INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)
Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
PEED
(POWER ELECTRONICS AND ELECTRICAL DRIVES)

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI
(Based on AICTE Model Curriculum)

IARE - R18

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2018 - 2019)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea you're life-think of it, dream of it, and live on that idea.
Let the brain muscles, nerves, every part of your body be full of that idea
and just leave every other idea alone.
This is the way to success" Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a subject offered by the University for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Structural Engineering, Embedded Systems, CSE, etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program / UG degree program: B.Tech.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her second year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "IARE-R18" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', him', 'his', occur, they imply 'she', 'her', 'hers' also.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2018 - 20)

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1.0 CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work /mini project work with seminar/ viva / seminars / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3.0 ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.
b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4.0 UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M.Tech programme will be placed in one of the groups as listed in the Table 1.

Table 1: Group of Courses

S. No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Electrical Power Systems	Electrical and Electronics Engineering	EPS
3	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of four kinds: **Core, Elective, Open and Audit.**

5.1 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in said discipline of study.

5.2 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

There shall be five professional core elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. In addition, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

5.3 Open Elective Course:

An elective may be discipline centric focusing on those courses which add generic proficiency to the students or may be chosen from supportive/general discipline called as "Open Elective".

5.4 Audit Course:

The value added courses are audit courses offered through joint ventures with various organizations providing ample Scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6.0 SEMESTER STRUCTURE

The institute shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term. Each semester shall be of 23 weeks (Table 2) duration and this period includes time for course work, examination preparation and conduct of examinations. Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical shall be 75 and 15 days shall be for examination preparation. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic Calendar is declared at the beginning of the academic year as given in Table2.

Table 2: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 Week	
	Preparation & Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Summer Vacation and Supplementary Exams			4 weeks
THIRD SEMESTER	I Spell Instruction Period	9 weeks	18 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Project Work Phase – I		
	Semester End Examinations		1 week
FOURTH SEMESTER	Project Work Phase - II		18 weeks

7.0 PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 5.0/10.0 CGPA.
b) In the event of non-completion of project work and/or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the project. In such a case, the candidate will not be permitted to submit the report earlier than three months and not later than six months from the date of registration.

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Elective Core Courses, Laboratory Course, Mini Project with Seminar, Internship, Project Work-1 and Project Work-2.

Each Theory and Laboratory course carries credits based on the number of hours / week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.
- **Project Work:** 1 credit for 2 hours of project work per week.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Core Courses	3	3
2	Professional Core Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	2	2
7	Project Work-1 Dissertation	20	10
8	Project Work-2 Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04)+Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (03)	04@2credits	08
Mini Project with Seminar(01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Project Work-1	1 @10credit	10
Project Work-2	1 @16credits	16
TOTAL CREDITS		**68**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIE during the semester, marks are awarded by taking average of two sessional examinations.

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE units and each unit carries equal weightage in terms of marks distribution. The question paper pattern shall be as defined below.Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Table 4: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Technical Seminar and Term Paper	
Max. CIA	25	5	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:

Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

9.2 Laboratory Course:

9.2.1 Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

9.2.2 All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.

9.3 Project work

Normally, the project work should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized Educational Institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

9.3.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I of project work shall be evaluated by Project Review Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Guide and Head of the Department.

9.3.2 The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final viva voce examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for presentation/ publication in a conference/journal and produce the proof of acceptance of the paper from the organizers/publishers.

9.3.3 The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

The evaluation of the project work and the marks allotted are as under:

S. No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Guide	30
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, guide and HOD.	70
Total (Phase – I)				**100**
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and guide wherein the HOD convenes its meeting.	30
4		End Semester Examination (An open seminar followed by viva-voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and guide wherein the HOD shall be the chairman of the committee.	70
Total (Phase-II)				**100**

9.3.4 As soon as a student submits his project work, Principal shall appoint the External Examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.3.5 The Principal shall schedule the End Semester Examination in project work soon after the completion of the study of program and a student can appear for the same provided s/he has earned successfully all the requisite credits. The student shall produce the dissertation duly certified by the guide and HOD during the Examination.

9.3.6 The project reports of M.Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the Controller of Examinations. The results of the project work evaluation will be declared by the Controller of Examinations only after the successful completion of the courses by those students.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 80% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2 For cases of medical issues, deficiency of attendance in each course to the extent of 15% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 80% to 65% in every course, subjected to submission of medical certificate and other needful documents to the concerned department.

10.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program.

10.3 However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.5 A prescribed fee shall be payable towards Condonation of shortage of attendance.

10.6 A candidate shall put in a minimum required attendance at least in three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, s/he shall not be eligible for readmission into the same class.

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations.

11.3 Internal Examiner shall prepare a detailed scheme of valuation.

11.4 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.5 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by him shall be taken as final.

11.6 HOD shall invite 3-9 external examiners to evaluate all the end semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.7 Examination Control Committee shall consolidate the marks awarded by internal and external examiners to award grades.

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

i. Not less than 40% marks for each theory course in the semester end examination, and

ii. A minimum of 50% marks for each theory course considering both CIA and SEE

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Seminar and Technical Writing / Project, if s/he secures

i. Not less than 40% marks for each Laboratory / Seminar / Project course in the semester end examination,

ii. A minimum of 50% marks for each Laboratory / Mini project with Seminar / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
100 - 80	10	S (Superior)
70 – 79	9	A+ (Excellent)
60 – 69	8	A (Very Good)
55 – 59	7	B+ (Good)
50 – 54	6	B (Average)
Below 50	0	F (Fail)
Absent	0	Ab (Absent)
Authorized Break of Study	0	ABS

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”.

13.3 A student obtaining Grade “F” shall be considered Failed and will be required to reappear in the examination.

13.4 "SA" denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.5 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student's is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

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

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0

$$Thus, CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0}{93} = 6.51$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of M .Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 68 credits.

17.2 A student who fails to earn 68 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 5.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.5 and < 6.5	CGPA ≥ 5.0 and < 5.5	CGPA < 5.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

a) In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the marks memo.

b) All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

19.0 IMPROVEMENT OF GRADE:

A candidate, after becoming eligible for the award of the degree, may reappear for the final examination in any of the theory courses as and when conducted for the purpose of improving the aggregate and the grade. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

The college shall institute prizes and medals to meritorious students annually on Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

25.0 TRANSITORY REGULATIONS

25.1 A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

25.2 Semester End Examination in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman, BOS concerned.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE OF AERONAUTICALENGINEERING

(AUTONOMOUS)

POWER ELECTRONICS AND ELECTRICAL DRIVES

COURSE STRUCTURE

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BPEB01	Power Electronic Converters	PCC	Core	3	0	0	3	30	70	100
BPEB02	Machine Modeling and Analysis	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - I	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective – II	PEC	Elective	3	0	0	3	30	70	100
BPEB01	Audit Course - I	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BPEB09	Machine Modelling and Analysis Laboratory	PCC	Core	0	0	4	2	30	70	100
BPEB10	Power Electronic Converters Laboratory	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**08**	**16**	**210**	**490**	**700**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BPEB11	Advanced Power Electronic Converters	PCC	Core	3	0	0	3	30	70	100
BPEB12	Electrical Drives	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - III	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective - IV	PEC	Elective	3	0	0	3	30	70	100
	Audit Course - II	Audit - II	Audit	2	0	0	0	30	70	100
PRACTICAL										
BPEB19	Advanced Power Electronic Converters Lab	PCC	Core	0	0	4	2	30	70	100
BPEB20	Electrical Drives Laboratory	PCC	Core	0	0	4	2	30	70	100
BPEB21	Mini Project with Seminar	PCC	Core	2	0	0	2	30	70	100
TOTAL				**16**	**00**	**08**	**18**	**240**	**560**	**800**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCSB31	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PEC	Elective	3	0	0	3	30	70	100
	Open Elective	OE	Elective	3	0	0	3	30	70	100
PRACTICAL										
BPEB40	Phase-I Dissertation	Major Project	Core	0	0	20	10	30	70	100
TOTAL				**08**	**00**	**20**	**18**	**120**	**280**	**400**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BPEB41	Phase-II Dissertation	Major Project	Core	0	0	32	16	30	70	100
TOTAL				**00**	**00**	**32**	**16**	**30**	**70**	**100**

PROFESSIONAL CORE ELECTIVE COURSES

PROFESSIONAL CORE ELECTIVE – I

Course Code	Course Title
BPEB03	Power Electronics for Renewable Energy Systems
BPEB04	Smart Grid Technologies
BPEB05	Dynamics of Electrical Machines

PROFESSIONAL COREELECTIVE – II

Course Code	Course Title
BPEB06	Power Semiconductor Devices and Modeling
BPEB07	Reactive Power Compensation and Management
BPEB08	High Frequency Magnetic Components

PROFESSIONAL CORE ELECTIVE – III

Course Code	Course Title
BPEB13	Industrial Load Modeling and Control
BPEB14	SCADA Systems and Applications
BPEB15	PWM Converters and Applications

PROFESSIONAL CORE ELECTIVE – IV

Course Code	Course Title
BPEB16	Advanced Microcontroller Based Systems
BPEB17	Power Quality
BPEB18	Integration of Energy Sources

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BPEB22	Reliability Engineering
BPEB23	Flexible AC Transmission Systems
BPEB24	HVDC Transmission

OPEN ELECTIVE COURSES

Course Code	Course Title
BCSB25	Business Analytics
BCSB26	Industrial Safety
BCSB27	Operations Research
BCSB28	Cost Management of Engineering Projects
BCSB29	Composite Materials
BCSB30	Energy from Waste

AUDIT COURSES

Course Code	Course Title
BCSB32	English for Research Paper Writing
BCSB33	Disaster Management
BCSB34	Sanskrit for Technical Knowledge
BCSB35	Value Education
BCSB36	Constitution of India
BCSB37	Pedagogy Studies
BCSB38	Stress Management by Yoga
BCSB39	Personality Development through Life Enlightenment Skills

SYLLABUS

(I – IV SEM)

POWER ELECTRONIC CONVERTERS

I Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand the characteristics and principle of operation of modern power semiconductor devices.
II. Comprehend the concepts of different power converters and their applications
III. Analyze and design switched mode regulators for various industrial applications.

UNIT-I	AC VOLTAGE CONTROLLERS	Classes: 09

Single phase AC voltage controllers with resistive, resistive, inductive and resistive, inductive, induced emf loads, ac voltage controllers with PWM control, effects of source and load inductances, synchronous tap changers; three phase ac voltage controllers, analysis of controllers with star and delta connected resistive, resistive-inductive loads, effects of source and load inductances, applications, problems.

UNIT-II	CYCLO-CONVERTERS	Classes:10

Single phase to single phase cycloconverter, analysis of midpoint and bridge configurations, three phase to three phase cycloconverter, analysis of midpoint and bridge configurations, limitations, advantages, applications, problems, matrix converter.

UNIT-III	SINGLE PHASE & THREE PHASE CONVERTERS	Classes:08

Single phase converters, half controlled and fully controlled converters, evaluation of input power factor and harmonic factor, continuous and discontinuous load current, single phase dual converters, power factor improvements techniques, extinction angle control, symmetrical angle control, PWM, single phase sinusoidal PWM, single phase series converters, overlap analysis, applications, problems.

Three phase converters: Half controlled and fully controlled converters, evaluation of input power factor and harmonic factor, continuous and discontinuous load current, three phase dual converters, power factor improvements techniques, three phase PWM, twelve pulse converters, applications, problems, design of converters.

UNIT-IV	DC TO DC CONVERTERS	Classes:09

Analysis of step-down and step-up dc to dc converters with resistive and resistive, inductive loads, switched mode regulators, analysis of buck regulators, boost regulators, buck and boost regulators, Cuk regulators, condition for continuous inductor current and capacitor voltage, comparison of regulators, multi output boost converters, advantage, applications, problems.

UNIT -V	PULSE WIDTH MODULATED INVERTERS	Classes:09

Principle of operation: Performance parameters, single phase bridge inverter, evaluation of output voltage and current with resistive, inductive and capacitive loads, voltage control of single phase inverters; Single PWM: Multiple PWM, sinusoidal PWM, modified PWM, phase displacement control, advanced modulation techniques for improved performance, trapezoidal, staircase, stepped, harmonic injection and delta modulation, advantages, applications, problems. three phase inverters, analysis of 180 degree conduction for output voltage and current with resistive, inductive loads, analysis of 120 degree conduction, voltage control of three phase inverters, sinusoidal PWM, third harmonic PWM, 60 degree PWM, space vector modulation, comparison of PWM techniques, harmonic reductions, problems.

