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
ELECTRICAL POWER SYSTEMS

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 2019 - 20)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE VISION | MISSION | QUALITY POLICY

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.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

To produce comprehensively trained, socially responsible, innovative electrical engineers and researchers of high quality who can contribute for the nation's and global development.

MISSION

The mission of Electrical and Electronics Engineering is to provide academic environment with a strong theoretical foundation, practical engineering skills, experience in interpersonal communication and teamwork along with emphasis on ethics, professional conduct and critical thinking. Further, the graduates will be trained to have successful engagement in research and development and entrepreneurship.

M. TECH (EEE) - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

The students of M.Tech - Electrical Power Systems, are prepared to:

PEO - I	Impart engineering knowledge in specific and re-equip with latest technologies to analyze, synthesize the problems in power system and multidisciplinary sectors.
PEO - II	Design, develop innovative products and services in the field of electrical power systems with the latest technology and toolset.
PEO - III	Inculcate research attitude and life-long learning for a successful career.
PEO - IV	Attain intellectual leadership skills to cater the needs of power industry, academia, society and environment.

M.TECH - PROGRAM OUTCOMES (PO's)

Upon completion of M.Tech Degree, the students will be able to:

PO - 1	An ability to independently carry out research/investigation and development work to solve practical problems.
PO - 2	An ability to write and present a substantial technical report / document.
PO - 3	Student should be able to demonstrate a degree of mastery over Electrical Power System in designing and analyzing real-life engineering problems and to provide strategic solutions ethically.
PO - 4	Identify, formulate and solve complex problems on modern-day issues of Power Systems using advanced technologies with a global perspective and envisage advanced research in thrust areas.
PO - 5	Model and apply appropriate techniques and modern tools on contemporary issues in multidisciplinary environment.
PO - 6	Engage in life-long learning for continuing education in doctoral level studies and professional development.

CONTENTS

"Take up one idea. Make that one idea your 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 innature.

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 perweek.

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: Master of Technology (M.Tech) degree program.

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

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 thestudent.

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 2019- 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 CREDITSYSTEM

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 earning 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 learningoutcomesandcomprisesoflectures/tutorials/laboratorywork/fieldwork/projectwork /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 FORADMISSION

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 program will be placed in one of the seven 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 OFCOURSES

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 ElectiveCourse:

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 PROGRAMDURATION

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 fulfil 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 ANDCOURSESTRUCTURE

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 Table3.

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)and70marksforSemesterEndExamination(SEE).Outof30marks allotted for CIE during the semester, marks are awarded by taking average of two session 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 weight age 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 assessmentand70marksforsemesterendlabexamination.Outof30marksofinternal 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 laboratory 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 DETENTIONPOLICY

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.

10.4 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.

10.5 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.

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

10.7 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.

10.8 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 read mission 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 ANDEVALUATION

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 externalexaminer.

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 SCHEMEFORTHEAWARDOFGRADE

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 andSEE

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 apass.

13.0 LETTER GRADES AND GRADEPOINTS

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
90% and above (≥ 90% , ≤ 100%)	10	S (Superior)
Below 90% but not less than 80% (≥80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% (≥70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% (≥60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% (≥ 50% , <60%)	6	B (Average)
Below 50% (< 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 tocompute 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 students 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 up to the semester and m represent the number of semesters completed in which a student registered up to the semester.

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

15.0ILLUSTRATION OF COMPUTATION OF SGPA ANDCGPA

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 AWARDOFDEGREE

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 provisionalcertificatesubjecttothefulfillmentofalltheacademicrequirements.

19.0 IMPROVEMENT OFGRADE:

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 THEPROGRAM

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 OFRESULTS

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 GRADUATIONDAY

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 REDRESSALCOMMITTEE

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 ANDCURRICULUM

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)

ELECTRICAL POWER SYSTEMS

COURSE CATALOG – R18

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										
BPSB01	Modern Power System Analysis	PCC	Core	3	0	0	3	30	70	100
BPSB02	Economic Operation of Power Systems	PCC	Core	3	0	0	3	30	70	100
	Program Elective - I	PE	Elective	3	0	0	3	30	70	100
	Program Elective – II	PE	Elective	3	0	0	3	30	70	100
	Audit Course - I	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BPSB09	Power System Computational Laboratory	PCC	Core	0	0	4	2	30	70	100
BPSB10	Internet of Things 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										
BPSB11	Digital Protection of Power System	PCC	Core	3	0	0	3	30	70	100
BPSB12	Power System Dynamics	PCC	Core	3	0	0	3	30	70	100
	Program Elective - III	PE	Elective	3	0	0	3	30	70	100
	Program Elective - IV	PE	Elective	3	0	0	3	30	70	100
	Audit Course - II	Audit - II	Audit	2	0	0	0	30	70	100
BPSB21	Mini Project with Seminar	PCC	Core	2	0	0	2	30	70	100
PRACTICAL										
BPSB19	Artificial Intelligence Laboratory	PCC	Core	0	0	4	2	30	70	100
BPSB20	Power Systems Laboratory	PCC	Core	0	0	4	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
	Program Elective – V	PE	Core	3	0	0	3	30	70	100
	Open Elective	OE	Elective	3	0	0	3	30	70	100
PRACTICAL										
BPSB40	Phase-I Dissertation	PCC	Major Project	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
THEORY										
BPSB41	Phase-II Dissertation	PCC	Major Project	0	0	32	16	30	70	100
TOTAL				**00**	**00**	**32**	**16**	**30**	**70**	**100**

PROGRAM ELECTIVE COURSES

PROGRAM ELECTIVE – I

Course Code	Course Title
BPSB03	HVDC Transmission
BPSB04	Renewable Energy Systems
BPSB05	Smart Grid Technologies

PROGRAM ELECTIVE – II

Course Code	Course Title
BPSB06	Electrical Power Distribution System
BPSB07	Reactive Power Compensation and Management
BPSB08	Hybrid Electric Vehicles

PROGRAM ELECTIVE –III

Course Code	Course Title
BPSB13	Restructured Power Systems
BPSB14	Swarm Intelligence Techniques in Power Systems
BPSB15	Industrial Load Modelling and Control

