Frank Vahid/Tony Givargis, John Wiley@2005.
2. Microcontroller (Theory and Applications) Ajay V Deshmukh,Tata McGraw- Hill@2005.
3. An Embedded Software Primer-David E.Simon, Pearson Education @ 1999.

## References:

1. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
2. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hintz, Daniel Tabak, Tata McGraw-Hill@2005.
3. 8051 Microcontrollers & Embedded Systems 2nd Edition -Sampath Kr, Katson Books@2006

<b>BEEE-007</b>	<b>ELECTRONIC DEVICES</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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## Learning Objective

1. To enrich student about the Electronics Devices
2. To teach students about the generation and recombination of carriers, design parameters of Electronics system.
3. To enrich students about electronics circuit design and enrich them.

**UNIT-I:** Introduction to semiconductor physics: Review of quantum mechanics, electrons in periodic lattices, E-k diagrams. 8

**UNIT-II:** Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current, drift current, mobility and resistivity, sheet resistance, design of resistors. 8

**UNIT-III:** Generation and recombination of carriers, Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models. 8

**UNIT-IV:** Avalanche breakdown, Zener diode, Schottky diode, Bipolar Junction Transistor, I-V characteristics, Ebers-Moll model. 8

**UNIT-V:** MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell. 8

## Text /Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.
2. D. Neamen , D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.

4. C.T. Sah, "Fundamentals of Solid State Electronics," World Scientific Publishing Co. Inc, 1991.

5. Y. Tsvetkov and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ. Press, 2011.

6. Muhammad H. Rashid, "Electronic Devices and Circuits," Cengage publication, 2014.

**Course Outcomes:** At the end of this course students will demonstrate the ability to:

1. Understand the principles of semiconductor Physics.
2. Understand and utilize the mathematical models of semiconductor junctions.
3. Understand carrier transport in semiconductors and design resistors.
4. Utilize the mathematical models of MOS transistors for circuits and systems.
5. Analyze and find application of special purpose diodes.

<b>BEEE-009</b>	<b>AUTOMOBILE ENGINEERING</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**UNIT-I Introduction:** Basic concepts of Automobile Engineering and general configuration of an automobile, Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination.

**UNIT-II Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

**UNIT-III Braking System:** General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects. 5 Chassis and Suspension System: Loads on the frame, Strength and stiffness, Independent front & rear suspension, Perpendicular arm type, Parallel arm type, Dead axle suspension system, Live axis suspension system, Air suspension & shock absorbers.

**UNIT-IV Electrical System:** Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc. Fuel Supply System: Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI.

**UNIT-V Emission standards and pollution control:** Indian standards for automotive vehicles- Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives and modern trends in automotive engine efficiency and emission control. Maintenance system: Preventive maintenance, break down maintenance and overhauling.

### **Learning Outcome**

At the end of the course students will be able to learn

4. Understand the basic concepts of Automobiles and its working functions.
5. Understand the transmission and braking systems of the automobile.
6. Understand the electrical applications in automobiles and pollution control prevention techniques.

**Books and References:**

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.
3. Automobile Engineering - Narang.
4. Automobile Engineering –TTTI, Pearson India
5. Automotive Mechanics- Crouse
6. Automobile Engineering - Newton and Steeds.
7. Automobile Engineering –Ramakrishna, PHI, India

<b>BEEE-010</b>	<b>VLSI circuits</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**Objectives:**

- Introduce the basics of VLSI design and its importance.
- Analyze the switching Characteristics of MOS transistor.
- To learn about the programming of Programmable device using Hardware description Language.

**Unit-I**

Introduction to integrated circuit technology. CMOS fabrication, the p-well process, n-well process, twin tube process. Bi-CMOS technology. Basic electrical properties of MOS circuits,  $I_{ds}$ - $V_{ds}$  relationship, MOS transistor threshold voltage  $V_t$ , Transconductance and output conductance, MOS transistor figure of merit.

**Unit-II**

The n-MOS inverter, pull-up to pull-down ratio, CMOS inverter and its characteristics, latch-up in CMOS circuits, stick diagrams, n-MOS design style, CMOS design style, lambda based design rules, Body effect, sheet resistance, capacitances of layers, Gate delays, Delay estimation, logical efforts, Scaling models and scaling factors, limitation of scaling, Limits of miniaturization.

**Unit-III**

n-MOS, CMOS NAND Gates, n-MOS, CMOS NOR gates. Combinational circuit design, sequential circuit design, design considerations, problems associated with VLSI Design, Design Methodology and Tools, Standard Cell Based Design, Design Flows, Automated Layout Generation, Placement, Floor planning, Routing, Parasitic Extraction, Timing Analyses.

**Unit-IV**

Full Custom Design, Semi Custom Design, Programmable Logic structures, Field Programmable Gate arrays (FPGA), Configurable Logic Block (CLB), Application-Specific Integrated Circuits(ASICs)

### Unit-V

Design for Test ability, Faults types and Models, Controllability and Observability, ADHOC Design Techniques, Scan-Based Techniques, Built-In self Test (BIST) Techniques, Current Monitoring IDDQ Test. Packaging, Package Parasitics, Heat dissipation, Design Economics, Parametric yield

### Outcomes:

- Expose to HDL language and ability to design PLD devices and simple application.

### Text Books:

1. Basic VLSI Design by Douglas A.Pucknell & Kamran Eshraghian, Prentice-Hall of India.
2. CMOS VLSI Design, AC circuits and Systems Perspective by Neil H.E.Weste, David Harris, Ayan Banerjee, Pearson Education.
3. CMOS Digital Integrated Circuits Analysis and Design by Sung-Mo Kang, Yusuf Leble bici. Tata Mc-Graw-Hill.

### References:

- 1.Digital Integrated Circuits A Design Perspective by JabM. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Prentice-Hall of India Pvt. Limited.
- 2.PrinciplesofC-MOS VLSI Design A systems Perspective by Neil H.E.Weste, Kamrau Eshraghian, Pearson Education
3. Application-Specific Integrated Circuits by Michal John Sebastian smith, PearsonEducation.

<b>BEEE-011</b>	<b>INTERNET OF THINGS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### Unit-I: IoT Web Technology

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

## **Unit-II: IoT Applications for Value Creation**

Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

## **Unit-III: Internet of Things Privacy, Security and Governance**

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smarty Approach. Data Aggregation for the IoT in Smart Cities, Security

## **Unit-IV: Architectural Approach for IoT Empowerment**

Introduction, Defining a Common Architectural Ground, IoT Standardization, M2M Service Layer Standardization, OGC Sensor Web for IoT, IEEE, IETF and ITU-T Standardization activities, Interoperability Challenges, Physical vs. Virtual, Solve the Basic First, Data Interoperability, Semantic Interoperability, Organizational Interoperability, Eternal Interoperability, Importance of Standardization, Plan for Validation and testing, Important Economic Dimension, Research Roadmap for IoT Testing Methodologies. Semantic as an Interoperability Enabler and related work.

## **Unit-V: Identity Management Models in IoT**

Introduction, Vulnerabilities of IoT, Security requirements, Challenges for a secure Internet of Things, identity management, Identity portrayal, Different identity Management model: Local identity, Network identity, Federated identity, Global web identity, Identity management in Internet of Things, User-centric identity management, Device-centric identity management, Hybrid identity management.

### **Text Books/ Reference Books:**

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things key applications and protocols", Wiley
2. Michael Miller "The Internet of Things" Pearson
3. Adrian McEwen, Hakin Cassimally, "Designing the Internet of Things" Wiley India

<b>BEEE-013</b>	<b>COMPUTER NETWORKS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### **Learning Objectives**

1. To enrich the students with fundamentals and application knowledge of Communication Networks.

2. To provide the students' knowledge about OSI Reference Layers and their relevance detailed working of protocols for real time application

**UNIT-I: INTRODUCTION:** Network structure, network architectures. The OSI reference model, services, standardization, Other architectures, Connection oriented and connection less services, example networks.

The Physical Layer: Transmission media, EIA RS-232C, EIA RS-449. Pulse code modulation. FDM & TDM. Circuit switching. Packet switching. Hybrid switching Polling. CCITT X.21. Ethernet.

**UNIT-II: The Data Link Layer:** Basic link protocols. Character oriented and bit oriented protocols. The ALOHA protocols. IEEE standard 802 for LAN, framing, Error control, Flow control.

**UNIT-III: The Network Layer:** Design Issues. Routing Algorithms. Congestion control Algorithms. Subnet concept, Virtual circuit and Data gram Subnet, Flow control, Internetworking, Bridges, Routers, Gateways and different level switches.

**UNIT-IV: The Transport Layer:** Design Issues. Connection management. Study of Internet and ATM transport layer protocols.

**UNIT-V: Internet Issues:** Principles of bridges and routers. The TCP/IP Protocol suite: Overview of TCP/IP. Addressing, Subnetting and network layer protocols. Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW.

## Learning Outcomes

On successful completion of this course students will be able to:

1. To Identify, formulate and solve engineering related problems on network structure, network architectures, OSI reference model, services, and standardization.
2. To design network structures and to analyze the physical layer's transmission media, EIA RS-232C, EIA RS-449 with realistic constraints.
3. To use the techniques, skills, and modern engineering tools necessary for routing Algorithms, Congestion control Algorithms, Subnet concept, Virtual circuit, Routers, Gateways and different level switches.
4. To visualize and understand the necessity of Design Issues, Connection management, Internet and ATM transport layer protocols and data link layer basic link protocols which are character oriented and bit oriented protocols.
5. To recognize the need for lifelong learning of Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW.

## References:

1. Andrew S. Tanenbaum: Computer Networks, PHI India.
2. Leon-Garcia, Widjaja: Communication Networks, TMH.

3. Forouzan: Data Communications & Networking, TMH.
4. William Stallings: Data & Computer Communication, Prentice Hall.

<b>BEEE-014</b>	<b>DATA STRUCTURE AND ALGORITHMS</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**LEARNING OBJECTIVES:**

CO 1 Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications. K1, K2

CO 2 Discuss the computational efficiency of the sorting and searching algorithms. K2

CO 3 Implementation of Trees and Graphs and perform various operations on these data structure.  
K3 CO 4 Understanding the concept of recursion, application of recursion and its implementation and removal of recursion. K4

CO 5 Identify the alternative implementations of data structures with respect to its performance to solve a real world problem. K5, K6

**UNIT-I: Introduction:** Basic Terminology, Elementary Data Organization, Built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT) Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.

**UNIT-II: Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. Queues: Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.

**UNIT-III: Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.

**UNIT-IV: Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and

Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijkstra Algorithm.

**UNIT-V: Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree ,Complete Binary Tree . A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertation , Deletion, Searching & Modification of data in Binary Search . Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree , B Tree & Binary Heaps

**Text books:**

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures Using C and C++”, PHI Learning Private Limited, Delhi India
2. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publications Pvt Ltd Delhi India.
3. Lipschutz, “Data Structures” Schaum’s Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.
4. Thareja, “Data Structure Using C” Oxford Higher Education.
5. AK Sharma, “Data Structure Using C”, Pearson Education India.
6. Rajesh K. Shukla, “Data Structure Using C and C++” Wiley Dreamtech Publication.
7. Michael T. Goodrich, Roberto Tamassia, David M. Mount “Data Structures and Algorithms in C++”, Wiley India.