Text Books:
1. Mohammed H Rashid “Power Electronics”, Pearson Education, 3rd Edition, 2004. 2. Ned Mohan, Tore M Undeland and William P Robbins, “Power Electronics”, John Wiley & Sons 2nd Edition, 2006.
Reference Books:
1. Milliman Shepherd and Lizang – “Power converters circuits”, (Matrix converter) 2nd Edition, 2009. 2. MH Rashid, “Power electronics”, hand book. 3. Marian P Kaźmier kowski, Ramu Krishnan, Frede Blabjerg Edition:” Control in power electronics” illustrated Published by Academic Press, 2nd Edition, 2002.
Web References:
1. Power Electronic Web Course by NPTEL, IIT Kharagpur, www.nptel.iitm.ac.in 2. Lecture notes from iare website http://www.iare.ac.in 3. Bookboon.com/en/introduction, to-power-electronics-ebook/
E-Text Books:
1. https://www.freebookcentre.net 2. https://www.amazon.in/POWER-ELECTRONICS-HANDBOOK 3. https://www.circuitstoday.com

MACHINE MODELING AND ANALYSIS

I Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB02	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Explain the methods and assumptions in modeling of machines.
II. Understand the methods and assumptions in modeling of machines.
III. Describe voltage and torque equations in state space form for different machines.

UNIT-I	BASIC TWO-POLE DC MACHINE	Classes: 09

Basic two-pole dc machine: Primitive 2-axis machine, voltage and current relationship, torque equation, mathematical model of separately excited dc motor and dc series motor in state variable form, transfer function of the motor, numerical problems, mathematical model of dc shunt motor dc compound motor in state variable form, transfer function of the motor, numerical problems.

UNIT-II	LINEAR TRANSFORMATION	Classes:10

Linear transformation: Phase transformation (a, b, c to α, β, o): Active transformation (α .β, o to d, q),circuit model of a 3 phase induction motor, linear transformation, phase transformation, transformation to a reference frame, two axis models for induction motor, d-q model based DOL starting of induction motors.

UNIT-III	VOLTAGE AND CURRENT EQUATIONS IN STATOR REFERENCE	Classes:08

Voltage and current equations in stator reference equation in Rotor reference frame.

Equations in a synchronously rotating frame, torque equation, equations in state, space form.

UNIT-IV	CIRCUITS MODEL OF A 3PH SYNCHRONOUS MOTOR	Classes :09

Circuits model of a 3ph synchronous motor: Two axis representation of synchronous motor, voltage and current equations in state space variable form, torque equation, d-q model based short circuit fault analysis, emphasis on voltage, frequency and recovery time.

UNIT-V	MODELING OF MACHINES	Classes:09

Modeling of permanent magnet synchronous motor, modeling of brushless dc motor.

Text Books:

1. P S Bimbhra, "Generalized Machine theory", Khanna Publishers, 2nd Edition, 2002.
2. Paul C Krause, Oleg wasynezuk, Scott D Sudhoff, "Analysis of Electric Machinery and Drives Systems", A John wiley & Sons, Inc. Publication, 2nd Edition, 2009.

Reference Books:

1. Vedam Subranmanyam, "Thyristor control of Electric Drive", 2nd Edition, 1987.
2. Prabha Kundur, "Power System Stability and Control ", EPRI, 3rd Edition, 2006.
3. Performance optimization of induction motors during Voltage-controlled soft starting, Article in IEEE Transactions on Energy Conversion, July, 2004.
4. A Novel Method for Starting of Induction Motor with Improved Transient Torque Pulsations, Nithin KS, Dr. Bos Mathew Jos, Muhammed Rafeek, Dr. Babu Paul. International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 8, February2013.

Web References:

1. Power Electronic Web Course by NPTEL, IIT Kharagpur, www.nptel.iitm.ac.in
2. Lecture notes from iare website http://www.iare.ac.in
3. Bookboon.com/en/introduction-to-power-electronics-ebook

E-Text Books:

1. https://www.freebookcentre.net
2. https://www.amazon.in/POWER-ELECTRONICS-HANDBOOK
3. https://www.circuitstoday.com

POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

PE-I: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB03	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Explain about the stand alone and grid connected renewable energy systems.
II. Describe with required skills to derive the criteria for the design of power converters for renewable energy applications.
III. Analyze and comprehend the various operating modes of wind electrical generators and solar energy systems.
IV. Design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems. To develop maximum power point tracking algorithms.

UNIT-I	INTRODUCTION	Classes: 09

Environmental aspects of electric energy conversion: Impacts of renewable energy generation on environment (cost-GHG Emission), Qualitative study of different renewable energy resources, solar, wind, ocean, biomass, fuel cell, hydrogen energy systems and hybrid renewable energy systems.

UNIT-II	ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION	Classes: 09

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT-III	POWER CONVERTERS	Classes: 09

Block diagram of solar photo voltaic system: Principle of operation, line commutated converters (inversion-mode), boost and buck-boost converters, selection of inverter, battery sizing, array sizing wind.

Three phase ac voltage controllers, ac, dc, ac converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT-IV	ANALYSIS OF WIND AND PV SYSTEMS	Classes: 09

Standalone operation of fixed and variable speed wind energy conversion systems and solar system, grid connection issues, grid integrated PMSG, SCIG Based WECS, grid integrated solar system.

UNIT-V	HYBRID RENEWABLE ENERGY SYSTEMS	Classes: 09

Need for hybrid system: Range and type of hybrid systems, case studies of wind, PV, maximum power point tracking (MPPT).

Text Books:

1. S N Bhadra, D Kastha, S Banerjee, "Wind Electrical Systems", Oxford University Press, 1st Edition, 2005.
2. B HKhan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 1st Edition, 2009.

Reference Books:

1. Rashid M H "power electronics Hand book", Academic press, 1st Edition, 2001.

2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2nd Edition, 2006.
3. Rai G D, “Non conventional energy sources”, Khanna publishes, 3rd Edition, 1993.
4. Gray, L Johnson, “Wind energy system”, prentice hall linc, 1st Edition, 1995.
5. Andrzej M Trzynnadlowski, “Introduction to Modern Power Electronics”, Wiley India Pvt. Ltd, 1st Edition, 2012.

Web References:

1. http://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPTEL_NOTES
2. http://een.iust.ac.ir/profs/Arabkhabouri/Electrical%20Drives/Books/
3. https://ktu.edu.in/eu/att/attachments.htm?download=file&id=156232

E-Text Books:

1. http://www.mlbd.com/BookDecription.aspx?id=13779
2. *http://www.leeson.com/documents/PMAC_Whitepaper.pdf*

SMART GRID TECHNOLOGIES

PE-I: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB04	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand concept of smart grid and its advantages over conventional grid.
II. Explain smart metering techniques.
III. Describe the wide area measurement techniques.
IV. Understand the problems associated with integration of distributed generation & its solution through smart grid.

UNIT-I	INTRODUCTION TO SMART GRID	Classes: 09

Evolution of Electric Grid, concept of smart grid, definitions, need of smart grid, concept of robust &self healing grid present development & international policies in smart grid. introduction to smart meters, real time prizing, smart appliances, automatic meter reading (AMR), outage management system(OMS), plug in hybrid electric vehicles (PHEV), vehicle to grid, smart sensors, home, building automation, smart substations, substation automation, feeder automation.

UNIT-II	GEOGRAPHIC INFORMATION SYSTEM(GIS)	Classes: 09

Intelligent Electronic Devices (IED), their application for monitoring, protection, smart storage like battery, SMES, pumped hydro, compressed air energy storage, wide area measurement system (WAMS), phase measurement unit (PMU).

UNIT-III	CONCEPT OF MICRO-GRID	Classes: 09

Need and applications of micro grid, formation of micro grid, Issues of interconnection, protection, control of micro grid, plastic, organic solar cells, thin film solar cells, variable speed wind generators.

Fuel cells, micro turbines, captive power plants, integration of renewable energy sources.

UNIT-IV	POWER QUALITY AND EMC IN SMART GRID	Classes: 09

Power quality issues of grid connected renewable energy sources, power quality conditioners for smart grid, web based power quality monitoring, power quality audit.

UNIT-V	ADVANCED METERING INFRASTRUCTURE (AMI)	Classes: 09

Home area network (HAN), neighborhood area, network (NAN), wide area network (WAN), bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, wireless mesh network, basics of cloud computing and cyber security for smart grid, broadband over power line (BPL), IP based protocols

Text Books:

1. Ali Keyhani, "Design of Smart Power Grid Renewable Energy Systems", Wiley IEEE, 1st Edition, 2011.
2. Clark WGellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, 2nd Edition, 2009.

Reference Books:
1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”, Wiley, 2nd Edition, 2012. 2. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions”, CRC Press. 3. A GPhadke, “Synchronized Phasor Measurement and their Applications”, Springer.
Web References:
1. http://een.iust.ac.ir/profs/Arabkhabouri/Electrical%20Drives/Books/ 2. https://ktu.edu.in/eu/att/attachments.htm?download=file&id=156232
E-Text Books:
1. http://www.mlbd.com/BookDecription.aspx?id=13779 2. http://www.leeson.com/documents/PMAC_Whitepaper.pdf

DYNAMICS OF ELECTRICAL MACHINES

PE-I: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB05	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand introduce generalized modeling of electrical machines.
II. Analyze different electrical machines with dynamic modeling.
III. Understand the basic mathematical analysis of electrical machines and its characteristics.
IV. Describe the behavior of electrical machines under steady state and transient state.
V. Explain dynamic modeling of electrical machines.

UNIT-I	BASIC MACHINE THEORY	Classes: 09

Electromechanical Analogy: Magnetic saturation, rotating field theory, operation of induction motor, equivalent circuit, steady state equations of dc machines, operations of synchronous motor, power angle characteristics.

UNIT-II	ELECTRODYNAMICAL EQUATION AND THEIR SOLUTIONS	Classes:10

Spring and Plunger system: Rotational motion, mutually coupled coils, Lagrange's equation, application of Lagrange's equation solution of electro dynamical equations.

UNIT-III	DYNAMICS OF DC MACHINES	Classes: 08

Separately excited dc generations: Stead state analysis, transient analysis, separately excited dc motors.

Stead state analysis, transient analysis, inter connection of machines, ward Leonard system of speed control.

UNIT-IV	INDUCTION MACHINE DYNAMICS	Classes: 09

Induction machine dynamics during starting and braking, accelerating time, induction machine dynamic during normal operation, equation for dynamical response of the induction motor.

UNIT-V	SYNCHRONOUS MACHINE DYNAMICS	Classes: 09

Electro mechanical equation: Motor operation, generator operation, small oscillations, general equations for small oscillations, representation of the oscillation equations in state variable form.

Text Books:

1. Sen Gupta D P and JW "Electrical Machine Dynamics", Macmillan Press Ltd., 1st Edition, 1980.
2. Bimbhra P S, "Generalized Theory of Electrical Machines", Khanna Publishers, 2nd Edition, 2002.

Reference Books:

1. Vedam Subranmanyam, "Thyristor control of Electric Drives", 2nd Edition, 2002.
2. G Zenginobuz, "Performance Optimization of Induction Motors during Voltage-Controlled Soft Starting", Article in IEEE Transactions on Energy Conversion, July2004.

Web References:
1. https://nptel.ac.in/courses/108108077/ 2. https://en.wikipedia.org/wiki/Variable-frequency_drive 3. https://www.ti.com.cn/cn/lit/wp/slyy078/slyy078.pdf
E-Text Books:
1. https://www4.hcmut.edu.vn/~nntu/files/Modern_Power_Electronics_and_AC_Drives.pdf 2. https://een.iust.ac.ir/profs/Arabkhabouri/Electrical%20Drives/Books/Bimal%20K.%20Bose Power%20Electronics%20And%20Motor%20Drives_%20Advances%20and%20Trends%20(2006).pdf

POWER SEMICONDUCTOR DEVCES AND MODELLING

PE- II: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB06	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Describe improve power semiconductor device structures for adjustable speed motor control applications.
II. Explain the static and dynamic characteristics of current controlled power semiconductor devices.
III. Understand the static and dynamic characteristics of voltage controlled power semiconductor devices.
IV. Analyze the students for the selection of devices for different power electronics applications.
V. Explain the control and firing circuit for different devices.