PROGRAM ELECTIVE –IV

Course Code	Course Title
BPSB16	AI Techniques in Power Systems
BPSB17	Power Quality
BPSB18	Power System Planning and Reliability

PROGRAM ELECTIVE – V

Course Code	Course Title
BPSB22	SCADA System and Applications
BPSB23	Flexible AC Transmission Systems
BPSB24	Electrical Transients in Power Systems

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	Waste to Energy

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 – III SEMESTERS)

MODERN POWER SYSTEM ANALYSIS

I Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Modern Power system analysis deals with planning and operation of power system, short circuit analysis, power flow analysis, contingency analysis and state estimation techniques. First the bus impedance matrices are formulated by various methods and their power flow analysis is performed using Newton Raphson method and gauss Seidal methods. Short circuit analysis performed for balanced and unbalanced networks. Different techniques used for contingency analysis also discussed in this course. This course also covers state estimation for power system which includes and identification of bad measurements, estimation of quantities not being measured, network observability.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic components and restructuring of power systems.
II. The power flow analysis using various methods.
III. The fault analysis for balanced and unbalanced faults.
IV. The power system security concepts and study the methods to rank the contingencies.
V. The need of state estimation and study simple algorithms for state estimation.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Utilize the representation of basic components and single line diagram of power system for understanding there structuring of system	Understand
CO 2	Examine the optimal power flow solution using FACTS devices to solve power flow analysis problems using various methods.	Apply
CO 3	Analyse the new bus voltages contingency by adding/removal of lines for illustrating the various techniques for contingency evaluation and analysis.	Apply
CO 4	Evaluate the operating states and security monitoring of power systems to describe its contingency analysis.	Apply
CO 5	Understand the importance of power flow analysis in planning and operation of power systems.	Understand
CO 6	Apply the various algorithms for state estimation to estimate different components and states of power systems.	Apply

IV. SYLLABUS

UNIT-I	PLANNING AND OPERATIONAL STUDIES OF POWR SYSTEMS	Classes: 09

Need for system planning and operational studies, basic components of a power system, introduction to restructuring, single line diagram, per phase and per UNIT analysis, generator, transformer, transmission line and load representation for different power system studies, primitive network, construction of Y-bus using inspection and singular transformation methods,Z-bus.

UNIT-II	POWER FLOW ANALYSIS	Classes:10

Importance of power flow analysis in planning and operation of power systems, statement of power flow problem, classification of buses, development of power flow model in complex variables form, iterative solution using Gauss-Seidel method, Q-limit check for voltage controlled buses, power flow model in polar form, iterative solution using Newton-Raphson method, decoupled and fast decoupled power flow solutions, DC power flow solution, power flow solution using FACTS devices, optimal power flow solution.

UNIT-III	SHORT CIRCUIT ANALYSIS	Classes:08

Balanced faults: Importance of short circuit analysis, assumptions in fault analysis, analysis using Thevenin‟s theorem, Z-bus building algorithm, fault analysis using Z-bus, computations of short circuit capacity, post fault voltage and currents.

Unbalanced faults: Introduction to symmetrical components, sequence impedances, sequence circuits of synchronous machine, transformer and transmission lines, sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin‟s theorem and Z-busmatrix.

UNIT-IV	CONTINGENCY ANALYSIS	Classes:09

Contingency Evaluation: Operating states of a power system, concept of security monitoring, techniques for contingency evaluation, Importance of contingency analysis, addition / removal of one line, construction of a column of bus impedance matrix from the bus admittance matrix, calculation of new bus voltages due to addition / removal of one line, calculation of new bus voltages due to addition / removal of two lines.

UNIT-V	STATE ESTIMATION	Classes:09

Power system state estimation, maximum likelihood weighted least squares estimation, matrix formulation, state estimation of AC network, state estimation by orthogonal decomposition, detection and identification of bad measurements, estimation of quantities not being measured, network observability and pseudo measurements.

Text Books:

1. J J Grainger, W D Stevenson, “Power system analysis”, McGraw Hill, 1st Edition,2003.
2. A R Bergen & Vijay Vittal, “Power System Analysis”, Pearson, 2nd Edition,2000.

Reference Books:

1. K Umarao, “Computer Techniques and Models in Power Systems”, I K International Pvt.Ltd.
2. HadiSaadat, “Power System Analysis”, TMH, 2nd Edition,2003.
3. Grainger and Stevenson, “Power System Analysis”, Tata McGraw-Hill, 3rd Edition,2011.
4. J Duncan Glover and M S Sarma., THOMPSON, “Power System Analysis and Design”, 3rd Edition 2006.

Web References:

1. https://www.worldcat.org/title/computer-methods-in-power-system-analysis/.../600788826
2. https://www.sjbit.edu.in/.../COMPUTER%20%20TECHNIQUES%20IN%20POWER%20%20SYS.
3. https://www.books.google.com › Technology & Engineering ›Electrical
4. https://www.nptel.ac.in/courses/108105067/
5. https://www.jntusyllabus.blogspot.com/2012/01/computer-methods-power-systems-syllabus.html

E-Text Books:

1. https://www.scribd.com/.../Computer-Methods-in-Power-System-Analysis-by-G-W-St...
2. https://www.academia.edu/8352160/Computer_Methods_and_Power_System_Analysis_Stagg
3. https://www.uploady.com/#!/download/ddC9obmVTiv/NwO1AnQrlmogeJjS

ECONOMIC OPERATION OF POWER SYSTEMS

I Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB02	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I.COURSEOVERVIEW:

This course will illustrate the difference between economic load dispatch and unit commitment problem and provide the mathematical platform to solve economic load scheduling (with and without network losses) and unit commitment problem, solve hydro-thermal scheduling problem This subject will also cover the analyze of single area and two area systems for frequency deviation and help students to solve the OPF problem using ac and dc load flow methods.

II.COURSE OBJECTIVES:

The students will try to learn:

I. How to formulate and derive the necessary conditions for economical load scheduling problem.
II. The various constraints, problem formulation and methods to solve the UNIT commitment problem.
III. The constraints related to hydel power plants, problem formulation and solution techniques for hydro-thermal scheduling problem.
IV. The necessity, factors governing the frequency control and analyze the uncontrolled and controlled LFC system.
V. The basic difference between ELS and OPF problem, formulation of the OPF problem and solution techniques.