<b>BEEE-015</b>	<b>FLUID MACHINERY</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**LEARNING OBJECTIVES:**

To learn about the application of mass and momentum conservation laws for fluid flows.

- To understand the importance of dimensional analysis.
- To obtain the velocity and pressure variations in various types of simple flows.
- To analyze the flow in water pumps and turbines.

**UNIT-I** Definition of fluid, Newton’s law of viscosity, Units and dimensions-Properties of fluids,mass density, specific volume, specific gravity, viscosity, compressibility and surfacetension, Incompressible flow, Bernoulli’s equation and its applications - Pitot tube, orifice meter, venturi meter and bend meter, notches and weirs, momentum equation and its application to pipe bends.

**UNIT-II** Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible

flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two- and three-dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential. Buckingham's Pi theorem, important dimensionless numbers and their significance.

**UNIT-III** Equation of motion for laminar flow through pipes, turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sublayer, separation and its control, Drag and lift, drag on a sphere, a two-dimensional cylinder, and an aerofoil, Magnus effect.

**UNIT-IV** Introduction to hydrodynamic thrust of jet on a fixed and moving surface, Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel. Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

**UNIT-V** Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics. Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics.

**Course Outcomes:** Upon completion of this course, students will be able to mathematically analyze simple flow situations. They will be able to evaluate the performance of pumps and turbines.

**Books and References:**

1. Introduction to fluid mechanics and Fluid machines by S.K Som, Gautam Biswas, S Chakraborty.
2. Fluid mechanics and machines by R.K Bansal.
3. F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008.
4. Fluid Mechanics and Its Applications by V.K.Gupta et.al.
5. Fluid Mechanics by Yunus Cengel.
6. Batchelor, G. K. (1999). Introduction to fluid dynamics. New Delhi, India: Cambridge University Press.
7. Acheson, D. J. (1990). Elementary fluid dynamics. New York, USA: Oxford University Press.
8. R.W. Fox, A.T. McDonald and P.J. Pritchard, Introduction to Fluid Mechanics, 6th Ed., John Wiley, 2004.

<b>BEEE-016</b>	<b>IMAGE PROCESSING</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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### **LEARNING OBJECTIVES:**

1. Describe And Explain Basic Principles Of Digital Image Processing .
2. Design And Implement Algorithms That Perform Basic Image Processing (E.G., Noise Removal And Image Enhancement)
3. Design And Implement Algorithms For Advanced Image Analysis (E.G., Image Compression, Image Segmentation)
4. Assess The Performance Of Image Processing Algorithms And Systems.

### **UNIT-I**

Image: Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception  
[60] Digital Image-sampling and quantization serial & parallel Image processing

### **UNIT-II**

Signal Processing - Fourier, Walsh- Hadmard discrete cosine and Hotelling transforms and their properties, filters, correlators and convolvers Image enhancement-Contrast modification, Histogram specification, smoothing, sharpening, frequency domain enhancement, pseudo-colour enhancement

### **UNIT-III**

Image Restoration-Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

### **UNIT-IV**

Segmentation Techniques- thresholding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications

### **UNIT-V**

Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, skelton detection, Hough transform, topological and texture analysis, shape matching. Practical Applications – Finger print classification, signature verification, text recognition, map understanding, bio-logical cell classificaton..

**LEARNING OUTCOMES:** Students who complete this course will be able to:

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation, restoration etc
5. Implement image process and analysis algorithms.
6. Apply image processing algorithms in practical applications.

**TEXT / REFERENCE BOOKS:**

1. Ganzalez and Wood, “Digital Image Processing”, Addison Wesley, 1993.
2. Anil K. Jain, “Fundamental of Image Processing”, Prentice Hall of India  
References: 1. Rosenfeld and Kak, “Digital Picture Processing” vol.I & vol.II, Academic, 1982  
2. Ballard and Brown, “Computer Vision”, Prentice Hall, 1982
3. Wayne Niblack, “An Introduction to Digital Image Processing”, Prentice Hall, 1986
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis and Machine Vision”, Vikas Publications.

<b>BEEE-017</b>	<b>POWER PLANT ENGINEERING</b>	<b>3L:0T:0P</b>	<b>3 credits</b>
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**UNIT I Hydro-electric power plants** – selection of site, elements of power plant, classification, water turbines, governor action, hydro-electric generator, plant layout, pumped storage plants.

**UNIT II Thermal Steam power plants** – selection of site, elements and operational circuits of the power plant, turbo-alternators, plant layout, steam turbines, controls and auxiliaries.

**UNIT III Nuclear power plants** – selection of site, nuclear reaction – fission process and chain reaction, constituents of power plant and layout, nuclear reactor – working, classification, control, shielding and waste disposal.

**UNIT IV Renewable power plants** – Solar power generation – Photo-voltaic and solar thermal generation – solar concentrators, Wind power generation – types of wind mills, wind generators, tidal, biomass, geothermal and magneto-hydro dynamic power generation, microhydel power plants, fuel cells and diesel and gas power plants.

**UNIT V Combined operation of power plants** – plant selection, choice of size and number of generator units, interconnected systems, real and reactive power exchange among interconnected systems. Power plant economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants, Economic Load Sharing.

**LEARNING OUTCOMES:** Students who complete this course will be able to:

7. Understand the hydro-electric power plant construction and operation.
8. Describe the different element of thermal power plant and its operations.
9. Design and development of Nuclear power plants.
10. Understand renewable resources and power plant operations in combinations.

**Text Books:**

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A text book on Power Systems Engg.', DhanpatRai and Sons, New Delhi, 2nd revised edition, 2010.
2. JB Gupta, 'A course in Power Systems', S.K. Kataria and sons, reprint 2010-2011.

**Reference Books:**

1. Wadhwa, C.L., 'Generation Distribution and Utilization of Electrical Energy', New Age International publishers, 3rd edition, 2010.
2. Deshpande M.V, 'Elements of Electrical Power systems Design', Pitman, New Delhi, PHI Learning Private Limited, 1st edition, 2009.

**LIST OF MANDATORY COURSES (NON-CREDIT)****BMC-301/BMC-401/BMC-501:****Constitution of India – Basic features and fundamental principles**

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial

activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”.

### **Course content**

- Meaning of the constitution law and constitutionalism
- Historical perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India
- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy – Its importance and implementation
- Federal structure and distribution of legislative and financial powers between the Union and the States
- Parliamentary Form of Government in India – The constitution powers and status of the President of India
- Amendment of the Constitutional Powers and Procedure
- The historical perspectives of the constitutional amendments in India
- Emergency Provisions : National Emergency, President Rule, Financial Emergency
- Local Self Government – Constitutional Scheme in India
  
- Scheme of the Fundamental Right to Equality
- Scheme of the Fundamental Right to certain Freedom under Article 19
- Scope of the Right to Life and Personal Liberty under Article 21.

### **BMC-302/BMC-402/BMC-502:**

#### **Universal Human Values – 1**

The objective of the course is four fold:

- Sensitization of student towards self, family (relationship), society and nature.
- Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
- Strengthening of self reflection.
- Development of commitment and courage to act.

At the end of the course, students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

## **BMC-303/BMC-403/BMC-503:**

### **Environment Science**

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two type of activities.

#### ***(a) Awareness Activities:***

- Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
- Slogan making event Poster making event
- Cycle rally
- Lectures from experts

#### ***(b) Actual Activities:***

- Plantation
- Gifting a tree to see its full growth
- Cleanliness drive
- Drive for segregation of waste
- To live some big environmentalist for a week or so to understand his work
- To work in kitchen garden for mess
- To know about the different varieties of plants
- Shutting down the fans and ACs of the campus for an hour or so

## **BMC-304/BMC-404/BMC-504:**

### **Essence of Indian Knowledge Tradition:**

#### **Essence of Indian Knowledge Tradition Pt-I**

□□□□□□□□□□□□ - 1

#### **Course objective**

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

#### **Course Contents**

- Basic structure of Indian Knowledge System:
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- □ □□□□□, □□□□ □□□□) □□□□□□□□ (□□ □, □, □□, □□□□, □□□□□□, □□□□) □ □□□□□□□ (□□ □□, □□□□□□□□, □□□□□□, □□ □□ )
- Modern Science and Indian Knowledge System Yoga and Holistic Health care
- Case studies

#### **References**

- V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan Fritzo Capra, *Tao of Physics*
- Fritzo Capra, *The Wave of life*
- VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Arnakulam
- *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
- GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
- RN Jha, *Science of Consciousness Psychotherapy and Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
- P B Sharma (English translation), *Shodashang Hridayan*

**Pedagogy:** Problem based learning, group discussions, collaborative mini projects.

**Outcome:** Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

## Essence of Indian Knowledge Tradition-Pt-2

□□□□□□□□□□ - 2

### Course objective

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-2 focuses on Indian philosophical traditions, Indian linguistic Tradition, and Indian artistic tradition.

### Course Contents

- Philosophical Tradition (□□□□□)- □□, □□□□□□□, □□□, □□□, □□□□□□□, □□□□□□□, □□□□□□□, □□□□, □□□□
- Indian Linguistic Tradition (Phonology, morphology, syntax and semantics)
- Indian Artistic Tradition - □□ □□□□, □□□□□□□□, □□ □□□□□, □□□□, □□□□□□□, □□ □□□□□□□□□□□□
- Case studies

### References

- V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- S.C. Chatterjee & D.M. Datta, *An Introduction to Indian Philosophy*, University of Calcutta, 1984
- K.S. Subrahmanialyer, *Vakyapadiya of Bhartrihari, (Brahma Kanda)*, Deccan College Pune 1965
- *Panini Shiksha*, MotilalBanarasidas
- V.N. Jha, *Language, Thought and Reality*,
- □□□□□□□□□□ □ □□□□, □□□□□□□□□ □□□□, □□□□□ □□□□, □□□□□□□□□□,1952
- Pramod Chandra, *India Arts*, Howard Univ. Press, 1983
- Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987
- R. Nagaswamy, *Foundations of Indian Art*, Tamil Arts Academy, 2002

**Pedagogy:** Problem based learning, group discussions, collaborative mini projects.

**Outcome:** Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

**BMC-305/BMC-405/BMC-505:**

**Learning an Art Form**

Cultivation of arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. They come into being not when we move beyond necessity but when we move to a deeper necessity, to the deeper human need to create order, beauty and meaning out of chaos. They are the expressions of deepest human urges, imperatives and aspirations.

While enriching the process of learning through enhanced perceptual and cognitive skills, learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others.

Each institution will offer a range of introductory courses in different art forms: music, dance, theatre, painting, and other art forms. Care should be taken to give adequate representation to local and regional art forms in which our culture abounds. For example, Banaras has local traditions in vocal music like *Chaiti*, *Hori*, *Kajri* and *Birha*. An institution in Banaras area can offer courses on these art forms apart from regular classical and semi -classical vocal music forms. Similar local art tradition can be utilized in different cities and regions. This will, in turn, also ensure wider community involvement/interaction with the institution. Students will be given an option to choose a particular art form, and learn and practice it under an artist-instructor. At the end of the course, a student should be able to demonstrate basic proficiency in that particular art form. Contact hours per week should be 3-4 hours.

Towards the end of the course, the institution can organize a function/program in which all the students publicly demonstrate their skills.

*This will be a mandatory non-credit course and would run during Induction Program.*

**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES**

**(HSMC)**

## **BHU-501/ BHU-601/ BHU-501:**

### **Humanities, Social Science including Management Courses:**

Under the new UG curriculum, courses related to Humanities and Social Science and Management have 12 credits.