UNIT-I	POWER DIODES	Classes: 09

Basic structure and V-I characteristics, breakdown voltages and control, on-state losses, switching characteristicsturnon transient, turn off transient and reverse recovery transient, Schottky diodes, snubber requirements for diodes, diode snubber, modelling and simulation of power diodes. 5 Hrs, power BJT'S,basic structure and V-I characteristics, breakdown voltages and control, secondary breakdown and it's control, FBSOA and RBSOA curves, on state losses, switching characteristics, resistive switching specifications, clamped inductive switching specifications, turn-on transient, turn-off transient, storage time, base drive requirements, switchinglosses.

UNIT-II	POWER BJT'S	Classes:10

Device protection- snubber requirements for BJT'S and snubber design switching aids,modeling and simulation of power BJT'S, silicon Controlled Rectifiers(thyristors),basic structure, V-I characteristics, turn on process, on state operation, turn off process, switching characteristics, turnon transient and di/dt limitations, turnoff transient, turnoff time and reapplied dv/dt limitations, gate drive requirements, ratings of thyristors,snubber requirements and snubber design, modeling and simulation ofthyristor, triac, basic structure and operation-I characteristics, ratings, snubber requirements, modeling and simulation of triacs.

UNIT-III	GATE TURNOFF THYRISTOR (GTO)	Classes: 08

Basic structure and operation, GTO switching characteristics, GTO turn on transient, GTO turn off transient, minimum on and off state times, gate drive requirements, maximum controllable anode current, over current protection of GTO'S, modelling and simulation of GTO'S.

Power MOSFET'S: Basic structure, V-I characteristics, turn-on process, on state operation, turnoff process, switching characteristics, resistive switching specifications, clamped inductive switching specifications - turn-on transient and di/dt limitations, turn-off transient, turn off time, switching losses, effect of reverse recovery transients on switching stresses and losses, dv/dtlimitations, gating requirements, gate charge, ratings of MOSFET'S, FBSOA and RBSOA curves, device protection -snubber requirements, modeling and simulation of Power MOSFET'S.

UNIT-IV	INSULATED GATE BIPOLAR TRANSISTORS (IGBTS)	Classes: 09
Basic structure and operation, latch up IGBT, switching characteristics, resistive switching specifications, clamped inductive switching specification, IGBT turn-on transient, IGBT turn off transient, current tailing, gating requirements ,ratings of IGBT'S, FBSOA and RBSOA curves, switching losses, minimum on and off state times, switching frequency capability, overcurrent protection of IGBT'S, short circuit protection, snubber requirements and snubberdesign.		
UNIT-V	**ADVANCED POWER SEMICONDUCTOR DEVICES**	**Classes: 09**
MOS gated thyristors, MOS Controlled thyristors or MOSGTO'S, base resistance controlled thyristors, emitter switched thyristor, thermal design of power electronic equipment, modelling and simulation, heat transfer by conduction, transient thermal impedance, heat sinks, heat transfer by radiation and convection - heat sink selection for power semiconductor devices.		

Text Books:

1. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics Converters, Applications and Design", Wiley India Pvt Ltd, 3rd Edition, 2011.
2. G Massobrio, P Antognetti, "Semiconductor Device Modeling with Spice", McGraw Hill, 2nd Edition, 2010.

Reference Books:

1. BJayantBaliga, "Power Semiconductor Devices", International Thompson Computer Press, st Edition, 1995.
2. V Benda, J Gowar, and D A Grant, "Discrete and Integrated Power Semiconductor Devices: Theory and Applications", John Wiley & Sons, 1st Edition 1999.

Web References:

1. Power Electronic Web Course by NPTEL, IIT Kharagpur, www.nptel.iitm.ac.in
2. https://www.Bookboon.com/en/introduction-to-power-electronics-ebook/

E-Text Books:

1. http://www.chettinadtech.ac.in/g_articlen/10-10-12/10-10-12-08-46-17-bresnav.pdf
2. http://www.docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1208&context=ecetr
3. http://www.docs.google.com/a/iare.ac.in/file/d/1QAmwi0gy0kOQKiIgpAfxu10N7Bk82TU3avy8wisTBEjtIGuKclHMSwH3-SPH/edit

REACTIVE POWER COMPENSATION AND MANAGEMENT

PE- II: PEED

Course Code	Category	Hours / Week			Credits	MaximumMarks		
		L	T	P	C	CIA	SEE	Total
BPEB07	CORE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Explain the necessity of reactive power compensation
II. Describe load compensation
III. Understand the various types of reactive power compensation in transmission systems
IV. Illustrate reactive power coordination system
V. Discuss distribution side and utility side reactive power management.

UNIT-I	**LOAD COMPENSATION**	**Classes: 09**

Objectives and specification: Reactive power characteristics, inductive and capacitive approximate biasing, load compensator as a voltage regulator, phase balancing and power factor correction of unsymmetrical loads examples.

UNIT-II	**STEADYSTATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM**	**Classes: 09**

Uncompensated line: Types of compensation, passive shunt and series and dynamic shunt compensation, examples transient state reactive power compensation in transmission systems: Characteristic time periods, passive shunt compensation, static compensations, series capacitor compensation, compensation using synchronous condensers, examples.

UNIT-III	**REACTIVE POWER COORDINATION**	**Classes: 09**

Objective,mathematical modeling, Operation planning , transmission benefits, Basic concepts of quality of power supply, disturbances steady ,state variations.

Effects of under voltages, frequency, Harmonics, radio frequency and electromagnetic interferences.

UNIT-IV	**DEMAND SIDE MANAGEMENT**	**Classes: 09**

Load patterns , basic methods load shaping , power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels; Distribution side reactive power management: System losses ,loss reduction methods , examples , Reactive power planning , objectives , Economics Planning capacitor placement , retrofitting of capacitor banks.

UNIT-V	**USER SIDE REACTIVE POWER MANAGEMENT KVAR**	**Classes: 09**

requirements for domestic appliances, Purpose of using capacitors, selection of capacitors, deciding factors, types of available capacitor, characteristics and Limitations; Reactive power management in electric traction systems and are furnaces: Typical layout of traction systems, reactive power control requirements, distribution transformers, Electric arc furnaces , basic operations- furnaces transformer, filter requirements, remedial measures , power factor of an arc furnace.

Text Books:

1. T J E Miller, “Reactive power control in Electric power systems”, Wiley Publication, 1st Edition, 1982.
2. Reactive power Management by D MTagare, Tata McGraw Hill, 1st Edition, 2004.

Reference Books:
1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just "Reactive Power Compensation: A Practical Guide", Wiley publication, 4th Edition, 2012.
Web References:
1. http://www.academia.edu/9885014/special_electrical_machines_nptel_notes 2. http://een.iust.ac.ir/profs/Arabkhabouri/Electrical%20Drives/Books/ 3. https://ktu.edu.in/eu/att/attachments.htm?download=file&id=156232
E-Text Books:
1. http://www.mlbd.com/BookDecription.aspx?id=13779 2. http://www.leeson.com/documents/PMAC_Whitepaper.pdf

HIGH FREQUENCY MAGNETIC COMPONENTS

PE- II: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB08	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Design of magnetic components (i.e., inductor and transformer) in a converter.
II. Explain the skin effect and proximity effect.
III. Perform steady-state analysis of switched mode power supply.
IV. Understand core loss in an electromagnetic device, recognize and describe its effect.
V. Describe the engineering uses of electromagnetic waves, by frequency band, and the respective hazards associated with

UNIT-I	FUNDAMENTALS OF MAGNETIC DEVICES	Classes: 09

Introduction, magnetic relationships, magnetic circuits, magnetic laws, eddy currents, core saturation, volt-second balance, inductance, inductance factor, magnetic energy, self-resonant frequency, classification of power losses in magnetic components, non-inductive coils; Magnetic CORES: Introduction, properties of core materials, magnetic dipoles, magnetic domains, curie temperature, magnetization, magnetic materials, hysteresis, core permeability, core geometries, Iron alloy cores, amorphous alloy cores, nickel, iron and cobalt,iron cores, ferrite cores, powder cores, nano-crystalline cores, superconductors, hysteresis core loss, eddy-current core loss, total core loss, complex permeability.

UNIT-II	SKIN EFFECT AND PROXIMITY EFFECT	Classes: 09

Introduction, magnet wire, wire insulation, skin depth, ratio of ac-to-dc winding resistance, skin effect in long single round conductor, current density in single round conductor, impedance of round conductor, magnetic field intensity for round wire, other methods of determining the round wire inductance, power density in round conductor, skin effect on single rectangular plate. proximity and skin effects in two parallel plates, anti-proximity and skin effects in two parallel plates, proximity effect in multiple-layer inductor, appendix: derivation of proximity power loss, winding resistance at high frequencies: introduction, winding resistance, square and round conductors, winding resistance of rectangular conductor, winding resistance of square wire, winding resistance of round wire, leakage inductance, solution for round conductor winding in cylindrical coordinates, litz wire, winding power loss for inductor current with harmonics, effective winding resistance for non-sinusoidal inductor current, thermal model of inductors.

UNIT-III	TRANSFORMERS	Classes: 09

Introduction, Neumann's formula for mutual inductance, mutual inductance, energy stored in coupled inductors, magnetizing inductance, leakage inductance, measurement of transformer inductances, stray capacitance, high-frequency transformer model, non-interleaved windings, interleaved windings, ac current transformers, winding power losses with harmonics, thermal model of transformers.

Design of transformers: Introduction, area product method, optimum flux density, transformer design for fly-back converter in CCM, transformer design for fly-back converter in DCM, transformer design for fly-back converter in CCM, transformer design for fly-back converter in DCM.

UNIT-IV	INTEGRATED INDUCTORS	Classes: 09

Introduction, resistance of rectangular trace, inductance of straight rectangular trace, construction of integrated inductors, meander inductors, inductance of straight round conductor, inductance of circular round wire loop, inductance of two-parallel wire loop, inductance of rectangle of round wire, inductance of polygon round wire loop, bond-wire inductors, single-turn planar inductor, inductance of planar square loop, planar spiral inductors, multi-metal spiral inductors, planar transformers,

MEMS inductors, inductance of coaxial cable, inductance of two-wire transmission line, eddy currents in integrated inductors, model of RF integrated inductors, PCB inductors,design of inductors: introduction, restrictions on inductors, window utilization factor, temperature rise of inductors, mean turn length of inductors, area product method, ac inductor design, inductor design for buck converter in CCM, inductor design for buck converter in DCM method.

UNIT-V	SELF-CAPACITANCE	Classes: 09

Introduction, high frequency inductor model, self-capacitance components, capacitance of parallel-plate capacitor, self-capacitance of foil winding inductors, capacitance of two parallel round conductors, capacitance of round conductor and conducting plane, self-capacitance of single-layer inductors, self-capacitance of multi-layer inductors, capacitance of coaxial cable.

Text Books:

1. Umanand L., Bhat, S R, "Design of Magnetic Components for Switched Mode Power Converters", ISBN: 978-81-224-0339-8, Wiley Eastern Publication, 1st Edition, 1992.
2. Marian K Kazimierczuk, "High-Frequency Magnetic Components", ISBN:978-0-470-71453-9 John Wiley & Sons, Inc, 1st Edition, 2009.

Reference Books:

1. G C Chryssis, "High frequency switching power supplies", McGraw Hill, 2nd Edition, 1989.
2. Eric Lowdon, "Practical Transformer Design", Handbook, Howard W. Sams & Co., Inc., 2nd Edition, 1989.
3. P L Dowell, "Effects of eddy currents in transformer windings", 1st Edition, 1994.
4. J Ding, J S Buckkeridge, "Design Considerations For A Sustainable Hybrid Energy System" IPENZ Transactions, 1st Edition, 2000.