III.COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Solve the unit Commitment problem with various constraints using conventional optimization techniques and general transmission line loss formula	Apply
CO 2	Identify an optimal operation setup of power system for minimizes operation costs and meet desired needs	Apply
CO 3	Categorize single area load frequency control and two area load frequency control to minimize the transient deviations and steady state error to zero	Analyze
CO 4	Analyse the importance of Reactive power control and Power Factor in power systems for efficient and reliable operation of power systems.	Apply
CO 5	Develop the appropriate control scheme for compensating reactive power	Apply
CO 6	Identify the different types of compensating equipment for reducing reactive power to improve system's efficiency	Apply

IV. SYLLABUS

UNIT-I	ECONOMIC LOAD SCHEDULING	Classes: 09

Characteristics of steam turbine, variations in steam UNIT characteristics, economic dispatch with piecewise linear cost functions, Lambda iterative method, LP method, economic dispatch under composite generation production cost function, base point and participation factors, thermal system dispatching with network losses considered.

UNIT-II	UNIT COMMITMENT	Classes:10

UNIT Commitment, definition, constraints in UNIT commitment, UNIT commitment solution methods, priority, list methods, dynamic programming solution.

UNIT-III	HYDRO THERMAL SCHEDULING	Classes:08
Characteristics of Hydroelectric UNITs, introduction to hydrothermal coordination, long range and short range hydro scheduling. Hydroelectric plant models, hydrothermal scheduling with storage limitations, dynamic programming solution to hydrothermal scheduling.		
UNIT-IV	**LOAD FREQUENCY CONTROL**	**Classes:09**
Control of generation, models of power system elements, single area and two area block diagrams, generation control with PID controllers, implementation of Automatic Generation control (AGC), AGCfeatures.		
UNIT-V	**OPTIMAL POWER FLOW**	**Classes:09**
Introduction to Optimal power flow problem, OPF calculations combining economic dispatch and power flow, OPF using DC power flow, algorithms for solution of the ACOPF, optimal reactive power dispatch.		

Text Books:

1. J J Grainger & W DStevenson, "Power system analysis", McGraw Hill,2nd Edition,2003.
2. Allen JWood, Bruce F Wollenberg, Gerald B Sheblé, "Power Generation, Operation and Control", WileyInterscience2ndEdition,2013.

Reference Books:

1. Olle, Elgerd, "Electric Energy Systems Theory an Introduction", TMH, 2nd Edition, 1983.

Web References:

1. https://pdfs.semanticscholar.org/b99b/cedc7f9e06d8b21d910767bb886a6d038283.pdf
2. https://core.ac.uk/download/pdf/33363832.pdf

E-Text Books:

1. https://core.ac.uk/download/pdf/33363832.pdf
2. http://vbn.aau.dk/files/226382872/seyedmostafa_farashbashiastaneh.pdf

HVDC TRANSMISSION

PEC-I: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB03	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This subject deals with the importance of HVDC transmission, analysis of HVDC Converters, Harmonics and Filters, Reactive power control and Power factor improvements of the system. It also deals with basic FACTS concepts, static shunt and series compensation and combined compensation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The state of the art HVDC technology.
II. The Methods to carry out modeling and analysis of HVDC system frontier-area power flow regulation.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Explain the basic fundamental of FACTS controllers	Understand
CO 2	Interpret the enhancement of stability using static shunt and series compensation	Understand
CO 3	Model and design of coordinating multiple FACTS controllers UPFC and IPFC using control techniques	Apply
CO 4	Develop the knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.	Apply
CO 5	Simplify and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links	Analyze

IV. SYLLABUS

UNIT-I	GENERAL ASPECTS OF HVDC TRANSMISSION	Classes: 09

Evolution of HVDC transmission, comparison of HVDC and HVAC systems, types of DC links, components of HVDC system, valve characteristics, properties of converter circuits, assumptions, single phase and three-phase converters, pulse number, choice of best circuit for HVDC converters.

UNIT-II	ANALYSIS OF BRIDGE CONVERTER	Classes: 09

Analysis of simple rectifier circuits, required features of rectification circuits for HVDC transmission, Analysis of HVDC converter, different modes of converter operation, output voltage waveforms and DC voltage in rectification, output voltage waveforms and DC in inverter operation, thyristor/ valve voltages, equivalent electrical circuit

UNIT-III	HVDC CONTROL TECHNIQUES	Classes: 09

Grid control, basic means of control, power reversal, limitations of manual control, constant current versus Constant voltage, desired features of control, actual control characteristics.

Constant minimum ignition angle control: Constant current control, constant extinction angle control, stability of control, tap-changer control, power control and current limits, frequency control.

UNIT-IV	CONVERTER FAULTS AND PROTECTION	Classes: 09
Converter mal-operations, commutation failure, starting and shutting down the converter bridge, converter protection.		
UNIT-V	**REACTIVE POWER MANAGEMENT**	**Classes: 09**
Smoothing reactor and DC Lines, reactive power requirements, harmonic analysis, filter design, power flow analysis in AC, DC systems, modeling of DC links, solutions of AC, DC Power flow.		

Text Books:

1. JArrillaga, "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.
3. SNSingh,"ElectricPowerGeneration,TransmissionandDistribution,PHI,NewDelhi,2nd Edition, 2008.
4. V Kamaraju, "HVDC Transmission" Tata McGraw-Hill Education Pvt Ltd, New Delhi, 2nd Edition, 2011.

Web References:

1. https://www.rceroorkee.in/pdf/pdfo/tee033.pdf
2. https://www.books.google.com/books?id=e24fndv2aroc
3. https://www.nptel.ac.in/syllabus/108108033/

E-Text Books:

1. https://www.site.uottawa.ca
2. https://www.galerybooks.com
3. https://www.jntubook.com/

RENEWABLE ENERGY SYSTEMS

PEC-I: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB04	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course envisages the renewable source of energy available in nature and to expose the students on sources of energy crisis, principle of operation of solar photo voltaic cell, different solar energy collectors and storage methods. It facilitates the study of wind turbines, geothermal energy, ocean, biomass, energy storage and distribution technologies. It concludes the knowledge of renewable energy resources for electrical applications.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The concepts of Non-renewable and renewable energy systems
II. The integrated operation of renewable energy sources.
III. The utilization of renewable energy sources for both domestic and industrial applications.
IV. The environmental and cost economics of renewable energy sources in comparison with fossil fuels.