#### **1. Introduction**

The world is changing rapidly today. Even though developments are taking place with greater production of physical facilities, conflict and strife are increasing in the individual and society. Environmental crisis in the form of climate change is putting life itself in danger.

In spite of achieving one's goals, the individual remains dissatisfied with jobs and positions that are intellectually and mentally unfulfilling, and wealth that breeds problems in family, chaos in society, and imbalance in nature. In fact, the nations and civilizations are increasingly at war.

It is believed that ideas in Humanities and Social Sciences can provide a new understanding, based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.

#### **2. Goals of the teaching of Humanities Courses**

A rich set of courses and projects would help in making students into holistic human beings. Through these, the student would become aware of oneself and one's surroundings. One would gain a larger understanding of family, society, nation and the world.

The student would develop holistically as an individual in terms of art and culture, language and literature with sensitivity and awareness of one's surroundings. One would also understand and be aware of one's self, allowing one to understand one's role in larger scheme of things. Such an individual would be connected with and have an understanding of one's family, neighbourhood, society, nation and the world.

Thus, while the individual would be a global citizen of humanity, he would also be connected with and capable of acting locally. The individual would have an understanding of the past and the present, but would not be limited to it. One would also understand the future, what ought to be, and act to make it so.

This would give leadership qualities to the student, and would also enable one to become a better practitioner of engineering, and a better developer of technology.

#### **3. Extension**

The engineering colleges would connect with the local surroundings ranging from the city of institute and to the larger region around the institute. It can draw its projects from the region and the country. This would form a rich learning context for students as

well as for its research. Hopefully, it would also contribute to the betterment of the surroundings.

#### **4. Approach towards Humanities**

Through various discussions emerged the approach to be adopted by the teaching humanities courses. The following was the broad agreement.

The institutes, through humanities courses, should encourage critical enquiry which cuts across disciplines. It should promote synergistic studies connecting humanities with science and technology. Such studies would generate interest among the students as well as throw new light on existing problems of mankind.

These courses should look for niche areas of work, which would connect it to society and to different disciplines. This would generate new ideas and help it reach excellence.

These courses should create platform for engineering students for creative combination of humanities with science and technology. Such a platform would create conditions for unearthing interdisciplinary insights and confluence of disciplines. Theory should help with practice, and practice should lead to theorizing.

This would create a new generation of people rooted in a new ethos. Engineers with such an ethos would be better connected to society, and are likely to do better engineering.

It would be extremely important to have a pedagogy which nurtures the confluence of technology with humanities. The courses would combine project work with insights from confluence of disciplines.

#### **Disciplines and Themes**

Courses could be organized around disciplines or around themes; examples of disciplines are sociology, economics, political science, psychology, philosophy etc. Examples of themes are

- History & Civilization
- Development Studies
- Language, Literature, Linguistics & Cog. Sc.
- Philosophy
- Education
- Culture

#### **BHU-502/ BHU-602/ BHU-702:**

#### **Foundational Courses in Humanities (Development of Societies/Philosophy)**

#### **1. OBJECTIVE:**

This is one of the foundation courses of Humanities (in Foundation Area 1). It is envisaged that this course will provide a natural link between engineering and humanities with an emphasis that Development is not just materialistic, larger view of all round human development should also be considered. Importance of sustainable development, inter-dependence and co -existence in nature should be realised through this course. It is to gain an understanding of alternative models of development.

## **2. COURSE TOPICS:**

### **2.1 Unit I: Social Development** (5 hours)

Concepts behind the origin of Family, Clan and Society  
Different Social Systems

Relation between Human being and Society

Comparative studies on different models of Social Structures and their evolution

### **2.2 Unit II: Political Development** (3 hours)

Ideas of Political Systems as learnt from History  
Different models of Governing system and their comparative study

### **2.3 Unit III: Economic Development** (18 hours)

Birth of Capitalism, Socialism, Marxism  
Concept of development in pre-British, British and post British period- Barter, Jajmani

Idea of development in current context.

E. F. Schumacher's idea of development, Buddhist economics.

Gandhian idea of development. Swaraj and Decentralization.

## **3. READINGS**

3.1 TEXTBOOK::

3.2 \*REFERENCE BOOKS::

## **OTHER SESSIONS**

4.1 \*TUTORIALS::

4.2 \*LABORATORY::

4.3 \*PROJECT:: Possible projects in this course could be

Interact with local communities and understand their issues.

Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.

Evaluation of technology in the context of its application. Social impact of technology. Environmental impact of technology. Evaluation from a holistic perspective.

**ASSESSMENT** (indicative only)

5.1 HA:: [xx% GRADE]

5.2 QUIZZES-HA:: [xx% GRADE]

5.3 PERIODICAL EXAMS:: [xx% GRADE]

5.4 \*PROJECT:: [xx% GRADE]

5.5 FINAL EXAM:: [xx% GRADE]

## **PHILOSOPHY**

### **1. Objective:**

Even though developments are taking place with greater production of physical facilities, conflict and strife are increasing in the individual and society. Environmental crisis in the form of climate change is putting life itself in danger.

In spite of achieving one's goals, the individual remains dissatisfied with jobs and positions that are intellectually and mentally unfulfilling, and wealth that breeds problems in family, chaos in society, and imbalance in nature. In fact, the nations and civilizations are increasingly at war.

It is believed that ideas in Humanities and Social Sciences can provide a new understanding, based on which one can move to overcome the current problems, both at the individual level as well as at the societal level.

It was felt that there is a need to introduce an orientation course for humanities courses in general and for philosophy courses in particular. The underlying reason for this is that while students till 10th class have a natural familiarity with humanities, this however gets discontinued subsequently.

This course is expected to relate philosophy to literature, culture, society and lived experience can be considered. This is in addition to training students in already available philosophical systems. Instead of only theory or only practical courses attempt can be made to combine both theory and practice.

This course is expected to bridge the gap between theory and practice by making the courses interactive. Along with projects, this course will have more illustrations that would invite students into the subject.

### **COURSE TOPICS:**

#### **1 Unit 1:**

The difference between knowledge (Vidya) and Ignorance (Avidya):

Upanishads;

Six systems orthodox and Heterodox Schools of Indian Philosophy.

Greek Philosophy:

#### **2.2 Unit 2:**

Origin of the Universe:

Nasidiya Sukta: "Who really knows?"

Brhadaranyaka Upanishad; Chandogya Upanishad: Non-self, Self, real and unreal.

Taittiriya Upanishad: Siksha Valli.

Plato's Symposium: Lack as the source of desire and knowledge. Socratic method of knowledge as discovery.

Language: Word as root of knowledge (Bhartrahari's Vakyapadiyam)

Fourteen Knowledge basis as a sources of Vidya: Four Vedas; Six auxiliary sciences (Vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.

### **2.3 Unit 3:**

Knowledge as Power: Francis Bacon. Knowledge as both power and self-realization in Bagavad Gita.

### **2.4 Unit 4:**

Knowledge as oppression: M. Foucault. Discrimination between *Rtam* and *Satyam* in Indian Philosophy.

### **2.5 Unit 5:**

Knowledge as invention: Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.

### **2.6 Unit 6:**

Knowledge about the self, transcendental self; knowledge about society, polity and nature

### **2.7 Unit 7:**

Knowledge about moral and ethics codes.

### **2.8 Unit 8:**

Tools of acquiring knowledge: *Tantrayuktis*, a system of inquiry (Caraka, Sushruta, Kautilya, Vyasa)

## **READINGS**

- Copleston, Frederick, History of Philosophy, Vol. 1. Great Britain: Continuum.
  - 2 Hiriyanna, M. Outlines of Indian Philosophy, Motilal Banarsidass Publishers; Fifth Reprint edition
  - (2009)
- Sathaye, Avinash, Translation of Nasadiya Sukta
- Ralph T. H. Griffith. The Hymns of the R̥gveda. Motilal Banarsidass: Delhi: 1973.
- Raju, P. T. Structural Depths of Indian Thought, Albany: State University of New York Press.
- Plato, Symposium, Hamilton Press.
- Kautilya Artha Sastra. Penguin Books, New Delhi.
- Bacon, Nova Orgum
- Arnold, Edwin. The Song Celestial.
- Foucault, Knowledge/Power.
- Wildon, Anthony, System of Structure.
- Lele, W.K. The Doctrine of Tantrayukti. Varanasi: Chowkamba Series.
- Dasgupta, S. N. History of Indian Philosophy, Motilal Banasidas, Delhi.
- Passmore, John, Hundred Years of Philosophy, Penguin.

## **OTHER SESSIONS:**

### 4.1 Mode of Conduct

## **ASSESSMENT (indicative only):**

Ask students to do term papers, for example, writing biographical details of founders, sustainers, transmitters, modifiers, rewriters; translating monographs of less known philosophers such as K. C. Bhattacharys, Daya Krishna, Gopinath Bhattacharya; comparative study of philosophical system such as Madhyastha Darshan.

## **OUTCOME OF THE COURSE:**

Students will develop strong natural familiarity with humanities along with right understanding enabling them to eliminate conflict and strife in the individual and society. Students shall be able to relate philosophy to literature, culture, society and lived experience can be considered.

## **BHU-503/ BHU-603/ BHU-703:**

### **Education, Technology Society**

#### **1. OBJECTIVES:**

- The goal of the proposed course is to enable students:
- To explore the various ways in which technology has and may in future affect not only the mode of delivery of education but also the very nature of education.
- To understand the requirement of education for becoming an effective member of the society  
to fulfill the potential of a learner to the fullest without too much thought of an individual's responsibility towards the contemporary society.

#### **COURSE TOPICS:**

2.1 Unit 1: Necessity of education for human life, Impact of education on society

2.2 Unit 2: Nature and scope of education (Gurukul to ICT driven), Emotional intelligence Domains of learning, Approaches to learning, Learning outcomes

2.3 Unit 3: Role of education in technology advancement.

2.4 Unit 4: Technology and society; management of technology; technology transfer

2.5 Unit 5: Ethical and value implications of education and technology on individual and society

### **3. COURSE OUTCOME:**

On successful completion of this course, the students will be able to integrate their technical education for betterment of society as well motivates them to lead a good human life.

### **REFERENCE BOOKS:**

- Education and Social order by Bertran
- Russel Theories of learning by Bower and Hilgard
- Technology and Society by Jan L Harrington

### **BHU-504/ BHU-604/ BHU-704:**

### **HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA**

#### **Unit-I**

#### **CONCEPTS AND PERSPECTIVES**

Meaning of History

Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history

Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism.

Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

#### **Unit-II**

**HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA** Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

### **Unit-III**

#### **SCIENCE AND TECHNOLOGY IN ANCIENT INDIA**

Technology in pre-historic period

Beginning of agriculture and its impact on technology

Science and Technology during Vedic and Later Vedic times Science and technology from 1<sup>st</sup> century AD to C-1200.

### **Unit-IV**

#### **SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA**

Legacy of technology in Medieval India, Interactions with Arabs

Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences

Science and Technology on the eve of British conquest

### **Unit-V**

#### **SCIENCE AND TECHNOLOGY IN COLONIAL INDIA**

Science and the Empire

Indian response to Western Science

Growth of techno-scientific institutions

### **Unit-VI**

#### **SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA**

Science, Technology and Development discourse Shaping of the Science and Technology Policy

Developments in the field of Science and Technology Science and technology in globalizing India

Social implications of new technologies like the Information Technology and Biotechnology

**BHU-505/ BHU-605/ BHU-705:**

**NYĀYA LOGIC AND EPISTEMOLOGY**

Metaphysical, Epistemological and Rhetorical context of Nyaya Logic – The metaphysics of Padarthas, The theory of Prama and pramana.