Web References:

1. http://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPTEL_NOTES
2. http://een.iust.ac.ir/profs/Arabkhabouri/Electrical%20Drives/Books/
3. https://ktu.edu.in/eu/att/attachments.htm?download=file&id=156232

E-Text Books:

1. http://www.mlbd.com/BookDecription.aspx?id=13779
2. http://www.leeson.com/documents/PMAC_Whitepaper.pdf

MACHINE MODELLING AND ANALYSIS LABORATORY

I Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB09	Core	-	-	3	2	30	70	100
Contact Classes: 36	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Understand the methods and assumptions in modeling of machines.
II. Explain the different frames for modeling of AC machines.
III. Discuss the voltage and torque equations in state space form for different machines.

LIST OF EXPERIMENTS

Expt.1	**SPEED CONTROL OF DC MOTOTR USING MATLAB**
Develop a dynamic model of open loop controlled DC motor with digital simulation.	
Expt.2	**CLOSED LOOP SPEED CONTROL OF DC MOTOR USING MATLAB**
Develop a dynamic model of closed loop controlled DC motor with digital simulation.	
Expt.3	**CONVERSION OF ABC VOLTAGES STATIONARY REFERENCE FRAME USING MATLAB**
Convert ABC voltages into stationary frame with digital simulation	
Expt.4	**CONVERSION OF ABC VOLTAGES INTO SYNCHRONOUS REFERENCE FRAME USING MATLAB**
Convert ABC voltages into synchronous frames with digital simulation	
Expt.5	**CONVERSION OF ABC VOLTAGES INTO ROTOR REFERENCE FRAME USING MATLAB**
Convert ABC voltages into rotor reference frames with digital simulation.	
Expt.6	**DYNAMIC MODEL OF THREE PHASE INDUCTION MACHINE USING MATLAB**
Develop dynamic model of 3-phase Induction motor and generator with digital simulation.	
Expt.7	**SPEED CONTROL OF INDUCTION MOTOR WITH V/F CONTROL USING MATLAB**
Develop a mathematical model for V/f controlled 3-phase Induction motor with digital simulation.	
Expt.8	**MATHEMATICAL MODEL OF SYNCHRONOUS MOTOR WITH MATLAB**
Develop a mathematical model for 3-phase Synchronous motor with digital simulation.	

Expt.9	MATHEMATICAL MODEL OF PERMANENT MAGNET SYNCHRONOUS MOTOR WITH MATLAB
Develop a mathematical model for 3-phase permanent magnet synchronous motor with digital simulation.	
Expt.10	**MATHEMATICAL MODEL OF BRUSHLESS DC MOTOR WITH MATLAB**
Develop a mathematical model for Brushless dc motor with digital simulation.	

Reference Books:

1. R. Krishnan, "Electric Motor Drives Pearson Modeling Analysis and Control", Pearson Publications, 1st Edition, 2002.
2. B K Bose, "Modern Power Electronics and AC Drives", Pearson Publications, 1st Edition, 2008.
3. Ned Mohan, Tore M. Undeland20, William P. Robbins, "Power Electronics", John Wiley and Sons, 2nd Edition, 1990.

Web References:

1. Power Electronic Web Course by NPTEL, IIT Kharagpur, http://www.nptel.iitm.ac.in
2. hppt//www.Bookboon.com/en/introduction-to-power-electronics-ebook/
3. https://books.google.co.in/books?id=mjQskFwGUF8C&pg=PA396&lpg=PA396&dq=power+electronic+circuit+simulation+matlab

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 24 STUDENTS

HARDWARE: 05 numbers of Intel Desktop Computers with 1 GB RAM

SOFTWARE: Microsoft Windows 7 and MATLAB R2015a

POWER ELECTRONIC CONVERTERSLABORATORY

I Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB10	Core	-	-	3	2	30	70	100
Contact Classes: 36	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Understand the characteristics and principle of operation of modern power semiconductor devices.
II. Illustrate space vector PWM converter with digital simulation

LIST OF EXPERIMENTS

Expt.1	**SINGLE PHASE FULL CONVERTER USING MATLAB**
Single phase full converter using RL and E loads with digital simulation.	
Expt.2	**SINGLE PHASE SEMI CONVERTER USING MATLAB**
Single phase semi converter using RL and E loads with digital simulation.	
Expt.3	**THREE PHASE FULL CONVERTER USING MATLAB**
Three phase full converter using RL and E loads with digital simulation.	
Expt.4	**THREE PHASE SEMI CONVERTER USING MATLAB**
Three phase semi converter using RL and E loads with digital simulation.	
Expt.5	**THREE PHASE SIX STEPPED INVERTER USING MATLAB**
Three phase six stepped inverter with digital simulation	
Expt.6	**SINGLE PHASE CYCLO CONVERTER USING MATLAB**
Single phase Cyclo-converter using RL load with digital simulation.	
Expt.7	**THREE PHASE INVERTER WITH PWM CONTROL USING MATLAB**
Three-phase inverter with PWM controller with digital simulation.	
Expt.8	**BUCK, BOOST AND CUCK REGULATORS USING MATLAB**
BUCK,BOOST and CUCK regulators with digital simulation	
Expt.09	**SPACE VECTOR PWM CONVERTER WITH MATLAB**
Space vector PWM converter with digital simulation	

Expt.10	DYNAMIC MODEL FOR CLOSED LOOP CONTROL OF INDUCTION MOTOR USING MATLAB

Develop a dynamic model for closed loop control of induction motor

Reference Books:

1. R Krishnan, "Electric Motor Drives Pearson Modeling Analysis and Control", Pearson Publications, 1st Edition, 2002.
2. B K Bose, "Modern Power Electronics and AC Drives", Pearson Publications, 1st Edition, 2006.
3. Ned Mohan, Tore M. Undeland20, William P Robbins, "Power Electronics", John Wiley and Sons, 2nd Edition, 1990.

Web References:

1. Power Electronic Web Course by NPTEL, IIT Kharagpur, http://www.nptel.iitm.ac.in
2. hppt//www.Bookboon.com/en/introduction-to-power-electronics-ebook/
3. https://books.google.co.in/books?id=mjQskFwGUF8C&pg=PA396&lpg=PA396&dq=power+electronic+circuit+simulation+matlab

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 24 STUDENTS

HARDWARE: 05 number of Intel Desktop Computers with 1 GB RAM

SOFTWARE: Microsoft Windows 7 and MATLAB R2015a

ADVANCED POWER ELECTRONIC CONVERTERS

II Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB11	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand various advanced power electronics devices.
II. Describe the operation of multilevel inverters with switching strategies for high power applications.
III. Comprehend the design of resonant converters and switched mode power supplies.
IV. Develop and analyze various converter topologies.
V. Design AC or DC switched mode power supplies.

UNIT-I	MODERN POWER SEMICONDUCTOR DEVICES	Classes: 09

Modern power semiconductor devices, insulated gate bipolar transistor (IGBT), MOSFET MOS turn off thyristor (MTO), emitter turn off thyristor(ETO), integrated gate-commutated thyristor (IGCTS), MOS, controlled thyristors (MCTS), power integrated circuits (PICS), symbol, structure and equivalent circuit, comparison of their features.

UNIT-II	RESONANT PULSE INVERTERS	Classes: 09

Resonant pulse inverters: Series resonant inverters, series resonant inverters with unidirectional switches , series resonant inverters with bidirectional switches, analysis of half bridge resonant inverter, evaluation of currents and voltages of a simple resonant inverter, analysis of half bridge and full bridge resonant inverter with bidirectional switches, frequency response of series resonant inverters for series loaded inverter, for parallel loaded inverter, for series and parallel loaded inverters, parallel resonant inverters, voltage control of resonant inverters, class E resonant inverter, class E resonant rectifier, evaluationofvaluesofC'sandL'sforclassEinverterandClassErectifier, numerical problems.

UNIT-III	RESONANT CONVERTERS	Classes: 10

Resonant converters: Zero current switching resonant converters, L type ZCS resonant converter, M type ZCS resonant converter, zero voltage switching resonant converters.

Comparison between ZCS and ZVS resonant converters, two quadrant ZVS resonant converters, resonant dc-link inverters, evaluation of L and C for a zero current switching inverter, numerical problems.

UNIT-IV	MULTILEVEL INVERTERS	Classes: 08

Multilevel concept: Classification of multilevel inverters, diode clamped multilevel inverter, principle of operation, main features, improved diode clamped inverter, principle of operation, flying capacitors multilevel inverter principle of operation, main features, cascaded multilevel inverter, principle of operation, main features, multilevel inverter applications, reactive power compensation, back to back intertie system, adjustable drives, switching device currents, dc link capacitor voltage balancing, features of multilevel inverters, comparisons of multilevel converters.

UNIT-V	DC AND AC POWER SUPPLIES	Classes: 09

DC power supplies: classification, switched mode dc power supplies, fly back converter, forward converter, push pull converter, half bridge converter, full bridge converter, resonant dc power supplies, bidirectional power supplies, applications; AC power supplies: Classification, switched mode ac power supplies, resonant ac power supplies, bidirectional ac power supplies, multistage conversions, control circuit, applications, introduction, power line disturbances, power conditioners, uninterruptible power supplies, applications.

Text Books:

1. Mohammed H Rashid, "Power Electronics", Pearson Education, 3rd Edition 2004.
2. Ned Mohan, Tore MUndeland and William P Robbins, "Power Electronics", John Wiley & Sons, 2nd Edition, 2010.

Reference Books:

1. Milliman Shepherd and Lizang, "Power converters circuits", 2nd Edition, 2004.
2. M H Rashid, "Power Electronics", Hand Book.
3. Marian PKaźmier kowski, Ramu Krishnan, FredeBlabjerg, "Control in Power Electronics" illustrated Published by Academic Press, 2nd Edition, 2002

Web References:

1. https:// www.nptel.ac.in/courses/108101037/
2. https://www.princeton.edu/~stengel/MAE345Lecture8.pdfhttp://
3. https:// www.en.wikipedia.org/wiki/Hamiltonian_(control_theory)
4. https://www.nptel.ac.in/courses/108103008/

E-Text Books :

1. https://www.ece.mcmaster.ca/~ibruce/courses/EE4CL4_lecture31.pdf
2. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf
3. https://www.uodiyala.edu.iq/uploads/PDF%20ELIBRARY%20UODIYALA/EL43/Control%20System%20Design.pdf
4. https://www.calpoly.edu/~fowen/AutoMech2012/SampleBook.pdf

ELECTRICAL DRIVES

II Semester : PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB12	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand principle operation of scalar control of ac motor and corresponding speed-torque characteristics.
II. Comprehend the vector control for ac motor drive (IM and SM).
III. Explain the static resistance control and Slip power recovery drive.
IV. Describe synchronous motor drive characteristics and its control strategies.
V. Explain the principle of operation of brushless dc motor.

UNIT-I	RECTIFIER CONTROLLED DC MOTOR	Classes: 09

Rectifier controlled dc motor: Separately excited dc motors and dc series motors with single phase semi converter and single phase full converter, three phase controlled converter, control circuit, control modeling of three phase converter, steady state analysis of three phase converter control dc motor drive, two quadrant, three phase converter controlled dc motor drive, dc motor and load, converter, closed loop control of dc drive: current and speed controllers, current and speed feedback, design of controllers, current and speed controllers, motor equations, filter in the speed feedback loop speed controller, current reference generator, current controller and flow chart for simulation, harmonics and associated problems, sixth harmonics torque.

UNIT-II	CHOPPER CONTROLLED DC MOTOR DRIVES	Classes: 09

Chopper controlled dc motor drives: Principle of operation of the chopper, chopper with other power devices, model of the chopper, input to the chopper, steady state analysis of chopper controlled dc motor drives, closed loop operation, speed controlled drive system, current control loop, pulse width modulated current controller, hysteresis current controller, modeling of current controller, design of current controller.

UNIT-III	CONTROL OF INDUCTION MOTOR	Classes: 10

Introduction to motor drives: Torque production, equivalent circuit analysis, speed, Torque characteristics with variable voltage operation variable frequency operation constant v/t operation, variable stator current operation, induction motor characteristics in constant torque and field weakening regions.

Stator side control: Scalar control, voltage fed inverter control, open loop volts/Hz control, speed control slip regulation, speed control with torque and flux control, current controlled voltage fed inverter drive, rotor side control of induction motor drives: Slip power recovery drives, static Kramer drive, phasor diagram, torque expression, speed control of Kramer drive, static Scheribus drive, modes of operation.