III. COURSEOUTCOMES

After successful completion of the course, students will be able to:		
CO 1	Understand the need of energy conversion and the various methods of energy storage	Understand
CO 2	Analyze the major parameters of sun movement, solar radiation and tracking systems for calculation of solar insulation	Analyze
CO 3	Identify different concentrating collectors for conversion of solar energy into thermal energy	Apply
CO 4	Explain the concepts involved in wind energy conversion system using vertical and horizontal wind mills	Understand
CO 5	Illustrate the operational methods of ocean energy for electrical energy conversion	Understand
CO 6	Utilize the distribution technologies for renewable energy distribution and storage	Apply

IV.SYLLABUS

UNIT-I	GLOBAL AND NATIONAL ENERGY SCENARIO	Classes: 09

Over view of conventional & renewable energy sources, need and development of renewable energy sources, types of renewable energy systems, future of energy use, global and Indian energy scenario, renewable and non-renewable energy sources, energy for sustainable development, potential of renewable energy sources, renewable electricity and key elements, global climate change, CO2 reduction potential of renewable energy, concept of hybrid systems.

UNIT-II	SOLAR AND WIND ENERGY	Classes: 12

Solar energy system: Solar radiation, availability measurement and estimation, solar thermal conversion devices and Storage, applications solar photovoltaic conversion, solar thermal applications of solar energy systems; Wind Energy Conversion: potential, wind energy potential measurement, site selection, types of wind turbines, wind farms, wind generation and control, nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy, hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices,windmillcomponentdesign,economicsanddemandsidemanagement,energywheeling,energybanking concepts, safety and environmental aspects, wind energy potential and installation in India.

UNIT-III	BIO GAS, TIDAL AND OCEAN ENERGY CONVERSION SYSTEMS	Classes: 12

Biogas: 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 process, 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.

Tidal Energy generation: Characteristics of tides, power generation schemes, components in tidal power plant, wave energy, principle of wave energy plant, wave energy conversion machines, Ocean thermal energy conversion: principle, cycles of operation, types of OTEC plants, applications.

UNIT-IV	GEO-THERMAL ENERGY AND FUEL CELLS	Classes: 06

Geothermal Energy: Structure of earth‟s interior, geothermal fields, gradient, resources, geothermal power generation; Fuel cells: introduction, principle of operation, types of fuel cells, state of art fuel cells, energy output of a fuel cell operating characteristics of fuel cells, thermal efficiency, need for hybrid systems, types of hybrid systems.

UNIT-V	ENERGY SYSTEMS AND GRIDS	Classes: 06

Introduction, energy systems, distribution technologies, energy storage for grid electricity, social and environmental aspects of energy supply and storage, electricity grids(networks), dc grids, special challenges and opportUNITies for renewable electricity, power electronic interface with the grid

Text Books:

1. DP Kothari, K C Singal, R Ranjan, “Renewable Energy Resources and Emerging Technologies”, PHI 2nd Edition, 2011.
2. John Twidell and Tony Weir,“Renewable Energy Resources”, CRC Press 2nd Edition,2006.

Reference Books:

1. Volker Quaschning “Understanding Renewable Energy Systems”, by UK, 1st Edition,2005.
2. Faner Lin Luo Honer Ye, “Renewable Energy Systems-Advanced Conversion, Technologies &Applications” by Taylor & Francisgroup CRC press, 1st Edition,2000.
3. S P Sukhatme, “Solar Energy Principles of thermal collection and storage”, 1st Edition,1999.
4. J. A. Duffie and W A Beckman, “Solar Engineering of Thermal Processes”, 1st Edition,1995.
5. Anthony San Pietro, “Biochemical and Photosynthetic aspects of Energy Production”, Academic Press, 1st Edition, 1980.
6. Bridgurater, AV, “Thermochemical Processing of Biomass”, Academic Press, 1st Edition,1981.
7. Kreith, F and Kreider, J F, “Principles of Solar Engineering”, McGraw-Hill, 1st Edition,1978.
8. Bent Sorensen, “Renewable Energy”, Elsevier Academic Press, 2011.
9. Rakosh Das Begamudre, “Energy conversion systems”- New Age International Publishers, NewDelhi, 2nd Edition,2000.
10. D. D. Hall and R. P. Grover, “Biomass Regenerable Energy”, 1st Edition,2000.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

SMART GRID TECHNOLOGIES

PE-I: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB05	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course introduces concept of Smart Grid, the rationale for smart grid technology and its characteristics. This course focuses on monitoring, analysis, control and communication capabilities to the national electrical delivery system to maximize the throughput of the system while reducing the energy consumption. It also elaborates the integration of renewable energy resources and storage devices to achieve a more efficient and reliable grid, enable active participation of consumers with more environmental constraints.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The concept of smart grid and its advantages over conventional grid.
II. The smart metering techniques.
III. The different wide measurement techniques.
IV. The problems associated with integration of distributed generation and its solution through smart grid.

III.COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Explain the features smart grid to increase grid efficiency, self-healing, accessibility and reliability.	Understand
CO 2	Analyze the different energy storage solutions available for improving grid stability and security.	Analyze
CO 3	Analyze the dynamic behavior of Micro grid and its grid integration issues to meet the load requirement effectively.	Analyze
CO 4	Outline the role of different renewable resources like PV, Wind, etc for improving the system dynamics performance.	Understand
CO 5	Identify the efficient management of power quality for compatibility between all the equipments connected to the grid.	Understand
CO 6	Make use of sensors, transducers, intelligent electronic devices and meter to improve the distribution system overall performance.	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO SMART GRID	Classes: 09

Introduction to smart grid, evolution of electric grid, concept of smart grid, definitions, need of smart grid, concept of robust, self healing grid present development & international policies in smartgrid.