The nature of anumana as pramana. The process of Svarthanumana, Anumana and Anumiti, The nature of Parathanumana. The five Avayavas.

The important terms in anumana – Paksa, Sapaksa, Vipaksa, Vyapti, Avinabhava, Dṛstanta, Upadhi.

The classification of Anumana – Purvavat, Seshavat, Samanyatodrsta, Kevalanvayi, Kevalanvatireki, Anvayavyatireki(Nyaya), Svabhavanumana, Karyanumana(Buddhism), The three kinds of Hetu : Svabhava, Karya, Anuplabdhi.

Five characteristics of Hetu (Nyaya), Five Hetvabhasas (Nyaya).

The inductive element of Anumana – The way of knowing Vyapti: Bhuyodrasana (Mimamsa), Samanyalaksana Pratyasatti, Tarka (Nyaya); Tarka as Pramana (Jainism) Carvaka Criticism of Anumana.

Nature of Vyapti. Purvapaksa and Siddhantapaksa Vyapti.

Other pramanas comparable with Anumana; Sabda Upamana, Anupalabdhi, Arthapatti.

Their reducibility to Anumana.

**BOOKS FOR READING:**

1. D. N. Datta – Six ways of Knowing, Calcutta, 1960.
2. Athalye, Bodas – Tarkasamgraha of Annambhatta, Pune.
3. P. P. Gokhale – Inference and fallacies discussed in ancient Indian Logic.
4. Sachchidanand Mishra- Nyāya Darshan mein Anuman
5. S. C. Chatterjee--The Nyāya Theory of Knowledge

**BHU-506/ BHU-606/ BHU-706:**

**POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY**

**OBJECTIVES:**

This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfill them. In the process, we will end

with a critique of different systems and their implementations in the past, with possible future directions.

### **COURSE TOPICS:**

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. **(3 lectures)**

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. **(6 lectures)**

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. **(4 lectures)** (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

**Conclusion (2 lectures)**

**Total lectures: 39**

**Preferred Textbooks:** See Reference Books

**Reference Books:** Authors mentioned along with topics above. Detailed reading list will be provided.

### **GRADING:**

Mid sems

End sem

Home  
Assign

Term paper

**OUTCOME:**

The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

**BHU-507/ BHU-607/ BHU-707:**

**STATE, NATIONBUILDING AND POLITICS IN INDIA**

**OBJECTIVE:**

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

**TOPICS:**

Understanding the need and role of State and politics.

Development of Nation-State, sovereignty, sovereignty in a globalized world.

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government-unitary-federal, Presidential-Parliamentary,

The idea of India.

1857 and the national awakening

1885 Indian National Congress and development of national movement  
– its legacies. Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system?

National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari) New social movements.

The changing nature of Indian Political System, the future scenario. What can we do?

### **OUTCOME OF THE COURSE:**

It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

### **SUGGESTED READING:**

- Sunil Khilnani, The Idea of India. Penguin India Ltd., New Delhi.
- Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.
- Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
- Sumantra Bose, Transforming India: Challenges to the World's Largest Democracy, Picador India, 2013.
- Atul Kohli, Democracy and Discontent: India's Growing Crisis of Governability, Cambridge University Press, Cambridge, U. K., 1991.
- M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI, New Delhi, 2008, latest edition.
- Rajni Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005.

**BHU-508/ BHU-608/ BHU-708:**

**PSYCHOLOGICAL PROCESSES**

**1. OBJECTIVES:** The objectives of this course are to make students:

- aware of the basic principles of psychology for the behaviour of people,
- aware that psychology is both a theoretical and an applied science, and
- understand how the knowledge gained from this course can be used in their own personal and professional work life.

**COURSE TOPICS:**

**2.1 Unit 1:** Introduction: Psychology as a scientific study of behaviour. Biological and socio-cultural bases of behaviour. Fields of psychology.

**2.2 Unit 2:** Sensory and perceptual processes: Sensation, attention and perception.

**2.3 Unit 3:** Cognition and Affect: Learning and memory. Emotion and motivation

**2.4 Unit 4:** Thinking, problem solving and decision making

**2.5 Unit 5:** Personality and intelligence

**Required Text:**

Zimbardo, P. G. (2013). Psychology and Life (20<sup>th</sup> Ed.). New York: Pearson Education.

**Readings:**

- Baron, R. A. (2006). Psychology (5th Ed.). New Delhi: Pearson Education.
- Coon, D., & Mitterer, J. O. (2007). Introduction to Psychology: Gateway to mind and  
behaviour. New Delhi: Cengage.
- Feldman, R. S. (2013). Psychology and your life (2<sup>nd</sup> Ed.). New York: McGraw Hill.

**BHU-509/ BHU-609/ BHU-709:**

**POSITIVE PSYCHOLOGY**

**OBJECTIVE:**

Understanding psychology can improve your well-being and success both at work and in your personal life. Positive psychology is the growing branch of psychology that focuses on strengths, positive states and happiness. This Positive Psychology course will have a particular emphasis on applying positive psychology in your personal and working life.

**COURSE OUTLINE:**

- Positive Psychology: An Introduction
- Happiness
- Flow
- Subjective Well-being
- Hope
- Optimism
- Positive Illusions and Playfulness
- Creativity, Giftedness & Industry
- Judgment, Wisdom & Fairness
- Emotional Intelligence & Prudence
- Spirituality
- Love & Kindness
- Gratitude & Zest
- Modesty & Forgiveness
- Altruism & Empathy & Social Intelligence
- Positive Psychology at Work – Leadership, & Teamwork

- Curiosity, Self-Regulation & Positive Youth Development  
*Number of student allowed to enrol for this course: 30 (Maximum)*

**BHU-510/ BHU-610/ BHU-710:**

**APPLICATIONS OF PSYCHOLOGY**

**1. OBJECTIVES:**

The objectives of this course are to make students:

aware of the different applications of psychology to everyday issues of life,

aware of the different social issues, workplace issues, and behavioural issues, and

understand how the knowledge gained from this course can be used in their own personal and professional work life.

**Unit 1:** Introduction: Nature and fields. (6)

**Unit 2:** Psychology in industries and organizations: Job analysis; fatigue and accidents; consumer behavior. (8)

**Unit 3:** Psychology and mental health: Abnormality, symptoms and causes psychological disorders.(10)

**Unit 4:** Psychology and Counseling: Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling. (6)

**Unit 5:** Psychology and social behavior: Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation. (10)

**Text**

- Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall.
- Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
- Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
- Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall.

**BHU-511/ BHU-611/ BHU-711:**

**SOCIOLOGY, SOCIETY AND CULTURE**

**1. OBJECTIVE:**

This is one of the foundation course of Humanities (in Foundation Area 1). It strengthens the interest of the student in social issues and demonstrate both the process and challenge of scientific observation and analysis of social behaviour and social data. It focuses on the understanding of basic concepts and descriptive materials of sociology which is considered a tool for identifying the process of idea and a scientific approach for continuing social observation and analysis.

**COUSE TOPICS:**

**2.1 Unit I: Sociology as a Science (7 hours)**

Sociology and common Sense

Sociology and current affairs

Sociology as a science

Logic in sociological inquiry

Sociology of action

The field and relevance of sociology

Positivism

**2.2 Unit II: Society and Culture (12 hours)**

Culture and society

The structure of culture

Cultural Traits and complexes

Subcultures and counter

cultures Cultural  
integration

Cultural relativism

Real and Ideal  
culture  
Ethnocentrism

Xenocentrism  
Cultural lag

### **2.3 Unit III: Social Institutions**

(17 hours)

The concept of varna.

The Caste system:

Origin and characteristics (of caste) as a  
system Hierarchy based on birth

Religious sanctions on social participation

Caste and  
subcaste

Caste  
conflicts

Caste councils

An appraisal of caste system

Prospects of caste in modern India

3. The Class system:

What is social  
class?

Development  
of class

Self-identification and class  
consciousness Class in itself and  
class for itself

Class having blue collar status and white collar  
status Industrial class

Significance of social class

The future of social classes: From Proletariat to status seekers

## **2.4 Unit IV: Environment and Ecology**

(10 hours)

Conceptualising environment

Forest, ecology and society

Common Property Resources and its management

Significance of forest and environment in modern life

Environmental movement with reference to forest and water management

## **2.5 Unit V: Issues of modernity**

(14 hours)

Concept of modernity

Tradition Vs Modernity

Globalization

Is globalization new and real?

Has globalization weakened the state?

Has globalization led to cultural  
homogenisation? Does globalization lead to  
a clash of cultures?

### **READINGS:**

#### **3.1 Reference Books:**

- Gisbert, P. (2011), Fundamental of Sociology, Orient Blackswan Private Ltd.
- Horton, Paul B. and Hunt, Chester L. (Sixth edition), Sociology, Mc Graw Hill Book Company.
- Haralambos, M. and Heald, R.M. (26<sup>th</sup> impression, 2004), Sociology: Themes and Perspectives, Oxford University Press, New Delhi.
- Bettleille, Andre (2014), sociology: essays on Approach & Method, Oxford University Press, New Delhi.
- Ahuja, Ram (2006), Indian Social System, Rawat Publications, New Delhi.
- Guha, Ramchandra (1994), Social Ecology, Oxford University Press, New Delhi.

- Sundar Nandini, Jeffery Roger and Thin, Neil (2001) Branching out Joint Forest Management in India, Oxford University Press, New Delhi.
- Dunlap, Riley E. and Micelson, William (2008), Handbook of Environmental Sociology, Rawat Publications, New Delhi.
- Moore, Francis (2003), Environment and Society, Dominant Publishers, New Delhi. Boman, Z. (1989), Modernity and Holocaust, Cambridge Polity Press.
- Baudrilard, J. (1994), The Illusion of the End, Cambridge Polity Press.
- Jameson, Fredric (2006), Postmodernism OR The Cultural Logic of Late Capitalism, Duke University Press, Durham.
- Giddens, Anthony (1990), The Consequences of Modernity, Cambridge Polity Press. Gupta, Dipankar (2000), Mistaken Modernity, Harper Collins Publishers, India.

### **3.2 JOURNAL:**

Sociological Bulletin (upcoming editions from SAGE, India)

### **OTHER SESSIONS**

#### **4.1 TUTORIALS:** Three

#### **4.2 PROJECT:** Thematic projects on current social issues and environmental issues

**4.3 MODE OF CONDUCT:** Lecture, Tutorial, Power- point Presentations (PPTs), Audio Visual/ Video documentary on current issues, group discussions, etc.

### **5. ASSESSMENT:**

Performance of the students may be assessed by two class tests of 10 marks each, project report submission of 10 marks and presentation on the assigned topic of 10 marks with Final exam/ End semester exam of 60 marks and then grades may be assigned.

### **OUTCOME OF THE COURSE:**

At the end of the course, students are expected to increase their understanding on the basic concepts and social issues. Though the topics chosen here seem subjective but at the end, students' logical understanding will be improved and they will analyse the social issues and social facts in their objectivity. It is assumed that they would be able to apply their scientific knowledge and understanding in all their social actions.