UNIT-IV	VECTOR CONTROL OF INDUCTION MOTOR DRIVES	Classes: 08

Principles of vector control: Vector control methods, direct methods of vector control, indirect methods of vector control, adaptive control principles, self-tuning regulator model referencing control, direct torque control of ac motors.

UNIT-V	CONTROL OF SYNCHRONOUS MOTOR DRIVES	Classes: 09

Synchronous motor and its characteristics: Control strategies, constant torque angle control, unity power factor control, constant mutual flux linkage control, closed loop operation.

Text Books:

1. R. Krishnan, "Electric Motor Drives Pearson Modeling, Analysis and control", Publications, 1st Edition, 2002.
2. B K Bose, "Modern Power Electronics and AC Drives", Pearson Publications, 1st Edition, 2000.

Reference Books:

1. MD Murthy and FG Turn Bull, "Power Electronics and Control of AC Motors", Pergman Press, 1st Edition, 2008.
2. BK Bose, "Power Electronics and AC Drives", Prentice Hall Eagle wood diffs New Jersey, 1st Edition, 2002.
3. MH Rashid , "Power Electronic circuits Deices and Applications", PHI, 1st Edition,1995.
4. G K Dubey, "Fundamentals of Electrical Drives", Narosa Publications, 1st Edition, 1992.

Web References:

1. https:// www.en.wikipedia.org/wiki/Power_electronics
2. http:// www.bookboon.com/en/electrical-electronic-engineering-ebooks
3. https:// www.en.wikipedia.org/wiki/Power_optimization_(EDA)

E-Text Books :

1. https://www.utwente.nl/ewi/te/projects/past/mope/https:
2. https//www.pes.ee.ethz.ch/uploads/tx_ethpublications/ecpe_bayerninnovativ_VirtualPrototyping Optimization_FINAL.pdf
3. http://www.faculty.ece.vt.edu/lindner/Ref_PE-O-J3.pdf
4. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf

INDUSTRIAL LOAD MODELLING AND CONTROL

PE -III: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB13	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the energy demand scenario.
II. Explain the modeling of load and its ease to study load demand industrially.
III. Describe the Electricity pricing models.
IV. Discuss reactive power management in Industries.

UNIT-I	ELECTRIC ENERGY SCENARIO	Classes: 09

Demand Side Management: Industrial load management, load curves, load shaping objectives methodologies, barriers, classification of industrial loads, continuous and batch processes, load modeling.

UNIT-II	ELECTRICITY PRICING	Classes: 09

Dynamic and spot pricing: Models, direct load control, interruptible load control, bottom up approach, scheduling, formulation of load models, optimization and control algorithms, case studies.

UNIT-III	REACTIVE POWER MANAGEMENT IN INDUSTRIES	Classes: 10

Controls power: Quality impacts application of filters Energy saving in industries.

Cooling and heating loads load profiling: Modeling, cool storage types, control strategies, optimal operation problem formulation, case studies.

UNIT-IV	CAPTIVE POWER UNITS	Classes: 08

Operating and control strategies: Power pooling, operation models, energy banking, industrial cogeneration

UNIT-V	OPERATING STRATEGIES	Classes: 09

Selection of schemes, optimal operating strategies, peak load, saving constraints problem formulation case study, integrated load management for industries.

Text Books:

1. C O Bjork, “Industrial Load Management Theory”, Practice and Simulations", Elsevier, the Netherlands, 1st Edition, 1989.
2. C W Gellings and SN Talukdar, “Load management concepts”, IEEE Press, New York, 1st Edition, 1986.

Reference Books:

1. YManichaikul and F C Schweppe , “ Physically based Industrial load”, IEEE Trans. on PAS, 1st Edition, 1981.
2. H G Stoll, “Least cost Electricity Utility Planning”, Wiley Inter science Publication, USA, 1st Edition, 1989.

3. IJNagarath and D P Kothari, “Modern Power System Engineering”, Tata McGraw Hill publishers, New Delhi, 1st Edition, 1995.
4. IEEE Bronze Book, “Recommended Practice for Energy Conservation and Cost Effective Planning in Industrial Facilities”, IEEE Inc, USA.

Web References:

1. https://www.igniteengineers.com
2. https://www.ocw.nthu.edu.tw
3. https://www.uotechnology.edu.iq
4. https://www.iare.ac.in

E-Text Books :

1. https://www.etf.unssa.rs.ba/~slubura/Procesni%20racunari/Programmable%20Logic%20Controllers%204th%20Edition%20(W%20Bolton).pdf
2. https://www.idc-online.com/technical_references/pdfs/instrumentation/IntrotoPLCs.pdf
3. https://www.mycourses.ntua.gr/courses/ECE1254/document/Programmable_Controllers_-Theory_and_Implementation-.pdf
4. https://www.file:///C:/Users/iare10074/Downloads/pet10882OLCSampleChapterconstrained72.pdf

SCADA SYSTEMS AND APPLICATIONS

PE-III : PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB14	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand SCADA and its functions.
II. Describe the SCADA architecture and communication.
III. Explain the application of SCADA.

UNIT-I	**INTRODUCTION TO SCADA**	**Classes: 09**

Data acquisition systems, evolution of SCADA, communication technologies, monitoring and supervisory functions, SCADA applications in utility automation, industries SCADA.

UNIT-II	**INDUSTRIES SCADA SYSTEM COMPONENTS**	**Classes: 09**

Schemes, Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems.

UNIT-III	**SCADA ARCHITECTURE**	**Classes: 09**

Various SCADA architectures, advantages and disadvantages of each system.

Single unified standard architecture, IEC 61850.

UNIT-IV	**SCADA COMMUNICATION**	**Classes: 09**

Various industrial communication technologies, wired and wireless methods and fiber optics, open standard communication protocols.

UNIT-V	**SCADA APPLICATIONS**	**Classes: 09**

Utility applications, transmission and distribution sector, operations, monitoring, analysis and improvement. Industries: oil, gas and water, case studies, implementation, simulation exercises.

Text Books:

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 1st Edition, 2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 1st Edition, 2004.

Reference Books:

1. William T. Shaw, "Cyber Security for SCADA Systems", Penn Well Books, 1st Edition 2006.
2. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 1st Edition 2003.
3. Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", Penn Well 1st Edition, 1999.

Web References:

1. https://ieeexplore.ieee.org/Xplore/defdeny.jsp?url=http%3A%2F%2Fieeexplore.ieee.org%2Fstamp%2Fstamp.jsp%3Ftp%3D%26arnumber%3D4643960%26userType%3Dinst&denyReason=-133&arnumber=4643960&productsMatched=null&userType=inst
2. https://cordis.europa.eu/project/rcn/8960_en.html
3. https://www.researchgate.net/publication/3549822_Magnetics_modeling_for_computer-aided_design_of_power_electronics_circuits
4. https://books.google.co.in/books/about/Design_of_Electronic_Circuits_and_Comput.html?id=NwFkDi-XPHcC.

E-Text Books:

1. https://www.pwrx.com/pwrx/app/HighPwr.pdf
2. https:// www.injapan.no/energy2015-day1/files/2015/06/ESW-Iwamuro-SES.pdf
3. https://www.ijcsit.com/docs/Volume%203/vol3Issue4/ijcsit2012030403.pdf
4. https:// www.digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1043&context=elecengtheses

PWM CONVERTERS AND APPLICATIONS

PE-III:PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB15	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
II. Explain the steady state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

UNIT-I	**AC, DC AND DC, AC POWER CONVERSION**	**Classes: 09**

AC, DC and DC, AC power conversion, overview of applications of voltage source converters and current source converters.

UNIT-II	**PULSE WIDTH MODULATION TECHNIQUES**	**Classes: 09**

Pulse width modulation techniques for bridge converters, bus clamping PWM, space vector based PWM, advanced PWM techniques.

UNIT-III	**PRACTICAL DEVICES IN CONVERTER**	**Classes: 09**

Practical devices in converter, calculation of switching and conduction power losses.

UNIT-IV	**MULTILEVEL CONVERTERS**	**Classes: 09**

Compensation for dead time and DC voltage regulation, dynamic model of PWM converter, multilevel converters, constant V/F induction motor drives.

UNIT-V	**COMPENSATION**	**Classes: 09**

Estimation of current ripple and torque ripple in inverter fed drives, line side converters with power factor compensation, active power filtering, reactive power compensation, harmonic current compensation, selective harmonic elimination PWM technique for high power electric drives.

Text Books:

1. Ned Mohan, Undeand and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons, 1st Edition, 2003.
2. Erickson RW, "Fundamentals of Power Electronics", Chapman and Hall, 1st Edition, 2007.

Reference Books:

1. Vithyathil. J, "Power Electronics: Principles and Applications", Tata McGraw Hill, 1st Edition, 1998.

Web References:

1. http://www.inderscience.com/info/ingeneral/cfp.php?id=905
2. http:// www.documents.mx/documents/10-advanced-power-semiconductor-devices-and-protection.html
3. https://www.books.google.co.in/books/about/Advanced_Power_Semiconductor_Devices.html?id=Q34eAQAAIAAJ&redir_esc=y

4. http://www.nist.gov/pml/div683/grp06/power.cfm

E-Text Books:

1. https:// www.theses.lib.vt.edu/theses/available/etd-12042003-161511/unrestricted/ETD_Xu_12_03.pdf
2. http://www.pdfdrive.net/25-advanced-power-semiconductor-devices-apsd-e456994.html
3. http://catalogue.pearsoned.co.uk/samplechapter/0130167436.pdf
4. http://www.electronics.dit.ie/staff/ypanarin/Lecture%20Notes/K235-1/1%20Power%20Switches.pdf

ADVANCED MICROCONTROLLER BASED SYSTEMS

PE-IV: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB16	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the architecture of advance microcontrollers.
II. Explain the applications of these controllers.
III. Describe programming techniques of FPGA.

UNIT-I	COMPUTER ARCHITECTURE	Classes: 09

Basic computer organization, accumulator based processes, architecture, memory organization-i/o organization.

UNIT-II	MICROCONTROLLERS	Classes: 09

Microcontrollers: Intel 8051, intel8056, registers, memories, I/O ports, serial communication, timers, interrupts, programming, intel8051, assembly language programming, addressing, operations, stack and subroutines, interrupts,DMA.

UNIT-III	ARCHITECTURE PROGRAMMING	Classes: 09

PIC 16F877- Architecture programming.

Interfacing memory/ I/O Devices, Serial I/O and data communication.

UNIT-IV	INTRODUCTION TO FPGA	Classes: 09

Digital Signal Processor (DSP); Architecture programming, introduction to FPGA.

UNIT-V	MOTOR CONTROL APPLICATIONS	Classes: 09

Microcontroller: Development for motor control applications, stepper motor control using micro controller.

Text Books:

1. John F Wakerly, "Microcomputer Architecture and Programming", John Wiley and Sons, 1st Edition, 1981.
2. Ramesh S Gaonker, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing (India), 1st Edition, 1994.

Reference Books:

1. Raj Kamal, "The Concepts and Features of Microcontrollers", Wheeler Publishing, 1st Edition, 2005.
2. Kenneth J. Ayala, "The 8051 microcontroller", Cengage Learning, 1st Edition, 2004.
3. John Morton," The PIC microcontroller: your personal introductory course", Elsevier, 1st Edition, 2005.
4. Dogan Ibrahim, "Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series", Elsevier, 1st Edition, 2008.

Web References:

1. https:// www.as.wiley.com/WileyCDA/WileyTitle/productCd-1118634039.html.
2. https://www.academia.edu/3409546/Power_Electronics_Application_in_Renewable_Energy_System.
3. https://www.springer.com/us/book/9788132221180.
4. https://www.springer.com/us/book/9781447151036.

E-Text Books:

1. https://www.ijtra.com/view/role-of-power-electronics-in-non-renewable-and-renewable-energy-systems.pdf.
2. https://www.nitgoa.ac.in/News_files/STC.pdf.
3. https://www.jee.ro/covers/art.php?issue=WN1438788776W55c22ca867606.
4. https://www.magnelab.com/wp-content/uploads/2015/01/Role-of-power-electronics-in-renewable-energy-systems.pdf.