UNIT-II	AUTOMATION IN GRID MANAGEMENT	Classes:10

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-III	GEOGRAPHIC INFORMATION SYSTEM(GIS)	Classes: 08

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-IV	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-V	**POWER QUALITY IN SMART GRIDS**	**Classes: 09**
Power Quality, EMC in smart grid, power quality issues of grid connected renewable energy sources, power quality conditioners for smart grid, webbased power quality monitoring, power quality audit, advanced metering infrastructure (AMI) and various communication means and IP based protocols.		

Text Books:

1. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 2nd Edition,2011.
2. Clark W Gellings, "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, 1st Edition, 2012.
2. Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions "CRC Press, 2nd Edition,2011.
3. A GPhadke, "Synchronized Phasor Measurement and their Applications", Springer, 2nd Edition,2011.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

ELECTRICAL POWER DISTRIBUTION SYSTEM

PEC- II: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB06	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

Electric power distribution system plays an important role in the efficient operation of a modern industrial plant. Such a system includes high voltage circuit breakers, switchgear, transformers, motor control centers, electric motors, variable speed drive sheds' trouble-free electrical system is essential for an interruption-free plant operation. This course will cover all aspects of power distribution, including system planning, equipment selection and application, system grounding, protection and conformity with electrical code requirements, etc.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The application of SCADA in power distribution systems.
II. The different distribution automation.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Understand the importance of load forecasting in Distribution system to meet the future electrical load demands	Understand
CO 2	Apply different types of power factor correction methods to increase the efficiency of the distribution system	Apply
CO 3	Analyze communication systems, remote metering, automatic meter for collecting the data that's needed for billing purposes	Analyze
CO 4	Make use of SCADA in distribution automation to maintain efficiency, process data for smarter decisions	Understand
CO 5	Examine placement of optimal switching devicesfor monitoring and to increase the efficiency of the distribution system	Evaluate
CO 6	Apply AI techniques in electrical distribution system to enhance efficiency, reliability, and quality of electric service.	Apply

IV.SYLLABUS

UNIT-I	DISTRIBUTION OF POWER	Classes: 09

Distribution of power, management, power loads, load forecasting short-term and long-term, power system loading, technological forecasting

UNIT-II	ADVANTAGES OF DISTRIBUTION MANAGEMENT SYSTEM	Classes:10

Advantages of distribution management system (D.M.S.): Distribution Automation, definition, restoration, reconfiguration of distribution network, different methods and constraints, power factor correction.

UNIT-III	INTERCONNECTION OF DISTRIBUTION	Classes: 08

Interconnection of distribution, control, communication systems, remote metering, automatic meter reading and its implementation; SCADA: Introduction, block diagram, SCADA applied to distribution automation.

Common Functions of SCADA: Advantages of distribution automation through SCADA.

UNIT-IV	OPTIMAL SWITCHING DEVICE PLACEMENT	Classes: 09
Calculation of optimum number of switches, capacitors, optimum switching device placement in radial, distribution systems, sectionalizing switches, types, benefits, bellman‟s optimality principle, remote terminal UNITs, energy efficiency in electrical distribution, monitoring.		
UNIT-V	**MAINTENANCE OF AUTOMATED DISTRIBUTION SYSTEMS**	**Classes: 09**
Maintenance of automated distribution systems, difficulties in implementing distribution, automation in actual practice, urban, rural distribution, energy management, AI techniques applied to distribution automation.		

Text Books:

1. AS Pabla, “Electric Power Distribution”, Tata McGraw Hill Publishing Co. Ltd., 4th Edition,2012.
2. MK Khedkar, GM Dhole, “A Text Book of Electrical power Distribution Automation”, University Science Press, New Delhi, 2nd Edition,2010.

Reference Books:

1. Anthony J Panseni, “Electrical Distribution Engineering”, CRC Press, 2nd Edition,2010.
2. James Momoh, “Electric Power Distribution, automation, protection & control”, CRC Press 2ndEdition, 2006.

Web References:

1. https://www.nptelvideos.in/2012/11/distribution-automation.html
2. https://www.powersystem.org/distribution-automation
3. https://www.sciencedirect.com

E-Text Books:

1. https://www.schneider-electric.us/documents/customers/utility/br-distribution-feeder-automation.pdf
2. https://www.pdfs.semanticscholar.org/099e/bffd3b296af4aa0ef7b7777721f178be6b28.pdf

REACTIVE POWER COMPENSATION AND MANAGEMENT

PEC- II: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB07	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The purpose of this course is to make the students understand about load compensation and how to select various types of reactive power compensation devices in transmission systems both during steady state and transient state operation. The course also enables the students about the management of reactive power on demand side, distribution side, and utility side of the power system.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The necessity of reactive power compensation
II. The load compensation
III. The various types of reactive power compensation in transmission systems
IV. The reactive power coordination system
V. The distribution side and utility side reactive power management.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Discuss the objectives and specifications of reactive compensation for designing the compensating equipment.	Apply
CO 2	Describe the characteristics of an uncompensated line and a compensated line which are used for evaluating the performance of lines.	Analyze
CO 3	Examine the mathematical modeling, operation planning and transmission benefits in reactive power coordination.	Analyze
CO 4	Describe the load patterns, power tariffs, flicker and harmonic voltage levels used in billing the power consumers.	Apply
CO 5	Explain the use of different types of capacitors, their characteristics which are used in user side reactive power management.	Analyze
CO 6	Discuss the impact of electric traction systems and furnaces on the reactive power and suggest the user side reactive power management techniques.	Analyze

IV. SYLLABUS

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	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. TJE Miller, "Reactive power control in Electric power systems", Wiley Publication, 1st Edition,1982.
2. D M Tagare, "Reactive power Management", by Tata McGraw Hill, 1st Edition,2004.