**BHU-512/ BHU-612/ BHU-712:**

**EPOCHAL SHIFT**

**MODERNITY**

Conceptual understanding: centring, consensus and monoculture

Main attributes: rationalization, linearity and compartmentalization

Understanding of change and order: Macro theories (Conflict school and Functional theory)

Discontents: critical understanding: Frankfurt school.

**POST MODERNITY**

Conceptual understanding: de centring, differ, Multicultura

Main attributes: Hybridization and convergence

Understanding change: Micro theories (Ethno -methodology and symbolic interactionism)

**READING MATERIAL:**

Classical and contemporary sociological theory, sage publications Virtue Ethics and Sociology

Editors: **Flanagan, Kieran, Jupp**, Peter C. (Eds.) Issues of Modernity and Religion, Palgrave Macmillan UK,2000

Consequences of modernity by Anthony Giddens, Stanford press, 1990 Globalization: Bauman, polity Press,2000

Yogender Singh: Modernization of Indian tradition, Thomson, 1972 Dipankar Gupta, Mistaken modernity Mistaken Modernity

*India between Worlds, Harper collions, 2000*

Avijit Pathak, Indian modernity,Aakar,2001

**BHU-513/ BHU-613/ BHU-713:**

**VALUES & ETHICS**

Definition and classification of values: Extrinsic values, Universal and Situational values, Physical, Environmental, Sensuous, Economic, Social, Aesthetic, Moral and Religious values.

Concepts related to values: Purusartha, Virtue, Right, duty, justice, Equality, Love and Good.

Egoism, Altruism and universalism. The Ideal of Sarvodaya and Vasudhaiva Kutumbakam.

The Problem of Sustenance of value in the process of Social, Political and Technological changes.

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi.

### **BOOKS SUGGESTED**

□ :  
□ [ (Motilal Banarasidas, 2005)  
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□ :  
□ [ □□□□□□ □□□, (Allied Publication, Delhi,  
□ [ 1977)  
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Little

Willi  
am, : An Introduction of Ethics (allied Publisher, Indian  
Reprint 1955)

William, K Frankena : Ethics (Prentice Hall of India, 1988)

Dr. Awadesh Pradhan : Mahamana

**BHU-514/ BHU-614/ BHU-714:**

**ETHICS AND HOLISTIC LIFE**

**1) OBJECTIVE:**

In this course it is emphasized that understanding the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life. The status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.

Thus it is considered necessary to view place of Ethics and Human Values in development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

**2) COURSE TOPICS**

Human Life, its aim and significance: The concept of a successful life, happy life and a meaningful life.

Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

Creative and Leadership ability and their development: Intellectual, Emotional, Creative, Ethico-spiritual development, Aesthetic sense, Self-dependency, Activeness.

Development of positive attitude.

Harmony in Personal and Social Life: Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all.

Creating a value based work culture in hostel, classroom and other places in the campus and society.

Character, Righteousness and Virtues for a Meaningful Life: Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, *Maitri*/ Comradeship, Cooperation, Tolerance.

Dilemma Between materialistic development and human welfare: Science, Technology, Consumerism, Relation with Nature and Environment.

New dimension of Global Harmony: Democracy, Equality, Social Justice

### **3) ASSESSMENT:**

Project and term paper be there. Project may be survey based or interview based reflecting real view and opinion of common people, academics, activists, thinkers which will help students to make their concrete path of future life.

### **4) OUTCOME OF THE COURSE:**

- To enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
- To develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
- To enable students to cross examine their earlier decisions taken in life and

understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.

- To develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
- To enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

**BHU-515/ BHU-615/ BHU-715:**

**FOLK AND VERNACULAR EXPRESSIVE TRADITIONS AND POPULAR CULTURE**

**COURSE DESCRIPTION:**

While Indian culture is known for its diversity and plurality, and also for unity which underlies this diversity, this diversity and unity has been perceived and studied only in terms of classical traditions. Popular folk and vernacular expressive traditions and practices as being manifestations and embodiments of cultural values as of cultural diversity of our society/ community have largely remained unexplored. These practices and traditions play a crucial role in the making of social life, and through them people construct for themselves, individually and collectively, a sense of shared lived past and membership in various communities.

The preservation of folk and vernacular expressive traditions and practices becomes imperative in our Indian context especially in view of the fact that the diversity and plurality and the underlying unity of Indian civilization is under continual threat from

the forces of cultural homogenization on the one hand, and numerous fissiparous tendencies like communalism, regionalism, resurgence of linguistic identities and popular insurgencies in different parts of the country on the other. So far, our country has been able to nurture and sustain this diversity because different identities—religious, cultural, social, linguistic, ethnic etc.—have the space and potential for co-existence, not in insularity, but in communication and interaction with other. Any attempt to freeze or isolate particular identities and not allowing fluidity can be a deterrent to the dynamics of the interwoven web of cultural diversity of our country and civilization, thus disrupting the peace and harmony, and also the process of development and growth. Our folk and vernacular expressive traditions and practices have always played a major role in maintaining and sustaining the cultural diversity through a process of intercultural dialogue and exchange.

Drawing on the range of insights and practices evolved in Culture Studies which has emerged as an interdisciplinary field of inquiry intersecting humanities, social sciences, sciences and the arts, the course aims at exploring these traditions in their historical, social and cultural contexts. Such an approach would enable us to meaningfully engage and interact with these new modes of being and doing. By making us conscious of the many complex ways in which power impinges on our lives and constructs our cultures, it has the potential of empowering us to critically read cultural institutions and texts, to understand how they shape our identities and to think about how we could possibly shape them.

### **Course Units:**

- Expressive Traditions, Culture and Development
- Expressive Traditions and Lok Vidya
- Expressive Traditions and Lived Religion
- Expressive Traditions and Gender

### **READINGS:**

Course readings will be announced in the class.

### **ASSESSMENT AND GRADING:**

Discussion:

Project:



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**2.2 □□□□□□□□□□ □□□□ (□□□□□□□□ □□) (3L)**

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**2.2.2 □ □ (3L)**

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**2.2.3 □□□□□□□□ (6L)**

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**READINGS**

**3.1 TEXTBOOKS:**

“Foundational Course in Human Values & Professional Ethics” by R Sangal, RR Gaur and G P Bagaria.

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**3.2 \*REFERENCE BOOKS:**

□□□□ □□ □□□[<http://www.madhyasth-darshan.info>]

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**OTHER SESSIONS**

4.1 \* TUTORIALS: YES

4.2 \* LABORATORY: NIL

4.3 \* PROJECT: YES.

**ASSESSMENT** (Indicative only): To be specified by the instructor concerned, at the beginning of the semester.

5.1 HOME ASSIGNMENTS AND QUIZZES: [10% GRADE]

5.3 PERIODICAL EXAMS: [30% GRADE]

5.3 FINAL SEMESTER EXAM: [40% GRADE]

5.4 TERM PAPER: [20% GRADE]

### **OUTCOME OF THE COURSE:**

This course introduces the concepts of right understanding and definite human conduct in the students. This course will introduce the definite human conduct and right understanding in the students.

**BHU-517/ BHU-617/ BHU-717:**

### **GENDER, CULTURE AND DEVELOPMENT**

#### **COURSE DESCRIPTION**

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities.

This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination.

The course also features a number of exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

#### **UNIT 1: Introduction to Gender**

Definition of Gender

Basic Gender Concepts and Terminology Exploring Attitudes towards Gender

Social Construction of Gender

**UNIT 2: Gender Roles and Relations**

Types of Gender Roles

Gender Roles and Relationships Matrix

Gender-based Division and Valuation of Labour

**UNIT 3: Gender Development Issues**

Identifying Gender

Issues Gender

Sensitive Language

Gender, Governance and Sustainable Development Gender and Human Rights

Gender and Mainstreaming

**UNIT 4: Gender-based Violence**

The concept of violence

Types of Gender-based violence

The relationship between gender, development and violence Gender-based violence from a human rights perspective

**UNIT 5: Gender and Culture**

Gender and Film

Gender and Electronic

Media Gender and

Advertisement

Gender and Popular Literature

**READINGS:**

Course readings will be announced in the class.

Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

**BHU-518/ BHU-618/ BHU-718:**

**INTRODUCTION TO WOMEN'S AND GENDER STUDIES**

**COURSE OUTLINE**

**Unit-I**

**Concepts**

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

**Unit-II**

**Feminist Theory**

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

**Unit-III**

**Women's Movements: Global, National and Local**

Rise of Feminism in Europe and America. Women's Movement in India.

**Unit-IV**

**Gender and Language**

Linguistic Forms and Gender. Gender and narratives.

**Unit-V**

**Gender and Representation**

Advertising and popular visual media.

Gender and Representation in Alternative Media. Gender and social media.

**BHU-519/ BHU-619/ BHU-719:**

**ADVANCE COURSE IN PEACE RESEARCH**

**COURSE OBJECTIVES:**

The Advance course in Peace Research offers a state of the art opportunity for students and practitioners from diverse fields concerned with peace, security and community development. Assisted by highly trained faculty from within and outside the country, this unique course is proposed to take the students step-by-step through the process of analyzing the links between development, peace, faith and security in an increasingly globalized world-a world in need of creative and pragmatic thinkers in developing pedagogy and understanding of how to handle a conflict situation and transform conflicts towards positive social change. Students will develop important conflict management knowledge and skills that are increasingly sought after in today's job market. A primary goal of this course is to assist students who want to become agents of social change to promote peace and reduce violence.

The main objective of the course is to equip the students with field work skills to analyze and handle today's conflicts and to engage with peace building and conflict prevention as both critical pedagogy and active vocation.

**Unit 1**

Origin and Growth of Peace and Conflict Studies

**Unit 2**

Understanding Positive and Negative Peace

**Unit 3**

Understanding Conflict: Theoretical Constructs

**Unit 4**

Violent and Non-Violent Conflicts

**Unit 5**

Structural and Cultural Violence

**Unit 6**

Types of Conflict: Ethnic Conflict, Clash of Civilization and Environmental Conflict

**Unit 7**

Conflict Management and Conflict Resolution

**Unit 8**

Gandhi's Approach to Peace

**Unit 9**

UN System: Peace Making, Peace Keeping, Peace Building

**Unit 10**

Peace, Development, Faith and Security: An Integrated Focus

**Unit 11**

Conflict Handling Mechanism: Force, Adjudication, Arbitration, Negotiation, Mediation, Reconciliation and Dialogue

**Unit 12**

Conflict Management to Conflict Transformation

**Unit 13**

Citizen's Diplomacy

**Unit 14**

Alternative Dispute Resolution (ADR)

**Unit 15**

Role of Civil Society and NGO's in Peace Processes

**Unit 16**

Human Development and Human Security

**Unit 17**

Linking Gender, Conflict and Development

**Unit 18**

Environment, Conflict and Development

**RECOMMENDED READINGS:****Reading List**

- Bajpai, K. 2000. 'Human Security: Concept and Measurement.' Kroc Institute Occasional Paper, no.19, OP.1, August.
- Bercovitch, Jacob, et.al. 2009. The Sage Handbook of Conflict Resolution.

New Delhi: Sage Publication.