POWER QUALITY

PE-IV: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB17	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand the basics of power quality , power quality problems and power quality standards,
II. Explain about the characteristics of non-linear loads
III. Discuss the Voltage, Current, Power and Energy measurements and analysis methods of Laplace's, Fourier and Hartley and Wavelet Transforms
IV. Describe the analysis and conventional mitigation methods
V. Explain about various devices used to enhance power quality.

UNIT-I	INTRODUCTION	Classes: 09

Introduction of the Power Quality (PQ):Problem, terms used in PQvoltage, sag, swell, surges, harmonics, over voltages, spikes, voltage fluctuations, transients, interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT-II	LONG AND SHORT INTERRUPTIONS	Classes:10

Interruptions: Definition, difference between failures, outage, interruptions, causes of long interruptions , origin of interruptions, limits for the interruption frequency, limits for the interruption duration, costs of interruption, overview of reliability evaluation to power quality, comparison of observations and reliability evaluation; Short Interruptions: Definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems, multiple events, single phase tripping, voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT-III	SINGLE AND THREE-PHASE VOLTAGE SAGCHARACTERIZATION	Classes:08

Voltage sag: Definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration.

Three phase faults: Phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT-IV	POWER QUALITY CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS	Classes: 09

Voltage sag; Equipment behavior of power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation, mitigation of ac drives, adjustable speed dc drives and its operation, mitigation methods of dc drives.

UNIT-V	MITIGATION OF INTERRUPTIONS AND VOLTAGE SAG	Classes: 09

Overview of mitigation methods: from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods; System equipment interface: Voltage source converter, series voltage controller, shunt controller, combined shunt and series controller, power quality and EMC standards, introduction to standardization, IEC electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Text Books:
1. Math H J Bollen ,"Understanding Power Quality Problems", IEEE Press, 1st Edition, 2007. 2. Sastry Vedam Mulukutla S Sarma, "Power Quality VAR Compensation in Power Systems", R, CRC Press, 1st Edition, 2004.
Reference Books:
1. C Sankaran, "Power Quality", CRC Press, 1st Edition, 2007. 2. Roger C Dugan, Mark F McGranaghan, Surya Santo so, H Wayne Beaty, "Electrical Power Systems Quality, Tata McGraw Hill Education PrivateLtd, 1st Edition, 2003.
Web References:
1. https://www.en.wikipedia.org/wiki/ neural networks 2. https://www.jaicobooks.com/j/PDF%20HED/J-878%20Artificial%20Neural%20Systems.pdf 3. https://www.abebooks.co.uk/book-search/title/an-introduction-to-fuzzy-control/system.pdf
E-Text Books:
1. https://www.books.google.com / Computers/ Software Development & Engineering.pdf 2. https://www.springer.com/us/book/9783319046921.pdf 3. https://www .bookboon.com/en/introduction-to-soft-computing-ebook.pdf

INTEGRATION OF ENERGY SOURCES

PE-IV: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB18	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand the characteristics of various types of renewable energy sources and converters.
II. Explain the importance of storage and sizing of hybrid systems.
III. Discuss the control issues of isolated systems.
IV. Describe the harmonics, power quality, and voltage Imperfections, and power injection issues on the grid by integrating renewable energy sources.

UNIT-I	REVIEW OF CHARACTERISTICS OF POWER SOURCES	Classes: 09

Basic review of power generation from wind, solar PV, thermal, small hydro, biomass power strategies in each of these energy conversion systems, review of maximum PowerPoint tracking techniques in solar PV and wind (perturb and observe, hill climbs, incremental conductance).

UNIT-II	CONVERTER TOPOLOGIES	Classes:10

DC/DC converter (buck, boost, buck boost) - DC/AC inverters (sine, triangular, PWM techniques), phase locked loop for inverters.

UNIT-III	HYBRID SYSTEMS	Classes:08

Advantages of hybrid power systems: Importance of storage in hybrid power systems.

Design of hybrid power system based on load curve sizing of hybrid power systems.

UNIT-IV	ISOLATED SYSTEMS	Classes:09

Control issues in isolated systems for voltage and frequency, small signal stability in isolated power systems, importance of storage and dump load in isolated systems.

UNIT-V	ISSUES IN INTEGRATION OF RENEWABLE ENERGY SOURCES	Classes:09

Overview of challenges in integrating renewable sources to the grid, impact of harmonics on power quality, need to maintain voltage within a band and fluctuations in voltage because of renewable integration, power inverter and converter technologies, mechanism to synchronize power from renewable sources to the grid, overview of challenges faced in designing power injection from offshore generation sources, challenges in modeling intermittent nature of renewable power in a power system.

Text Books:

1. N Mohan, T M Undeland, W P Robbins, "Power Electronics Converters, Applications and Design", John Wiley and Sons, 1st Edition, 1995.
2. Hossain, Jahangir, Mahmud, "Renewable Energy Integration Challenges and Solutions Series Green Energy and Technology", Apel Eds. 1st Edition, 1998.

Reference Books:

1. A Farret, M Godoy Simões, "Integration of Alternative Sources of Energy Felix", Wiley-IEEE Press, 1st Edition, 2005.

Web References:
1. https:// www.en.wikipedia.org/wiki/Power_quality 2. https://www.energycentral.com/reference/directories/publications/690/Power-Quality-Assurance 3. https://www.cpccorp.com/pq.htm 4. https:// www.adfpowertuning.com/technology/power-quality.html
E-Text Books:
1. https://www.gcebargur.ac.in/sites/gcebargur.ac.in/files/lectures_desk/electrical_power_systems_quality.pdf 2. https:// www.prof.usb.ve/bueno/Libros/power_quality-0849310407.pdf 3. https://www.fer.unizg.hr/_download/repository/Power_Quality_Primer_-_Barry_W._Kennedy.pdf 4. https://www.pqmonitoring.com/papers/Power%20Quality%20Standards/overview.PDF

ADVANCED POWER ELECTRONIC CONVERTERS LABORATORY

II Semester: **PEED**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB19	Core	-	-	3	2	30	70	100
Contact Classes: 36	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Illustrate of various AC-AC, AC-DC, DC-DC, DC-AC converter topologies.
II. Understand the gate drive circuit configurations for converter circuits.
III. Describe the advanced converter topologies.

List of Experiments

Expt.1	**DIODE CLAMPED MULTILEVEL INVERTER USING MATLAB**
Single phase diode clamped Multilevel inverter with digital simulation.	
Expt.2	**FLYING CAPACITOR MULTILEVEL INVERTER USING MATLAB**
Single phase flying capacitor Multilevel inverter with digital simulation.	
Expt.3	**CASCADED MULTILEVEL INVERTER USING MATLAB**
Single phase cascaded Multilevel inverter with digital simulation.	
Expt.4	**PUSH PULL CONVERTER USING MATLAB**
Push pull converter with digital simulation.	
Expt.5	**FLY BACK CONVERTER USING MATLAB**
Fly back converter with digital simulation.	
Expt.6	**FORWARD CONVERTER USING MATLAB**
Forward converter with digital simulation.	
Expt.7	**SERIES RESONANT CONVERTER USING MATLAB**
Series resonant converter with digital simulation.	
Expt.8	**PARALLEL RESONANT CONVERTER USING MATLAB**
Parallel resonant converter with digital simulation.	
Expt.9	**ZERO VOLTAGE SWITCHING CONVERTER USING MATLAB**
Zero voltage switching with digital simulation.	
Expt.10	**ZERO CURRENT SWITCHING CONVERTER USING MATLAB**
Zero current switching with digital simulation.	

Reference Books:

1. R Krishnan, “Electric Motor Drives Pearson Modeling Analysis and Control”, Pearson Publications, 1st Edition, 2002.
2. B K Bose, “Modern Power Electronics and AC Drives”, Pearson Publications, 1st Edition, 2002.
3. Ned Mohan, Tore M. Undeland20, William P. Robbins, “Power Electronics”, John Wiley and Sons, 2nd Edition, 1990.

Web References:

1. Power Electronic Web Course by NPTEL, IIT Kharagpur, http://www.nptel.iitm.ac.in
2. hppt//www.Bookboon.com/en/introduction-to-power-electronics-ebook/
3. https://books.google.co.in/books?id=mjQskFwGUF8C&pg=PA396&lpg=PA396&dq=power+electronic+circuit+simulation+matlab

LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 24 STUDENTS

HARDWARE: 05 numbers of Intel Desktop Computers with 1 GB RAM

SOFTWARE: Microsoft Windows 7 and MATLAB R2015a

ELECTRIC DRIVES LABORATORY

II Semester: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB20	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 33				Total Classes: 33		

OBJECTIVES :

This course should enable the students to:

I. Understand PMDC motor drive characteristics and its control techniques.
II. Comprehend the speed control for ac motor drive.
III. Explain the static resistance control and Slip power recovery drive.
IV. Discuss the principle of operation of advanced converters.

LIST OF EXPERIMENTS

Week 1	**PMDC MOTOR**
Speed Measurement and closed loop control using PMDC motor.	
Week 2	**DUAL CONVERTER**
Study the characteristics of single phase dual converter with R and RL loads.	
Week 3	**THREE PHASE HALF CONVERTER**
Plot the characteristics of three phase half converter with R and RL loads.	
Week 4	**SPEED CONTROL OF INDUCTION MOTOR USING VVVF DRIVE**
Speed control of induction motor using VVVF drive in three phase AC to three phase variable AC with 400V line voltage	
Week5	**THREE PHASE WOUND ROTOR INDUCTION MOTOR**
Speed control of three phase wound rotor induction motor using static rotor resistance control.	
Week 6	**FOUR QUADRANT CHOPPER DRIVE**
Study of closed loop speed control of DC motor using three phase fed four quadrant chopper drive.	
Week 7	**DC MOTOR WITH THYRISTOR DRIVE**
Open loop speed control of DC motor using 1hp thyristor drive	
Week 8	**CLOSED LOOP CONTROL DC MOTOR**
Closed loop speed control of DC motor using 3 hp thyristor drive	
Week 9	**SPEED CONTROL INDUCTION MOTOR**
Open loop speed control of a squirrel cage induction motor by means of a potentiometer using 0.25 hp VFD.	
Week10	**SPEED CONTROL OF INDUCTION MOTOR BY TOGGLE SWITCHES**
Open loop speed control of a squirrel cage induction motor by means of toggle switches using 0.25 hp VFD.	

Text Books:
1. Dr. P S Bimbhra, “Power Electronics”, Khanna Pubishers, 1st Edition, 2009. 2. Philip T Krein, “Elements of Power Electronics”, Oxford University Press, 1st Edition, 2003.
Reference Books:
1. M S JamilAsghar, “Power Electronics”, PHI Private Limited. 2. John GKassakian ,”Principles of Power Electronics”, Martin F. Schlect, Geroge C.
Web References:
1. https://www.ni.com/newsletter/51141/en/http://www.csun.edu/~rd436460/Labview/Lecture-Overview.pdf 2. https://www.labviewmakerhub.com/ 3. https://www.home.hit.no/~hansha/documents/labview.
E-Text Books:
1. https://www.freebookcentre.net 2. https://www.amazon.in/power-electronics-handbook 3. https://www.circuitstoday.com

ELIABILITY ENGINEERING

PE-V: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB22	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand the single phase inverter applications and implementation.
II. comprehend the concept of reliability and unreliability
III. Explain the expressions for probability of failure, expected value and standard deviation of binominal distribution, poisson distribution, normal distribution and weibull distributions.
IV. Discuss the expressions for reliability analysis of series-parallel and non-series parallel systems
V. Describe the expressions for time dependent and limiting state probabilities using markov models.

UNIT-I	RELIABILITY AND PROBABILITY	Classes: 09

Rules for combining probabilities of events, definition of reliability, significance of the terms appearing in the definition; Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, binominal distribution, Poisson distribution, normal distribution, exponential distribution,Weibull distribution.

UNIT-II	HAZARD RATE	Classes: 10

Derivation of the reliability function in terms of the hazard rate, failures, causes of failures, types of failures (early failures, chance failures and wear-out failures),bath tub curve, preventive and corrective maintenance, modes of failure, measures of reliability, mean time to failure and mean time between failures.