Reference Books:

1. Wolfgang Hofmann, Jurgen Schlabbach, Wolfgang Just "Reactive Power Compensation: A Practical Guide", Wiely 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. https://www.digital-library.theiet.org/content/books/po/pbpo022e
2. http://www.leeson.com/documents/PMAC_Whitepaper.pdf

HYBRID ELECTRIC VEHICLES

PEC- II: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB08	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course will help students to acquire fundamental concepts and principles of hybrid electric vehicles (HEV). It will give an idea about design and analyze HEVs, electric machine and the internal combustion. It also covers the application of electric drives in vehicles / traction and strategies of energy management in HEVs.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The necessity of reactive power compensation.
II. The upcoming technology of hybrid system.
III. The different aspects of drives application.
IV. The electric traction.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals	Understand
CO 2	Analyze the use of different power electronics devices and electrical Machines in hybrid electric vehicles.	Analyze
CO 3	Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology	Understand
CO 4	Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.	Understand
CO 5	Develop the electric propulsion unit and its control for hybrid electric vehicles.	Apply

IV. SYLLABUS

UNIT-I	INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES	Classes: 09

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, basics of vehicle performance, vehicle power source characterization transmission characteristics, mathematical models to describe vehicle performance

UNIT-II	HYBRID TRACTION	Classes: 09

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive train topologies, fuel efficiency analysis.

UNIT-III	CONFIGURATION AND CONTROL OF DRIVES	Classes: 09

Introduction to electric components used in hybrid and electric vehicles, configuration and control of dc motor drives, configuration and control of introduction motor drives.

Configuration and control of permanent magnet motor drives configuration and control of switch reluctance, motor

drives, drive system efficiency.

UNIT-IV	ELECTRIC MACHINE AND THE INTERNAL COMBUSTION ENGINE	Classes: 09

Matching the electric machine and the internal combustion engine (ICE), sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, communications, supporting subsystems.

UNIT-V	ENERGY MANAGEMENT AND STRATEGIES	Classes: 09

Introduction to energy management and their strategies used in hybrid and electric vehicle, classification of different energy management strategies comparison of different energy management strategies Implementation issues of energy strategies.

Text Books:

1. Sira Ramirez, R Silva Ortigoza, "Control Design Techniques in Power Electronics Devices" Springer, 1st Edition, 2004.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, "Sliding mode control of switching Power Converters", 1st Edition, 2002.

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 1st Edition 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 1st Edition2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 1st Edition2003.
4. Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle(BEV).

Web References:

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.unep.org/transport/pcfv/PDF/HEV_Report.pdf
1. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf

E-Text Books:

1. https://www.onlinelibrary.wiley.com/book/10.1002/9781119998914
2. https://www.go2hev.com/hybrid-electric-vehicles-student-textbook.html
3. https://www.sciencedirect.com/science/book/9780444535658
4. https://www.accessengineeringlibrary.com/browse/hybrid-electric-vehicle-design-and-control-intelligent - omnidirectional-hybrids

POWER SYSTEM COMPUTATIONAL LABORATORY

I Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB09	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

I. COURSEOVERVIEW:

The main objective of the course is to provide a software-based power system analysis. This lab course will provide the computer-based formation of bus admittance matrix. It will also analyze the transient stability and load dispatch problem. It will also cover state estimation of power system and unit commitment problem.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The Y bus, Z bus for a n bus system and analyze various load flow studies.
II. The steady state, transient stability analysis and economic load dispatch problem.
III. The state estimation of power system and UNIT commitment problem.

III.COURSEOUTCOME:

After successful completion of the course, students will be able to:		
CO 1	Understand the concept of Admittance matrix for the formulation of various inspection and transformation methods.	Understand
CO 2	Develop the programming for load flow algorithms.	Apply
CO 3	Analyze the characteristics of fast decoupled loaf flow methods for developing algorithm.	Analyze
CO 4	Analyze the features of various algorithms applicable for protection of Transformers and transmission lines.	Apply
CO 5	Categorize the transient and short circuit analysis for analyzing the performance of the system.	Analyze
CO 6	Analyze the various iterative methods applicable for state estimation of the power system.	Analyze

LIST OF EXPERIMENTS

Expt. 01	**FORMATION OF BUS ADMITTANCE MATRIX**
Develop program for Y_{bus} formation by direct inspection method.	
Expt. 02	**SINGULAR TRANSFORMATION**
Develop program for Y_{bus} formation by singular transformation method**.**	
Expt. 03	**GAUSS - SEIDAL LOAD FLOW METHOD**
Develop program for G-S load flow algorithm	
Expt. 04	**NEWTON - RAPHSON LOAD FLOW METHOD**
Develop program for N-R load flow algorithm in polar coordinates	
Expt. 05	**FAST DECOUPLED LOAD FLOW METHOD**

Develop program for FDLF algorithm.	
Expt. 06	**DC LOAD FLOW**
Develop program for DC load flow algorithm.	
Expt. 07	**BUILDING ALGORITHM**
Develop Program for Z_{BUS} building algorithm.	
Expt. 08	**SHORT CIRCUIT ANALYSIS**
Develop program for short circuit analysis using Z_{BUS} algorithm.	
Expt. 09	**TRANSIENT STABILITY**
Develop program for transient stability analysis for single machine connected to infinite bus	
Expt. 10	**LOAD DISPATCH PROBLEM**
Develop program for economic load dispatch problem using lambda iterative method	
Expt. 11	**DYNAMIC PROGRAMMING METHOD**
Develop program for UNIT commitment problem using forward dynamic programming method.	
Expt. 12	**STATE ESTIMATION**
Develop program for state estimation of power system.	

Reference Books:

1. DP Kothari, B S Umre, "Lab manual for Electrical Machines", IK International Publishing House Pvt. Ltd, 1st Edition,1996.
2. MariesaLCrow, "Computational Methods for Electric Power Systems (Electric Power Engineering Series)", CRC Press Publishers, 1st Edition,1992.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.iare.ac.in
4. https://www.deltaww.com

INTERNET OF THINGS LABORATORY

I Semester: EPS

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB10	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

I. COURSEOVERVIEW:

The goal of the lab to fundamental understands of IoT using Arduino programming for different electrical digital apparatus. It will also explain the interfacing of data, I/O devices with Arduino UNO like Bluetooth, sensors, Webpage etc. It will also cover the digital protection schemes. A goal of the lab is to develop test-beds and experimental facilities, demonstrating the effects of ubiquitous IoT technology.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The IoT using Arduino programming.
II. The interfacing of data, I/O devices with ArduinoUNO.
III. The digital protection schemes in power system relays.