- Commission on Human Security. 2003. Human Security Now. New York: Commission on Human Security.
- Fisher, Simon, et al. 2000. Working with Conflict: Skills and Strategies for Action. London: Zed Books.
- Galtung, Johan, 1996. Peace by Peaceful Means. London: Sage Publication.
- Haq, Mahbub ul. 1995. Reflections on Human Development. New York: Oxford University Press.
- Huntington, Samuel P. 1996. The Clash of Civilizations and the Remaking of World Order. New York: Simon and Schuster.
- Jeong, Ho-Won. 2000. Peace and Conflict Studies: An Introduction. Aldershot: Ashgate.
- Jeong, Ho-Won. 2008. Understanding Conflict and Conflict Analysis. New Delhi: Sage Publications.
- Juergensmeyer, Mark. 2002. Gandhi's Way: A handbook of Conflict Resolution. Mass: University of California.
- Kriesberg, Louis. 1998. Constructive Conflicts: From Escalation to Resolution. New York: Rowman and Littlefield
- Sen, Amartya K. 1999. Development as Freedom. New York: Knopf Press.
- Upadhyaya, Priyankar. 2004. 'Human Security, Humanitarian Intervention and Third World Concerns.' Denver Journal of International Law & Policy, 33(4).
- Wallensteen, Peter, 2007, Understanding Conflict Resolution: War, Peace and the Global System, Britain: Sage.

**BHU-520/ BHU-620/ BHU-720:**

**CONTEMPORARY INDIA IN GLOBALIZED ERA:**

**CHALLENGES OF DEMOCRACY AND DEVELOPMENT**

**OBJECTIVE:**

This course introduces students to contemporary India with special focus on challenges of democracy and development and main vectors that are moulding

India's course in today's globalised era. The course begins with an overview of India's emergence from colonial trappings and its progression in past decades to acclaim a global stature in world affairs. It deliberates on major issues of Indian foreign policy, especially the problematic of peace and security in the globalised world. The overall aim is to develop a broad and yet nuanced understanding of prospects and challenges of contemporary India in the twenty-first century.

## **COURSE CONTENT**

### **Unit I: Contextualising Modern India**

Overarching visions of India's national movement: domestic and international

Challenges of nation-building within its domestic contours

Continuities and shifts in Indian polity and society

Rising aspirations and constraints in post Globalized era

Digitising India: Prospects and Challenges

### **Unit II: India in World Affairs**

Gandhi-Nehru Legacy and policy of nonalignment: Formative Years

Post-Cold war challenges and changing global configurations

India's growing role in world affairs: soft power capacity, diaspora, major bilateral, regional and global concerns and aspirations

India and Major Powers

India and its neighbours

India and Brics

### **Unit III: India's security concerns**

External Threats: China and Pakistan

Internal Threats: Kashmir and Northeast

Spectre of Terrorism

### **Unit IV: Non-traditional Security**

Human Security Concerns:

Energy Security

Water and Food Security

Health and Safet

### **Unit V:Challenges ahead**

India has had a phenomenal rise in terms of economic growth, technical knowhow, and has performed well on various other parameters. Nonetheless there are severe constraints to its unfolding. This topic will cover some of the challenges that India is facing today and the measures it is taking to overcome them.

**Reference books:** Select chapters from the following will be assigned reading for each class.

#### **Unit 1. Contextualising Modern India:**

Candra Bipin, 'Freedom Struggle'

Ram Chandra Guha, 'India after Gandhi'

Tharoor, Shashi. 'India: From Midnight to the Millennium' Chandra, Bipan. 'India since Independence'

Sen, Amartya. 'Development as Freedom'

Ninan Thomas,Pradeep. 'Digital India: Understanding Information, Communication and Social Change'

#### **Unit II. India in World Affairs:**

Menon, Shivshankar. 'Choices: Inside the Making of Indian Foreign Policy' Wajid Ali, H.M. 'India and the Non-aligned Movement'

Mandrup, Thomas. 'The BRICS and Coexistence'

Sikri, Rajiv. 'Challenge and Strategies: Rethinking India's Foreign Policy'

#### **Unit III. India's Security Concerns:**

P. Bajpai, Kanti. Pant, Harsh.V. 'India's National Security'. Budhania, Rajpal. 'India's National Security Dilemma'

Sondhi. M.L. 'Nuclear Weapons and India's National Security'

#### **Unit IV. Non-traditional Security:**

Centre for Strategic Studies - 'Energy Security Challenges: Non Traditional Security Planning in India'

Asthana, Vandana. Shukla, A.C. 'Water Security in India'

Kolas, Ashild and Miklian, Jason. 'India's Human Security: Lost Debates, Forgotten People, Intractable Challenges'.

**Unit V: Challenges ahead:**

Venkateshwar, Sita. 'Globalisation and the Challenges of Development in Contemporary India' **ASSESSMENT:**

There will be continuous assessment in this class. The breakup of the same will be as follows:

Class participation 25% based on interaction and reading responses

Group presentation 25% This can be in the form of short audio-visual presentations, role play, problem solving exercises, and mini theatre presentation on themes related to the course.

End semester term paper 50%. The term paper will offer students tremendous freedom to develop their own trajectories in the field taught.

**OUTCOME:** The student will develop a good sense of India's location in world politics and acquire a capacity to critically assess the prospects of the country in a globalised world. Besides, they will develop ingenious faculties and respond to the pressing matters of the contemporary world more successfully.

**BHU-521/ BHU-621/ BHU-721:**

**MAKING INDIAN CULTURE**

**EPISTEMIC TRADITIONS, LITERATURE AND PERFORMATIVE ARTS**

**OBJECTIVE:**

The Objective of this course is to develop an indigenous, Non- European perspective to study the dynamics of Indian Civilization. It will largely focus on its continuum or spectrum of continuity with change. Since the dynamics of all the civilizations vary from one another, so do their priorities. Consequently, the domains of their achievements and excellence in every respect will also be divergent and therefore, the parameters to study their dynamics must not be rooted exclusively in European matrix. This emphasizes that instead of applying the Eurocentric approach to study the dynamics of Indian civilization, an indigenous approach is needed. The knowledge of Indian civilization has been created by Europe. Later on, Indian

scholars have tried to challenge this orientalist creation in order to retrieve the dynamics of Indian civilization. However before doing this, they appear to have accepted the superiority of European civilization. And therefore, while devising an apparently indigenous civilizational model, they started showing that Indian Civilization had all that was claimed to be base of uniqueness of European civilization. Thus, instead of creating an indigenous model, Indian scholars imitated the European one. Therefore, this course will make an attempt to foster an indigenous perspective that will help in retrieving the dynamics, priorities and insights of Indian civilization disembedding it from the imitation of European model. First, it will show its achievements and then, will compare them to those of other civilizations. Thus, this indigenous and comparative approach will usher in a new era of dialogue among the various civilizations on equal footing. At the same time, it will aim at breaking the disciplinary boundary by taking the recourse to an interdisciplinary approach, and bringing out the totality of Indian civilization. This course will explore the changes in language, literature, music, arts, religion, philosophy and folk culture of North India in the second Millennium. This exploration will also underline the process of making of the Modern India. As it is believed that The Modern India is the invention of the British colonialism, in reality, it is not so. The dynamics of Indian Civilization itself was capable of giving birth to Indian Modernity. However the colonial intervention disrupted this process and it was claimed that India became modern only because of the colonialism. Thus, this course aims at exploring the dynamics of Indian modernity which was lost under the colonial subjugation.

## **SYLLABUS:**

### **UNIT-1: THE VERNACULAR MILLENNIUM**

#### **TOPICS**

**A- The Emergence of Modern Indian Languages with special reference to Hindi**

**B- Bhakha and its regional variations**

**C- The Idea of Hindi, Rekhta, Urdu and Hindustani**

#### **Text**

Poems: Vidyapati, Maulana Daud and Vishnudas

#### **Reference Books**

- Sunil Kumar. The Emergence of the Delhi Sultanate
- Hazari Prasad Drivedi Nath Sampradaya

- Dharmveer Bharati Siddha Sahitya

## **Unit-2: Early Modern India: Mughal Period and After Topics**

### **A- Religious Sects and Indian Islam**

### **B- Bhakha and Braj Bhasha**

### **C- Performative Tradition: Poetry and Music**

### **D- Text and Telling**

#### **Text**

- Poems: Kabir, Jayasi, Surdas, Meera Bai and Tulsidas
- Poems: Bihari and Ghananand

#### **Reference Books**

- Irfan Habib Medieval India: A Study of Civilization
- J.L.Mehta Advanced Study in the History of Medieval India, Vol. III: Medieval
- Indian Society and Culture
- Meenakshi Khanna Cultural History of Medieval India
- Hazari Prasad Drivedi Hindi Sahitya ki Bhumika
- Richard Eaton India's Islamic Traditions, 711-1750
- Barabara D Metcalf. Islam in South Asia in Practice
- S. M. Ikram. Muslim Civilization in India
- D. D. Kosambi. An Introduction to the Study of Indian History
- Saiyid Athar Abbas Rizvi A History of Sufism in India
- David Lorenzen Religious Movements in South Asia 600-1800
- David Lorenzen Bhakti Religion in North India
- Francesca Orsini . After Timur Left: Culture and Circulation in Fifteenth-Century North
- India
- Muzaffar Alam. Writing the Mughal World
- JonardenGaneri The Lost Age of Reason
- Sheldon Pollock TheCosmpolitan Vernacular (Essay)
- India in the Vernacular Millennium: Literary Culture and Polity, 1000-1500 (Essay)
- Indian Knowledge System on the Eve of British Colonialism
- Sanjay Shubramanayam Vignette of Early Modernity in South Asia

- Vasudha Dalmia Religious interaction in Mughal India
- Imtiaz Ahmad Lived Islam in South Asia

### **Unit-3: Colonial and Postcolonial India**

#### **Topics**

#### **A- Orientalism and India**

#### **B- Translating India: Language of Command and Command of Language**

#### **C- Colonial Modernity: Renaissance and Nationalism**

#### **D- Postcolonial Critique and Indian Modernity**

#### **Text**

- Bhartendu Harishchand Andher Nagari
- Premchand Godan
- Habib Tanvir Plays
- Vijaydan Detha Short Stories

#### **Reference Books**

- K. M. Sen Hinduism
- Nicholas B Dirks Castes of Mind
- Andrew J Nicholson Unifying Hinduism
  
- Gyanendra Pandeya
- The Construction of Communalism in Colonial North India
- Ranjit Guha Some Elementary Aspects of Peasant's Interaction in Colonial India
- Ashish Nandy The Intimate Enemy
- Kaviraj The Imaginary Institution of India
- William Crooke The Tribes and Caste of North-Western Provinces of India.
- Grierson Linguistic Survey of India
- W. Theodore de Bary Sources of Indian Tradition
- Sudhir Chandra the Oppressive Present
- Romila Thapar. The Past as Present
- Sunil Khilnani the Idea of India
- Sanjay Subramaniam Connected History
- David Lorenzon Who Invented Hinduism?
- Nehru The Discovery of India
- Dinkar Sanskritike Char Adhyaya

- Mahatam Gandhi Hind Swaraj
- K. C. Bhattacharya Swarajya of Mind
- LeelaGhandhi Postcolonial Theory
- Vinay Dharwadker The Collected Essays of A. K. Ramanuja
- Dipesh Chakrabarty Provincializing Europe

**BHU-522/ BHU-622/ BHU-722:**

**UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**

**Human Values Courses**

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as “H-102 Universal Human Values 2: Understanding Harmony” is designed which may be covered in their III or IV semester.