UNIT-III	CLASSIFICATION OF ENGINEERING SYSTEMS	Classes: 08

Series, parallel and series-parallel systems: Expressions for the reliability of the basic configurations.
Reliability evaluation of non-series parallel configurations: decomposition, Path based and cutest based methods, Deduction of the Paths and cut-sets from Event tree.

UNIT-IV	DISCRETE MARKOV CHAINS	Classes: 09

General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model, absorbing states; Continuous Markov processes: Modeling concepts, State space diagrams, stochastic transitional probability matrix, evaluating time dependent and limiting state probabilities of one component repairable model, evaluation of limiting state probabilities of two component repairable model.

UNIT-V	FREQUENCY AND DURATION TECHNIQUES	Classes: 09

Frequency and duration concepts, application to multi state problems, Frequency balance approach;
Approximate system reliability evaluation: Series systems, parallel systems, network reduction techniques, cut set approach, common mode failures modeling and evaluation techniques, examples.

Text Books:

1. Roy Billinton and Ronald NAllan “Reliability evaluation of Engineering systems”, BS Publications, 1st Edition, 1996.
2. Elsayed A Elsayed, “Reliability Engineering”, Prentice Hall Publications, 1st Edition, 1998.

Reference Books:

1. Alessandro Birolini, “Reliability Engineering: Theory and Practice”, Springer Publications, 1st Edition, 2008.
2. Charles Ebeling, “An Introduction to Reliability and Maintainability Engineering”, TMH Publications, 1st Edition, 1996.

3. E Balaguruswamy, “Reliability Engineering”, TMH Publications, 1st Edition, 1997.

Web References:

1. https:// www.en.wikipedia.org/wiki/Power_inverter
2. https://www.energy.ca.gov/electricity_analysis/rule21/
3. https:// www.nptel.ac.in/syllabus/108108035/

E-Text Books:

1. https:// www.ethesis.nitrkl.ac.in/3464/1/Final025.pdf
2. https://www.smps.us/power-inverter.html
3. https:// www.ethesis.nitrkl.ac.in/1873/1/piyush.pdf
4. https:// www.ecee.colorado.edu/copec/book/slides/Ch6slide.pdf

FLEXIBLE AC TRANSMISSION SYSTEMS

PE-V: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB23	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understanding of uncompensated lines and their behavior under heavy loading conditions.
II. Explain the concept and importance controllable parameters of FACTS controllers.
III. Describe the objectives of Shunt compensation, and basic operation of SVC and STATCOM.
IV. analyze the functioning of series controllers like GCSC, TSSC and TCSC

UNIT-I	**FACTS CONCEPTS**	**Classes: 09**

Transmission interconnections power flow in an ac system, loading capability limits, dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTScontrollers.

UNIT-II	**VOLTAGE SOURCE CONVERTERS**	**Classes: 09**

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation, three level voltage source converter, pulse width modulation converter, basic concept of current source converters, and comparison of current source converters with voltage source converters.

UNIT-III	**STATIC SHUNT COMPENSATION**	**Classes: 09**

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-IV	**SVC AND STATCOM**	**Classes: 09**

A The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT-V	**STATIC SERIES COMPENSATORS**	**Classes: 09**

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC) Control schemes for GSC TSSC and TCSC.

Text Books:

1. Sanjit K Mitra, "Digital Signal Processing: A computer-based approach ", Tata McGraw-Hill, 2nd Edition, 1998.
2. Dimitris G Manolakis, Vinay K Ingle and Stephen M Kogon, "Statistical and Adaptive Signal Processing", Mc Graw Hill international, 3rd Editions, 2000.

Reference Books:

1. S Salivahanan, AVallavaraj, C Gnanapriya "Digital Signal Processing", TMH 2nd Edition, 2001.
2. Lourens R Rebinar and Bernold, "Theory and Applications of Digital Signal Processing", 2nd Edition, 1996.
3. Auntoniam, Digital Filter Analysis and Design, TMH, 1st Edition, 1998.

Web References:
1. http://www.smartgridnews.com/story/understanding-and-designing-smart-grid/2012-02-07 2. http://w3.usa.siemens.com/smartgrid/us/en/transmission-grid/products/grid-analysis-tools/pages/grid-analysis-tools.aspx 3. http://digitalcommons.georgiasouthern.edu/cgi/viewcontent.cgi?article=1021&context=electrical-eng-facpubs 4. http://energy.sandia.gov/energy/ssrei/gridmod/renewable-energy-integration/smart-grid-tools-and-technology/
E-Text Books:
1. http:// www.s1.downloadmienphi.net/file/downloadfile6/192/1385280.pdf 2. http://www.gbv.de/dms/tib-ub-hannover/664445780.pdf 3. http://www.ieee-pes.org/presentations/gm2014/PESGM2014P-001876.pdf

HVDC TRANSMISSION

PE-V: PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPEB24	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

This course should enable the students to:

I. Understand HVDC technology.
II. Explain the methods to carry out modeling and analysis of HVDC system.

UNIT-I	**INTRODUCTION TO HVDC TRANSMISSION**	**Classes: 09**

Development of HVDC technology: DC versus AC transmission, selection of converter configuration. Rectifier and inverter operation, digital simulation of converters, control of HVDC converters and systems.

UNIT-II	**CONTROLLING TECHNIQUES**	**Classes: 10**

Individual phase control, equidistant firing controls, higher level controls, characteristics and non-characteristics harmonics filter design, fault development and protection.

UNIT-III	**INTERACTION BETWEEN AC DC POWER SYSTEMS**	**Classes: 08**

Interaction between AC-DC power systems. Over voltages on AC/DC side.

Multi-terminal HVDC systems, control of MTDC systems.

UNIT-IV	**POWER FLOW SOLUTION IN HVDC SYSTEMS**	**Classes: 09**

Modeling of HVDC systems, per unit system, representation for power flow solution, representation for stability studies.

UNIT-V	**HV TESTS AND MEASUREMENTS**	**Classes: 09**

Introduction to relevant national and international standards, safe clearances for HV, study regulations for HV tests, digital techniques in HV measurements.

Text Books:

1. J Arrillaga, “High Voltage Direct Transmission”, Peter Peregrinus Ltd. London, 1st Edition, 1983.
2. K R Padiyar, “HVDC Power Transmission Systems”, Wiley Eastern Ltd., 1st Edition, 1990.

Reference Books:

1. E W Kimbark, “Direct Current Transmission”, Vol. I, Wiley Interscience, 1st Edition 1971.
2. Erich Uhlmann, “Power Transmission by Direct Current”, B.S. Publications, 1st Edition 2004.

Web References:

1. https://www.sites.google.com/site/vrpsundar/Home/lecture.
2. https://www.Bookboon.com/en/introduction-to-power-electronics-ebook/
3. https://www.en.wikipedia.org/wiki/Virtual_instrumentation

E-Text Books:

1. https://www.dsp-book.narod.ru/302.pdf
2. https://www.amazon.in/CAD-CAM-Computer-Aided-Design-Manufacturing-ebook/dp/B001JNJDGY
3. https://www.eolss.net/sample-chapters/c05/e6-39a-04-08.pdf

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB31	Core	2	-	-	2	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand research problem formulation.
II. Analyze research related information
III. Follow research ethics
IV. Understand that today's world is controlled by Computer, Information Technology; but tomorrow world will be ruled by ideas, concept, and creativity.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II	**RESEARCH ETHICS**	**Classes: 09**

Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT-III	**RESEARCH PROPOSAL**	**Classes: 09**

Effective technical writing, how to write report, Paper Developing a Research Proposal,

Format of research proposal, a presentation and assessment by a review committee

UNIT-IV	**PATENTING**	**Classes: 09**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-V	**PATENT RIGHTS**	**Classes: 09**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

Reference Books:
1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd , 2007. 2. Mayall , “Industrial Design”, McGraw Hill, 1992. 3. Niebel , “Product Design”, McGraw Hill, 1974. 4. Asimov , “Introduction to Design”, Prentice Hall, 1962.
Web References:
1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in NewTechnological Age”, 2016 2. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008
E-Text Books:
1. http://nptel.ac.in/courses/107108011/

BUSINESS ANALYTICS

Open Electives

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB25	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the role of business analytics within an organization.
II. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
IV. To become familiar with processes needed to develop, report, and analyze business data.
V. Use decision-making tools/Operations research techniques.
VI. Mange business process using analytical and management tools.
VII. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

UNIT-I	BUSINESS ANALYTICS	Classes: 09

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT-II	REGRESSION ANALYSIS	Classes: 09

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III	ORGANIZATION STRUCTURES	Classes: 09

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

UNIT-IV	FORCASTING TECHNIQUES	Classes: 09

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V	DECISION ANALYSIS	Classes: 09
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.		
Text Books		
1. James Evans, "Business Analytics", Persons Education.		
Reference Books		
1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press.		
Web References		
1. http://nptel.ac.in/courses/110107092/		
E-Text Books		
1. http://nptel.ac.in/downloads/110107092/		

INDUSTRIAL SAFETY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB26	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Ensuring duty holders apply inherent safety principles in managing risks.
II. Prioritizing interventions based on the inherent hazards of the site and/or pipeline, performance of duty holders in controlling risks and other defined operational intelligence.
III. Identifying the underlying, as well as the immediate, causes of any deficiencies in duty holders arrangements for managing risks.
IV. Taking action to ensure immediate and underlying causes of failures of risk management are addressed.

UNIT-I	INDUSTRIAL SAFTEY	Classes: 09

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II	MAINTENANCE ENGINEERING	Classes: 09

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III	CORROSION AND PREVENTION TECHNIQUES	Classes: 09

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i.e. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication.

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV	FAULT TRACING	Classes: 09

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V	PERODIC AND PREVENTIVE MAINTENANCE	Classes: 09

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Text Books
1. Higgins & Morrow, “Maintenance Engineering Handbook”, Da Information Services. 2. H. P. Garg, “Maintenance Engineering”, S. Chand and Company.
Reference Books
1. Audels, “Pump-hydraulic Compressors”, Mcgraw Hill Publication. 2. Winterkorn, Hans, “Foundation Engineering Handbook”, Chapman & Hall London.
Web References
1. https://onlinecourses.nptel.ac.in/noc18_mg42/preview
E-Text Books
1. http://portal.unimap.edu.my/portal/page/portal30/Lecturer%20Notes/KEJURUTERAAN_KOMPUTER/Semester%201%20Sidang%20Akademik%2020142015/DPT333%20Industrial%20safety%20and%20health/Chapter%201%20-%20Introduction%20-Zaizu_0.pdf

OPERATIONS RESEARCH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB27	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The student should enable the students to:

I. Apply the dynamic programming to solve problems of discreet and continuous variables.
II. Understand the concept of nonlinear programming.
III. Describe the sensitivity analysis.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT-II	**FORMULATION TECHNIQUES**	**Classes: 09**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

UNIT-III	**NON LINEAR METHODS**	**Classes: 09**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem.

max flow problem - CPM/PERT.

UNIT-IV	**SCHEDULING MODELS**	**Classes: 09**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT-V	**DYNAMIC PROGRAMMING AND GAME THEORY**	**Classes: 09**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Text Books

1. H.A. Taha, "Operations Research - An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982.
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Reference Books

1. Hitler Libermann,"Operations Research" McGraw Hill Publications, 2009.
2. Pannerselvam, "Operations Research" Prentice Hall of India, 2010.
3. Harvey M Wagner, "Principles of Operations Research" Prentice Hall of India, 2010.

Web References

1. https://onlinecourses.nptel.ac.in/noc17_mg10/preview

E-Text Books

1. http://nptel.ac.in/courses/112106134/

COST MANAGEMENT OF ENGINEERING PROJECTS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB28	Open Elective	3	-	-	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

OBJECTIVES:

The course should enable the students to:

I. Establish systems to help streamline the transactions between corporate support departments and the operating units.
II. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units
III. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

UNIT-I	INTRODUCTION	Classes: 09

Introduction and Overview of the Strategic Cost Management Process

UNIT-II	COST CONCEPTS	Classes: 09

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and OpportUNITy cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-III	PROJECT MANAGEMENT	Classes: 09

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents.

Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT-IV	COST BEHAVIOR AND PROFIT PLANNING	Classes: 09

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement, Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V	QUANTITATIVE TECHNIQUES	Classes: 09

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation Problems, Assignment problems, Simulation, Learning Curve Theory.