III.COURSEOUTCOME:

After successful completion of the course, students will be able to:		
CO 1	Understand the concept of Internet of Things for implementation of digital measuring devices.	Understand
CO 2	Develop the Arduino programming for controlling lightning appliances.	Apply
CO 3	Analyze the characteristics of bluetooth modules for controlling the performance of appliances.	Analyze
CO 4	Analyze the features of various algorithms applicable for protection of Transformers and transmission lines.	Apply
CO 5	Categorize the digital relying algorithms for protection of three phase induction motor.	Analyze
CO 6	Analyze the various algorithms applicable for over current protection.	Analyze

LIST OF EXPERIMENTS

Expt-1	**DESIGN OF DIGITAL DC VOLTMETER AND AMMETER**

Design a Digital DC Voltmeter and Ammeter to measure the voltage and current in DC electrical circuits using Arduino and display the values in LCD display

Expt. 2	**DESIGN OF DIGITAL AC VOLTMETER AND AMMETER**

Design a Digital AC Voltmeter and Ammeter to measure the voltage and current in AC electrical circuits using Arduino and display the values in LCD display.

Expt. 3	**DIRECTION CONTROL OF THREE PHASE INDUCTION MOTOR**

Design a system to control the direction of three phase induction motor through IOT

Expt. 4	**DESIGN OF DIGITAL FREQUENCY METER**

Design a Digital frequency meter to measure the frequency in any AC electrical circuit using Arduino and display the values in LCD display

Expt. 5	MEASUREMENT OF POWER AND ENERGY
Measure the power and energy in electrical circuit using Arduino and display the values in LCD display	
Expt. 6	**MEASUREMENT OF PHASE SHIFT AND POWER FACTOR**
Measure the phase shift and power factor in an electrical circuit for different loads using Arduino and display the value in LCD display.	
Expt. 7	**IMPLEMENTATION OF OVER CURRENT RELAY**
Design an over current relay for distribution system and displaying the tripping status of the relay in substation through IOT.	
Expt. 8	**OVER/UNDER VOLTAGE PROTECTION OF HOME APPLIANCES**
Design a system to protect home appliances from over and under voltages using Arduino.	
Expt. 9	**PROTECTION OF THREE PHASE INDUCTION MOTOR**
Design a system for protecting the three phase induction motor from over voltages, over currents, temperature and displaying the status of the motor at remote location using IOT	
Expt. 10	**TRAFFIC SIGNAL CONTROL**
Design a traffic control system using IOT.	
Expt. 11	**RAILWAY GATE CONTROL BY STEPPER MOTOR**
Design a Railway gate control system using stepper motor and observe the status of the gate in a nearby station using IOT.	
Expt. 12	**DIRECTION AND SPEED CONTROL OF DC MOTOR**
To control the speed and direction of a DC motor using Arduino and display the status of the motor at the remote location using IOT.	

Reference Books:

1. Mark torvalds, "Arduino Programming: Step-by-step guide to mastering arduino hardware and software (Arduino, Arduino projects, Arduinouno, Arduino starter kit, Arduino ide, Arduinoyun, Arduino mega, Arduinonano) Kindle 2nd Edition,2001.
2. Michael J Pont, "Embedded C", Pearson Education, 2ndEdition,2008.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.iare.ac.in
4. https://www.deltaww.com

DIGITAL PROTECTION OF POWER SYSTEM

II Semester: **EPS**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB11	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course will provide the mathematical background of digital protection and understanding the importance of Digital Relays. It will also develop various protection algorithms. It will also cover the application of digital protection.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The working of numerical relays.
II. The mathematical approach towards protection.
III. The algorithms for numerical protection.

III.COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Illustrate the significance of protection systems and elements involved in protection of the power system	Understand
CO 2	Develop the structures, mathematical models and formulae of digital relays for mathematical analysis of the system	Apply
CO 3	Identify the basic components of digital relay and signal conditioning subsystems for implementation of digital protection.	Apply
CO 4	Develop the mathematical models for analysis of the relying algorithms to address the various types of faults in the power system	Apply
CO 5	Categorize the digital relying algorithms to minimize the transient deviations and steady state error to zero	Analyze
CO 6	Analyze the various algorithms applicable for protection of Transformers and transmission lines.	Analyze

IV. SYLLABUS

UNIT-I	MATHEMATICAL BACKGROUND TO DIGITAL PROTECTION	Classes: 09

Overview of static relays, transmission line protection, transformer protection, need for digital protection; performance and operational characteristics of digital protection, basic structure of digital relays, finite difference techniques, interpolation formulas, numerical differentiation, curve fitting and smoothing, Fourier analysis, Walsh function analysis, relationship between Fourier and Walsh coefficients.

UNIT-II	BASIC ELEMENTS OF DIGITAL PROTECTION	Classes: 09

Basic components of a digital relay, signal conditioning subsystems, conversion subsystem, digital relay subsystem, the digital relay as a UNIT.

UNIT-III	DIGITAL RELAYING ALGORITHMS-I	Classes: 10

Sinusoidal wave based algorithms: Sample and first derivative methods, first and second derivative methods, two sample technique, three sample technique, an early relaying scheme.

Fourier analysis based algorithms: Full cycle window algorithm, fractional-cycle window algorithms, Fourier-transform based algorithm. Walsh-function-based algorithms.

UNIT-IV	DIGITAL RELAYING ALGORITHMS-II	Classes: 08
Least squares based methods: Integral LSQ fit, power series lsq fit, multi-variable series lsq technique, determination of measured impedance estimates; differential equation based techniques: representation of transmission lines with capacitance neglected, differential equation protection with selected limits, simultaneous differential equation techniques; travelling-wave based protection: fundamentals of travelling-wave based protection, Bergeron‟s-equation based protection scheme, ultra-high-speed polarity comparison scheme, ultra-high-speedwavedifferentialscheme,discriminationfunctionbasedscheme,superimposedcomponenttrajectorybased scheme.		
UNIT-V	**DIGITAL PROTECTION OF TRANSFORMERS AND TRANSMISSION LINES**	**Classes: 09**
Principles of transformer protection, digital protection of Transformer using FIR filter based algorithm, least squares curve fitting based algorithms, Fourier-based algorithm, flux-restrained current differential relay; Digital Line differential protection: Current-based differential schemes, Composite voltage- and current- basedscheme.		