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

**Universal Human Values 2: Understanding Harmony**

Course code: HSMC (H-102)

Credits: L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credit

Pre-requisites: None. Universal Human Values 1 (desirable)

**1. OBJECTIVE:**

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

Strengthening of self-reflection.

Development of commitment and courage to act.

## **2. COURSE TOPICS:**

The course has 28 lectures and 14 practice sessions in 5 UNITS:

### **UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

Purpose and motivation for the course, recapitulation from Universal Human Values-I

Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration

Continuous Happiness and Prosperity- A look at basic Human Aspirations

Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

### **UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!**

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’

Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility

Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)

Understanding the characteristics and activities of ‘I’ and harmony in ‘I’

Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

### **UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

#### **UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

Understanding the harmony in the Nature

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

#### **UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

Natural acceptance of human values

Definitiveness of Ethical Human Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to

identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems

Strategy for transition from the present state to Universal Human Order: a. At the level of

individual: as socially and ecologically responsible engineers, technologists and managers b. At

the level of society: as mutually enriching institutions and organizations

Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial)

Sessions eg. to discuss the conduct as an engineer or scientist etc.

### **READINGS:**

1 Text Book

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

### **3.2 Reference Books**

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj - PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)

### **4. MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits)**

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at

hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

#### **5. ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

- Assessment by faculty mentor: 10 marks
- Self-assessment: 10 marks
- Assessment by peers: 10 marks

- Socially relevant project/Group Activities/Assignments: 20 marks
- Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

## **6. OUTCOME OF THE COURSE:**

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

faculty-student or mentor-mentee programs throughout their time with the institution

Higher level courses on human values in every aspect of living. E.g. as a professional

**BHU-523/ BHU-623/ BHU-723:**

**HUMAN RELATIONS AT WORK**

Prerequisite course: Applications of Psychology

**OBJECTIVES:**

The objectives of this course are to make students:

- Aware Of Human Relations At Work Its Relationship With Self.
- Aware About The Processes Involved In Interaction With People At Work.
- Understand The Importance Of Psychological And Physical Health In Maintaining Human Relations At Work And Progressing In Career.

**COURSE TOPICS:**

Unit I: Understanding and Managing Yourself: Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

Unit II: Dealing Effectively with People: Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

Unit III: Staying Physically Healthy: Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UnitIV: Staying Psychologically Healthy: Managing Stress and Personal Problems, Meditation.

Unit V: Developing Career Thrust: Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, Developing Good Work Habits.

**Required Text:**

- Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts,
- Applications, and Skills, 11<sup>th</sup> Ed. Upper Saddle River, NJ: Pearson.

**Readings:**

- Greenberg, J. S. (2017). Comprehensive stress management (14th edition). New York: McGraw Hill.
- Udai, Y. (2015). Yogasan aur pranayam. New Delhi: N.S. Publications.

**BHU-524/ BHU-624/ BHU-724:**

**Sanskrit Bhasa**

संस्कृत भाषा पाठ्यक्रम  
Course Code: HSMC (LLG-305)

- शब्दस्वरूप एवंभेद
- उच्चारण-स्थान एवंप्रयत्न
- पदसंरचना
  - (क) पदस्वरूप, भेद एवंप्रयोग
  - (ख) सुवन्तपद
  - (ग) तिङन्तपद
- वाक्यसंरचना
  - (क) वाक्यस्वरूप, भेद एवंप्रयोग
  - (ख) कर्तृवाच्य
  - (ग) कर्मवाच्य
  - (घ) भाववाच्य
- शब्द-अर्थ-सम्बन्ध
  - (क) शक्ति
  - (ख) लक्षणा
  - (ग) गौणी, व्यञ्जना, तात्पर्यआदि
- कारकपरिचय
  - (क) कारकस्वरूप, भेद एवंप्रयोग
  - (ख) विभक्तियोंकाअर्थ
- सन्धिपरिचय-सन्धिस्वरूप, भेद एवंप्रयोग
- स्मासपरिचय-स्वरूप, भेद एवंप्रयोग
- शाब्दबोध-प्रक्रिया एवंकारण
  - आकांक्षा, योग्यता, आसत्ति, तात्पर्यज्ञान

**BHU-525/ BHU-625/ BHU-725:**

**LANGUAGE AND COMMUNICATION**

**APPROACHES TO COMMUNICATION:**

The information Processing school, Shannon and Weaver; A Mathematical Theory of Communication, Formal Signal Processing approach.

Semiotic approach; information, communication and significance.

Chomskyan distinction between language structure and language use; form and function.

Towards a theory of performance; acceptability and grammaticality.

Communicative Competency; Possibility, appropriacy, feasibility.

**MEANING IN LANGUAGE USE:**

Speech Act Theory; communicative activity, locutionary act, directives, commissives, expressive, declarations and representatives.

Grice's theory of conversational meaning; the cooperative principle, quantity maxim, quality maxim, relational maxim, manner maxim.

Ancient Indian theory of meaning; lexical, compositional, extended.

Speaker intention in communication.

Discourse meaning; context and situation.

**LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION:**

Writing and Speech.

Gestures and Body language.

**STRUCTURE OF DISCOURSE/CONVERSATION:**

- Coherence
- Cohesion
- Initiating and closing conversations
- Intervention
- Turn taking

**POWER STRUCTURE AND LANGUAGE USE:**

- Gender and language use
- Politeness expressions and their use
- Ethical dimensions of language use
- Language rights as part of human rights

**MEDIA COMMUNICATION:**

- Power of media, Orwell's problem (Chomsky)
- Manufacturing of opinion and hidden agendas.

## **PERSUASIVE COMMUNICATION AND MISCOMMUNICATION:**

- Fundamentals of persuasive communication.
- Persuasive quotient
- Politics and communication barrier.

## **TEXT BOOKS:**

- Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press.
- Grice, P.1989.
  - Studies in the way of words. Cambridge, M.A: Harvard University Press.
  - Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge.
  - Chomsky, N.2006. Language and Mind, Cambridge University Press.
- J.Holmes
  - Hymes. D.N. 1972, On communication competence in J.B. Pride and (ed), Sociolinguistics, pp 269-293, London Penguin.
- Journal
  - Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in of Philosophy, page 75-87.
  - Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.
  - Stangley, J. 2007. Language in Context. Clarendon press, Oxford

## **BHU-526/ BHU-626/ BHU-726:**

### **LANGUAGE AND LINGUISTICS**

#### **How do human languages (spoken and signed) differ from means of communication used by other animals?**

"Design Features" of human languages

Innateness and (social) learning —"copying" and the spread of cultural phenomena.

Patterns vs Rules vs Analogies.

What language "Acquisition" and "Transmission" really mean?

Structural complexity of spoken languages — the significance of modularity.

Speaker-Idexicality — language and identity (race/ethnicity, socio-economic, class, gender, age group, education, professional affiliation, etc.)

## **Why do human languages differ structurally, despite their architectural Similarities? (Sense of typology).**

Variation vs transformational evolution.

Word order typology.

### **Structure and structure dependence:**

Diagnostics for structure; reference, co-reference and anaphoric reference; deixis, demonstratives, tense, pronominal. b) Context; topic, focus, focusing devices. Thematic role; agent, patient, goal.

Grammatical relation; subject and object.

Case; nominative, accusative.

### **Phrase structure;**

X-bar theory; head, complement, specifies.

S as IP and S-bar as CP.

DP analysis of noun phrase.

Syntactic operation; move; relative clause.

### **Meaning;**

Sense and reference and denotation and connotation.

Synonymy, antonym, hyponymy.

Propositions; ambiguity, generic vs specific, definite and indefinite.

### **Pragmatic:**

Presupposition.

Entailment.

Implicate.

### **Text books:**

- Akrnajian, A and Heny, F 1975. An Introduction to the Principles of Transformational Syntax, Cambridge, Mass: MIT Press.
- Chomsky, N and Halle, Morris 1966. Studies in Language, Harper and Row, publishers. New York
- Bolinger, D.L. 1980, Language, the Loaded Weapon, London: Longman. Stephen. C. Levenson, 1983 Pragmatics, Cambridge University Press.
- Song, Jae Jung, 2001 Linguistic Typology. Pearson Education Limited.

**BHU-527/ BHU-627/ BHU-727:**

**UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE**

**OBJECTIVE:**

The ultimate aim of the teaching-learning process should not only be about acquiring skills necessary for one's "trade", but to acquire knowledge and become a better human being, as a means towards the end of creating a better society. Understanding a society, its people, their mind, prevalent traditions and culture is imperative in developing a holistic worldview, which is essential for a sustainable society. In this course we shall pick up literary works of various countries/ regions / societies (referred to as "traditions" hereafter); and as it has been quoted often by many that - "Literature is the mirror of the society" – to the extent that it has almost become a saying – we shall read these works and attempt to understand the respective traditions to which the works belong.

**2. COURSE TOPICS:**

Literary works of various traditions would be the primary study material in this course. Through these works we will attempt to understand various aspects of the society. The course may be divided into the following units.

**2.1 Introduction (4 Hours)**

Knowledge tradition, what is Literature, Significance of studying literature, how to study society and culture through literature

## **2.2 Morality (7 Hours)**

Various literary pieces will be picked up that would help us to understand morality.

## **2.3 Dilemma (7 Hours)**

Various literary pieces will be picked up that would force us to think about situations where one is faced with a dilemma; where such ethical questions arise that differentiating between right and wrong becomes very difficult. This forces us to re-think our notions of right and wrong and helps us in understanding the various realities of life.

## **2.4 Gender (7 Hours)**

Various literary pieces will be picked up that questions the current notions of gender, and raises un-comfortable questions, challenging the status-quo, forcing us to think the real meaning of equality and emancipation.

## **3. READINGS:**

Literary works – Will be provided by the teacher.

Author's Background, Historical and Social Background which are significant for a better understanding of the work – Will be provided by the teacher.

Any other significant study material as required for an overall understanding of the literary work.

## **4. OTHER SESSIONS:**

**The study of each literary piece would be divided into the following sessions.**

4.1 Reading – The literary piece will be given to students beforehand and they are required to read it before coming to the class so that they are not totally unaware of the text. In the class the text will be read once again, where doubts if any will be cleared.

4.2 First Discussion – The reading will be followed by a discussion where the text will be analyzed in detail. The students will be encouraged to share their interpretation of the text.

4.3 Presentation – Having read and analyzed the text by now, the students will present their analysis of the text in front of the class. The students will keep in mind the author's background and the socio-historical and cultural backgrounds while preparing this presentation.

4.4 Q&A Session – Each presentation will be followed by a Q&A session wherein the students will be encouraged to ask questions to their respective classmates regarding the presentation/ analysis initiating a second discussion on the text.

4.5 Second Discussion – Having made their presentation, and heard the presentations made by their classmates, the students would now have a fairly good idea of the various nuances of the text, making it a ripe moment to have the second detailed discussion on the text. Here the teacher may refer to those points which may have been missed by the students.

4.6 Submission of a report – Having faced questions from their classmates, and after having a second discussion on the text, the student would come across new ideas which will be incorporated into the analysis and submitted in the form of a report.

#### **5. ASSESSMENT:**

1 Sessional Test (15%) + 1 Sessional Test (15%), 1 Term Paper (30%), End Semester Examination(40%)

#### **6. OUTCOME OF THE COURSE:**

6.1 Awareness of various traditions.

6.2 Ability to not just understand the diversity found between various traditions but

to celebrate them.