Text Books

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Reference Books

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.

Web References
1. https://onlinecourses.nptel.ac.in/noc16_ce02/preview
E-Text Books
1. http://nptel.ac.in/downloads/110101003/

COMPOSITE MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB29	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the manufacturing processes of reinforcement fibers and matrices for composites.
II. Understand the concept of tailored design philosophy.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II	**REINFORCEMENTS**	**Classes: 09**

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III	**MANUFACTURING OF METAL MATRIX COMPOSITES**	**Classes: 09**

Casting, Solid State diffusion technique, Cladding, Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites.

Liquid Metal Infiltration, Liquid phase sintering. Manufacturing of Carbon, Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV	**MANUFACTURING OF POLYMER MATRIX COMPOSITES**	**Classes: 09**

Preparation of Moulding compounds and prepregs, hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Properties and applications.

UNIT-V	**STRENGTH**	**Classes: 09**

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. R.W.Cahn, “Material Science and Technology” VCH, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam, “Materials Science and Engineering, An introduction”, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. ed-Lubin, “Hand Book of Composite Materials”
2. Deborah D.L. Chung, “Composite Materials Science and Applications”
3. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, “Composite Materials Design and Applications”

Web References:

1. https://freevideolectures.com/course/3479/processing-of-non-metals/5

E-Text Books:

1. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf

WASTE TO ENERGY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB30	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the principles associated with effective energy management and to apply these principles in the day to day life.
II. Develop insight into the collection, transfer and transport of municipal solid waste.
III. Explain the design and operation of a municipal solid wasteland fill.
IV. Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

UNIT-I	INTRODUCTION TO ENERGY FROM WASTE	Classes: 09

Introduction to Energy from Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste. MSW, Conversion devices. Incinerators, gasifiers, digestors

UNIT-II	BIOMASS PYROLYSIS	Classes: 09

Biomass Pyrolysis: Pyrolysis, Types, slow fast , Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III	BIOMASS GASIFICATION	Classes: 09

Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation. Gasifier burner arrangement for thermal heating.

Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV	BIOMASS COMBUSTION	Classes: 09

Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V	BIOGAS	Classes: 09

Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system. Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion. Types of biogas Plants, Applications. Alcohol production from biomass, Bio diesel production. Urban waste to energy conversion, Biomass energy programme in India.

Text Books:

1. Desai, Ashok V, “Non Conventional Energy”, Wiley Eastern Ltd., 1990.

Reference Books:

1. Khandelwal, K. C. and Mahdi, S. S, “Biogas Technology - A Practical Hand Book”, Vol. I & II Tata McGraw Hill Publishing Co. Ltd., 1983.
2. Challal, D. S, “Food, Feed and Fuel from Biomass”, IBH Publishing Co. Pvt. Ltd., 1991.

Web References:

1. http://nptel.ac.in/courses/103107125/

E-Text Books:

1. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996..

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB32	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Understand that how to improve your writing skills and level of readability
II. Learn about what to write in each section
III. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I	**PLANNING AND PREPARATION**	**Classes: 04**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II	**ABSTRACT**	**Classes: 05**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III	**DISCUSSION AND CONCLUSIONS**	**Classes: 05**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-IV	**WRITING SKILLS**	**Classes: 05**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-V	**QUALITY AND TIME MAINTENANCE**	**Classes: 05**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books:

1. Goldbort R, "Writing for Science", Yale University Press. 2011.
2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's book.

Web References:

1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf

E-Text Books:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

DISASTER MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB33	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I	INTRODUCTION	Classes: 04

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT-II	REPERCUSSIONS OF DISASTERS AND HAZARDS	Classes: 05

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT-III	DISASTER PRONE AREAS IN INDIA	Classes: 05

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT-IV	DISASTER PREPAREDNESS AND MANAGEMENT	Classes: 05

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT-V	RISK ASSESSMENT & DISASTER MITIGATION	Classes: 05

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Text Books:
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.
Reference Books:
1. Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi. 2. Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.
Web References:
1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf
E-Text Books:
1. Disaster management by Vinod k. Sharma

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB34	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Get a working knowledge in illustrious Sanskrit, the scientific language in the world
II. Learning of Sanskrit to improve brain functioning
III. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
IV. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

UNIT-I	**INTRODUCTION**	**Classes: 04**
Alphabets in Sanskrit, Past/Present/Future Tense		
UNIT-II	**SENTENCES**	**Classes: 04**
Simple Sentences		
UNIT-III	**ROOTS**	**Classes: 04**
Order, Introduction of roots		
UNIT-IV	**SANSKRIT LITERATURE**	**Classes: 04**
Technical information about Sanskrit Literature		
UNIT-V	**TECHNICAL CONCEPTS**	**Classes: 08**
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics		

Text Books:

1. Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi..

Reference Books:

1. Dr.Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, New Delhi

Web References:

1. http://learnsanskritonline.com/

E-Text Books:

1. Prathama Deeksha-Vempati Kutumb Shastri, "Teach Yourself Sanskrit", Rashtriya Sanskri Sansthanam, New Delhi Publication.

VALUE EDUCATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB35	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

UNIT-I	**VALUES AND SELF-DEVELOPMENT**	**Classes: 04**

Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

UNIT-II	**CULTIVATION OF VALUES**	**Classes: 06**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

UNIT-III	**PERSONALITY AND BEHAVIOR DEVELOPMENT**	**Classes: 06**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV	**CHARACTER AND COMPETENCE**	**Classes: 03**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

UNIT-V	**SELF CONTROL**	**Classes: 03**

All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Text Books:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

Web References:

1. http://www.best-personal-development-books.com/personal-value-development.html
2. http://nptel.ac.in/courses/109104068/

E-Text Books:

1. R.P. Shukla, “Value education and human rights”.

CONSTITUTION OF INDIA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB36	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Understand the premises informing the twin themes of liberty and freedom from a civil right perspective.
II. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION	Classes: 08

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT-II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	Classes: 04

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III	ORGANS OF GOVERNANCE	Classes: 04

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Minister.

Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT-IV	LOCAL ADMINISTRATION	Classes: 04

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT-V	ELECTION COMMISSION	Classes: 04

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
2. M. P. Jain, "Indian Constitution Law", Lexis Nexis, 7th Edition,2014.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web References:
1. http://www.constitution.org/cons/india/p18.html
E-Text Books:
1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

PEDAGOGY STUDIES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB37	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers.
II. Identify critical evidence gaps to guide the development.

UNIT-I	INTRODUCTION	Classes: 04

Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II	THEMATIC OVERVIEW	Classes: 02

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III	PEDAGOGICAL PRACTICES	Classes: 04

Evidence on the effectiveness of pedagogical practices. Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV	PROFESSIONAL DEVELOPMENT	Classes: 04

Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

UNIT-V	RESEARCH GAPS	Classes: 02

Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

Reference Books:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

Web References:
1. www.pratham.org/images/resource%20working%20paper%202.pdf. 2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell
E-Text Books:
1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB38	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. To achieve overall health of body and mind.
II. To overcome stress.

UNIT-I	**INTRODUCTION**	**Classes: 08**
Definitions of Eight parts of yog. (Ashtanga)		
UNIT-II	**YAM AND NIYAM**	**Classes: 04**
Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha		
UNIT-III	**SHAUCHA**	**Classes: 04**
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan		
UNIT-IV	**ASAN AND PRANAYAM**	**Classes: 04**
Asan and Pranayam. Various yog poses and their benefits for mind & body		
UNIT-V	**BREATHING TECHNIQUES**	**Classes: 04**
Regularization of breathing techniques and its effects-Types of pranayam		

Text Books:

1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata

Reference Books:

1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur

Web References:

1. https://americanyoga.school/course/anatomy-for-asana/
2. https://www.yogaasanasonline.com/

E-Text Books:

1. "Stress Management By Yoga" by Todd A. Hoover, M. D. D., Ht.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB39	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

OBJECTIVES:

The course should enable the students to:

I. To learn to achieve the highest goal happily
II. To become a person with stable mind, pleasing personality and determination
III. To awaken wisdom in students

UNIT-I	**HOLISTIC DEVELOPMENT**	**Classes: 08**

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

UNIT-II	**BHAGWAD GEETA**	**Classes: 04**

Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3-Verses 13, 21, 27, 35.

UNIT-III	**BHAGWAD GEETA**	**Classes: 04**

Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT-IV	**BASIC KNOWLEDGE**	**Classes: 04**

Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT-V	**ROLE MODEL**	**Classes: 04**

Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63

Text Books:

1. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

Reference Books:

1. Swami Swarupananda, "Srimad Bhagavad Gita",Advaita Ashram (Publication Department), Kolkata.

Web References:

1. http://openlearningworld.com/section_personality_development.html

E-Text Books:

1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

M.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: 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 **(Design/Development of Solutions).**

PO-4: 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 **(Conduct Investigations of Complex Problems).**

PO-5: 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 **(Modern Tool Usage).**

PO-6: 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 **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: 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 **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: 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 **(Life-long learning).**

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Programme Educational Objectives (PEO's)

A graduate of the Electrical and Electronics Engineering Program should:

A graduate of the Electrical and Electronics Engineering Program should:

PEO – I: To provide students with the knowledge of Basic Sciences in general and Electrical and electronics Engineering in particular so as to acquire the necessary skills for analysis and synthesis of problems in generation, transmission and distribution.

PEO – II: To provide technical knowledge and skills to identify, comprehend and solve complex tasks in industry and research and inspire the students to become future researchers / scientists with innovative ideas.

PEO – III: To prepare the students for successful employment in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to handle critical situations and meet deadlines.

PEO – IV: To train the students in basic human and technical communication skills so that they may be good team-members, leaders and responsible citizen.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: Able to utilize the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based teamwork.

PSO – II: Can explore the scientific theories, ideas, methodologies and the new cutting edge Technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.

PSO – III: The understanding of technologies like PLC, PMC, process controllers, transducers and HMI one can analyze, design electrical and electronics principles to install, test , maintain power system and applications.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**
   In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. **Shall IARE award its own Degrees?**
   No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. **What is the difference between a Deemed University and an Autonomy College?**
   A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. **How will the Foreign Universities or other stake – holders know that we are an Autonomous College?**
   Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. **What is the change of Status for Students and Teachers if we become Autonomous?**
   An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. **Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?**
   There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. **Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?**
   No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. **Can IARE have its own Convocation?**
   No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. **Can IARE give a provisional degree certificate?**
   Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. **Will Academic Autonomy make a positive impact on the Placements or Employability?**
Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. **What is the proportion of Internal and External Assessment as an Autonomous College?**
Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. **Is it possible to have complete Internal Assessment for Theory or Practicals?**
Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. **Why Credit based Grade System?**
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. **What exactly is a Credit based Grade System?**
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B,C,D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. **What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?**
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. **What is a Semester Grade Point Average (SGPA)?**
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and $i$represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. **What is a Cumulative Grade Point Average (CGPA)?**
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{n} (C_i S_i) / \sum_{j=1}^{n} C_i$$

Where,S_i is the SGPA of the i^{th}semester and $C_i$is the total number of credits in that semester and *j*represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. **Is there any Software available for calculating Grade point averages and converting the same into Grades?**
Yes,The institute has its own MIS software for calculation of SGPA,CGPA,etc.

19. **Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?**
No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. **Will there be any Revaluation or Re-Examination System?**
No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. **How fast Syllabi can be and should be changed?**
Autonomy allows us the freedom to change the syllabi as often as we need.

22. **Will the Degree be awarded on the basis of only final year performance?**
No. The CGPA will reflect the average performance of all the semester taken together.

23. **What are Statutory Academic Bodies?**
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24. **Who takes Decisions on Academic matters?**
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25. **What is the role of Examination committee?**
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc fall within the duties of the Examination Committee.

26. **Is there any mechanism for Grievance Redressal?**
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. **How many attempts are permitted for obtaining a Degree?**
All such matters are defined in Rules & Regulation

28. **Who declares the result?**
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual

deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. **Who will keep the Student Academic Records, University or IARE?**
    It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30. **What is our relationship with the JNT University?**
    We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31. **Shall we require University approval if we want to start any New Courses?**
    Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32. **Shall we get autonomy for PG and Doctoral Programmes also?**
    Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and

		project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT/PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms. ---------- joining I Semester for the academic year 2018-2019 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R18 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number