6.3 Strengthening of the analytical capability.

6.4 Improvement in language skills and ability of expressing complex ideas.

**7. \*ANY OTHER: A course of this nature requires that the class strength is not too high.**

**BHU-528/ BHU-628/ BHU-728:**

**FUNDAMENTALS OF LINGUISTICS**

**COURSE DESCRIPTION:**

It will be a 3 credits Course that will introduce the students to a discipline called Linguistics which may be defined in one sentence as the scientific study of language. We will explore some basic issues and questions related to language in this course such as what do we know when we know a language, the relation between language and brain, language and society, how does a child learn a language, how the languages of the world are similar as well as different, how can we analyze language as a structure etc. The course will also provide the students to a brief outline of language studies in Indian and western tradition and many applications of linguistics in different fields.

**Unit 1 (10 hours)**

What is language and where is language?

Language is a means of communication, a social product

Language is a cognitive ability, relation between language and brain

What is Linguistics and what is not Linguistics?

Linguistics is not prescriptive grammar learnt in the school

Linguistics is not learning of many languages

Linguistics provides tools to analyze language structure scientifically

Study of Language in Indian and western traditions

**Unit 2 (18 hours)**

Levels of Language Analysis: Form and content

Sound

Word

Sentence

meaning

Similarities and differences of languages

**Unit 3 (2 hours)**

Applications of Linguistics

Natural Language Processing

Clinical Linguistics

Psycholinguistics etc

**BHU-529/ BHU-629/ BHU-729:**

**ELEMENTS OF LITERATURE**

**OBJECTIVE:**

To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

**COURSE CONTENTS**

Introduction to Elements of Literature

**Relevance of literature**

Enhances Reading, thinking, discussing and writing skills.

Develops finer sensibility for better human relationship.

Increases understanding of the problem of humanity without bias.

Providing space to reconcile and get a cathartic effect.

**Elements of fiction**

Fiction, fact and literary truth.

Fictional modes and patterns.

Plot character and perspective.

**Elements of poetry**

Emotions and imaginations.

Figurative language.

(Simile, metaphor, conceit, symbol, pun and irony).

Personification and animation.

Rhetoric and trend.

**Elements of drama**

Drama as representational art.

Content mode and elements.

Theatrical performance.

Drama as narration, mediation and persuasion.

Features of tragedy, comedy and satire.

**READINGS:**

An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.

An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.

The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991.

The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.

The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

3.1 Textbook:

3.2 \*Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

**OTHER SESSION:**

4.1\*Tutorials:

4.2\*Laboratory:

4.3\*Project: The students will write a term paper to show their understanding of a particular piece of literature

**5.\*ASSESSMENT:**

5.1HA:

5.2Quizzes-HA:

5.3Periodical Examination: one

5.4Project/Lab: one (under the guidance of the teachers the students will take a volume of

poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.

5.5Final Exam:

**OUTCOME OF THE COURSE:** Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

**BHU-530/ BHU-630/ BHU-730:**

**HUMANITY AND MULTIPLE DIMENSIONS OF ECOLOGY**

**OBJECTIVE:**

This course would explore the multiple meanings of *Oikos*, the Greek for “home”, by pluralizing the connotation of “ecology”. There can be an “ecology of mind”, as Gregory Bateson suggests. Knowledge systems, as Bateson insists, should focus on the interconnectedness of nature and culture, civilization and ancient wisdom. This course attempts to sensitize the students to the necessity of understanding and appreciating our interconnected existence on the planet – the way all living organisms, all cultures and ecologies, all human beings, animals and plants, and all

societies, despite their differences and even apparent mutual conflicts, are interconnected and interdependent. Through a reading of selected texts by philosophers, social scientists, poets and novelists, and through class discussions, and audio-visual presentations, the students would be encouraged to build up a forum for debating the ethical issues that are our foremost concerns today. They would not only learn to be sensitive to natural environments and fellow human beings but also challenge the ethos of atomic individualism. The course will be interactive, and as less traditional in methodology as possible.

All the course materials will be supplied by the class instructor.

### **Unit 1: Redefining the *Oikos***

We will try to redefine the “oikos” by analyzing some philosophical doctrines, and explore the multiple connotations of “ecology”. It will be interesting to see how one may feel at home within a particular belief system, or a particular cultural framework, as well as natural environment, while keeping open the possibility of interlinking all these little homes, and of celebrating an inter-ecological understanding of our plural existence. In short, we will see how the concept of “home” itself may lead to certain self-critical modes of defining and exploring ecological issues. The issues we will explore are:

What do we mean by a “home” (*Oikos* in Greek)?

Whom can we accommodate within our “home”?

How are the concepts of “home” and “hospitality” interlinked?

Texts:

Selected portions from Gregory Bateson’s *Steps to an Ecology of Mind* (one or two short chapters)

### **Unit 2: Oneness and Interconnectivity**

We will have a look at the Vedantic concept of the Oneness of the universe and discuss its relevance to the contemporary issues of intercultural and intercommunal harmony as well as environmental balance. Besides, we will explore how the tantric traditions focus on the interconnectivity of all living beings without positing a necessary ontological hierarchy. Blending these two models, we will propose a paradigm of interconnectivity within the Oneness of the cosmos, where All and Each become one, thereby initiating a powerful mode of existential altruism. Texts:

Selected portions from Ruth Frankenberg and Lata Mani, *The Tantra Chronicles*, selected portions of *The Life Divine* by Sri Aurobindo, and Emerson, “Each and All” (poem)

### **Unit 3: The Sacred, the Secular, the Sacredsecular**

Here we will re-interrogate the questions relating to the sacred and the secular. The sacred, when allowed to be self-centred, may give rise to fundamentalism. And the secular, when allowed to be self-contained, may turn into an exclusivist structure and

heartless materialism. So, perhaps it is necessary to blend the sacred and the secular and detach the sacred from the ritualistic framings that make it limited in scope.

The contemporary eco-consciousness and social awareness may benefit from the idea of the sacredness of life which need not be confined to any particular religious' doctrine. Texts:

Selected portions from Lata Mani, *Sacredsecular*. Stephen Talbott, "Toward an Ecological Conversation".

#### **Unit 4: Dharma as Regard for the Whole**

Here we will explore the concept of *Bhuma* developed in the Upanishads and relate it to the issue of the *holistic* approach to our planet that is required by our contemporary ecological consciousness. Besides, we will redefine Dharma as a mode of connecting with the *Bhuma*.

Texts:

For this, we will read some Upanishadic texts, and some portions (not more than 10 pages) of Robert Pirsig's philosophical novel *Zen and the Art of Motorcycle Maintenance*. References will be made to the Goethean character Makarie who is a metaphorical composite figure for natural sciences and mystic wisdom.

#### **Unit 5: Ecology for Women**

We will explore how the "home" of the patriarchal society in which men feel at home is not a home for

women. In other words, in order to make our society more habitable for women, we need to develop

certain ethical attitudes that will lead to the emergence of gender justice in the contemporary society.

Men must get involved in the project of gender justice, and would usher in what Betty Friedan calls "the

second stage" in the fight for gender egalitarianism.

Text:

Wisława Szymborska, "Portrait of a Woman" (poem)

#### **Film Screening**

Akira Kurosawa, *Dreams*

In a separate class the ecological themes explored in the film will be discussed.

#### **MODE OF CONDUCT:**

Students will be asked to write term papers on any innovative topic, e.g., the possibilities of modernizing the concept of Dharma and applying it to the secular context, Dharma as a mode of synthesizing freedom and responsibilities, the

multiple meanings of ecology, the metaphors of chaos and cosmos in the context of Oneness and planetary plurality etc. Besides, students will be encouraged to do poster presentations and audio-visual presentations. Students will also be encouraged to present creative writing (in English or Hindi or Bengali) related to the broad theme explored in the course.

#### **MODE OF EVALUATION:**

Interaction and short class presentations will be more important than conventional modes of evaluation, and the term papers would offer the students tremendous creative freedom. 40-50% weightage would be given to the term papers, while 20-30% will be on group presentations (audio-visual, power point or poster presentations)/creative writing (individual or collaborative).

#### **OUTCOME:**

The students will be trained in the ethical values integral to the Technology-Humanities interface. Instead of becoming heartless technocrats, our students will be more sensitive and sympathetic to the weaker sections of the society and would develop a passion for social and environmental justice. Besides, they will develop creative faculties and respond to the burning issues of the contemporary world more effectively. The main objective of this course will be to kindle the latent wisdom in them which is intrinsically connected to the hunger for goodness.

### **BHU-531/ BHU-631/ BHU-731:**

#### **FILM APPRECIATION**

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

#### **Theme - A: The Component of Films**

A-1: The material and equipment

A-2: The story, screenplay and script

A-3: The actors, crew members, and the director

A-4: The process of film making... structure of a film

**Theme - B: Evolution of Film Language**

B-1: Film language, form, movement etc.

B-2: Early cinema... **silent film** (Particularly French)

B-3: The emergence of feature films: **Birth of a Nation**

B-4: Talkies

**Theme - C: Film Theories and Criticism/Appreciation**

C-1: Realist theory; Auteurists

C-2: Psychoanalytic, Ideological, Feminists

C-3: How to read films?

C-4: Film Criticism / Appreciation

**Theme – D: Development of Films**

D-1: Representative Soviet films

D-2: Representative Japanese films

D-3: Representative Italian films

D-4: Representative Hollywood film and the studio system

**Theme - E: Indian Films**

E-1: The early era

E-2: The important films made by the directors

E-3: The regional films

E-4: The documentaries in India

**READING:**

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

**BHU-532/ BHU-632/ BHU-732:**

**LAW AND ENGINEERING**

The aim of this course is to provide a basic understanding of the legal concepts and issues relevant to those wishing to practice as Engineers.

**1. THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE:**

1.1 Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law-Principles taken from decisions of judges constitute binding legal rules.

1.2 The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court)

1.3 Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

**BASIC PRINCIPLES OF CONTRACT LAW**

**SALE OF GOODS LAW**

**BUSINESS ORGANISATIONS:**

4.1 SOLE TRADERS (Business has no separate identity from you, all business property belongs to you)

4.2. PARTNERSHIPS: There are three types of Partnerships: Limited Liability Partnership, General Partnership, Limited Partnerships

4.3 COMPANIES:

4.3.1 The nature of companies.

4.3.2 Classification of companies.

4.3.3 Formation of companies.

4.3.4 Features of a public company.

4.3.5 Carrying on business.

4.3.6 Directors—Their Powers and Responsibilities/Liabilities.

**LAWS RELATING TO INDUSTRIAL POLLUTION, ACCIDENT,  
ENVIRONMENTAL PROTECTION, HEALTH AND SAFETY AT WORK.**

**PATENT LAW.**

**INFORMATION TECHNOLOGY LAW AND CYBER CRIMES.**

**LAW AND SOCIETY: INTERDISCIPLINARY NATURE OF  
LAW, LEGAL IDEOLOGIES/PHILOSOPHY/ SCHOOLS OF  
JURISPRUDENCE.**

**CONSTITUTIONAL LAW: THE SUPREME LAW OF THE LAND.**

**CASE STUDIES: IMPORTANT LEGAL DISPUTES AND JUDICIAL  
LITIGATIONS**