Text Books:

1. AG Phadke and J S Thorp, “Computer Relaying for Power Systems”, Wiley / Research studies Press, 1st Edition, 2009.
2. AT Johns and S K Salman, “Digital Protection of Power Systems”, IEEE Press, 1st Edition,1999.

Reference Books:

1. Gerhard Zeigler, “Numerical Distance Protection”, Siemens Public Corporate Publishing, 1st Edition,2006.
2. SRB hide “Digital Power System Protection” PHI Learning Pvt. Ltd. 3rd Edition,2014.

Web References:

1. https://www.sciencedireect.com
2. https://www.spinger.com
3. https://www.ieeexplore.ieee.org/Xplore/home.jsp

E-Text Books:

1. https://www.nptel.ac.in/downloads/108105066/
2. https://www.minitorn.tlu.ee/~jaagup/kool/java/kursused/15/robootika/elektriopik.pdf

POWER SYSTEM DYNAMICS

II Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB12	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course will illustrate to the development of mathematical models for synchronous machine, Exciter, Governor and Prime mover. It will also cover power system dynamic phenomena and the effects of exciter and governor control. This course will also provide the idea of power system stability and help the students to understand methods to improve dynamic stability.

II.COURSE OBJECTIVES:

The course should enable the students to:

I. Development of mathematical models for synchronous machine, Exciter, Governor and Primemover.
II. Study power system dynamic phenomena and the effects of exciter and governor control.
III. Understand the methods to improve dynamic stability.

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Illustrate the significance of power system stability and approach for analysis of multi machine system.	Understand
CO 2	Develop the state space equations, unit conversions, equivalent circuits for mathematical analysis of the synchronous machines.	Apply
CO 3	Develop the basic components of digital relay and signal conditioning subsystems for implementation of digital protection.	Apply
CO 4	Identify the types of excitation and voltage control configurations to address the effects of voltage changes and reactive power.	Analyze
CO 5	Explain the methods to enhance the small signal stability of the power system.	Analyze

IV. SYLLABUS

UNIT-I	POWER SYSTEM STABILITY: A CLASSICAL APPROACH	Classes: 09

Introduction, requirements of a reliable electrical power service, swing equation, power-angle curve, stability analysis of SMIB system, equal area criteria, classical model of a multi-machine system, shortcomings of the classical model, block diagram of one machine, system response to small disturbances: types of problems studied, the unregulated synchronous machine, modes of oscillation of an unregulated multi-machine system, regulated synchronous machine.

UNIT-II	SYNCHRONOUS MACHINE MODELING-I	Classes: 09

Introduction, Park's Transformation, flux linkage equations, voltage equations, formulation of state- space equations, current formulation, per UNIT conversion, normalizing the voltage and torque equations, equivalent circuitofasynchronousmachine,thefluxlinkagestate-spacemodel,loadequations,sub-transientandtransient inductances and time constants, simplified models of the synchronous machine, turbine generator dynamic models.

UNIT-III	SYNCHRONOUS MACHINE MODELING-II	Classes: 10

Steady state equations and phasor diagrams, determining steady state conditions, evaluation of initial conditions, determination of machine parameters.

Digital simulation of synchronous machines, linearization and simplified linear model and state-space representation of simplified model.

UNIT-IV	EXCITATION AND PRIME MOVER CONTROL	Classes: 08
Simplified view of excitation control, control configurations, typical excitation configurations, excitation control system definitions, voltage regulator, exciter buildup, excitation system response, state-space description of the excitation system, computer representation of excitation systems, typical system constants, and the effects of excitation on generator power limits, transient stability and dynamic stability of the power system; Prime mover control: Hydraulic turbines and governing systems, steam turbines and governing systems.		
UNIT-V	**SMALL SIGNAL STABILITY ANALYSIS**	**Classes: 09**
Fundamental concepts of stability of dynamic systems, Eigen properties of the state matrix, small-signal stability of a single-machine infinite bus system, effects of excitation system, power system stabilizer, system state matrix with amortisseurs, characteristics of small-signal stability problems.		

Text Books:

1. P M Anderson & A A Fouad "Power System Control and Stability", Galgotia, New Delhi, 1st Edition,1981.
2. J Machowski, J Bialek& J R W Bumby, "Power System Dynamics and Stability", John Wiley &Sons, 1st Edition,1997.

Reference Books:

1. P Kundur, "Power System Stability and Control", McGraw Hill Inc., 1st Edition, 1994.
2. E WKimbark,"Powersystemstability",Vol.I&III,JohnWiley&Sons,NewYork1st Edition, 2002.
3. L Leonard Grigsby (Ed.); "Power System Stability and Control", CRC Press, 1st Edition,2007.

Web References:

1. https://www.scribd.com/doc/27104147/Electric-Motor-Drives-Modeling-Analysis-And-Control-2001-R-Krishnan.

E-Text Books:

1. https://www.Bimal K. Bose-Modern power electronics and AC drives -Prentice Hall PTR(2002)
2. https://www.freebookcentre.net
3. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf

RESTRUCTURED POWER SYSTEMS

PEC-III: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB13	Elective	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course introduces the differences between conventional power system and restructured power system. The course provides restructuring experiences of different countries with special focus on Indian power system. It elaborates the design of power markets, market architectural aspects, changes in operational aspects with new operational challenges like congestion management. It provides an insight to develop economically efficient power system.

II. COURSEOBJECTIVES:

The students will try to learn:

I. The what is meant by restructuring of the electricity market.
II. The need behind requirement for deregulation of the electricity market.
III. The money, power and information flow in a deregulated power system.

III. COURSEOUTCOMES

After successful completion of the course, students will be able to:		
CO 1	Explain deregulation of electric utilities in view of technical and economic issues in power industry.	Understand
CO 2	Analyze the consumer and supplier behavior with the principle of demand and supply elasticity	Analyze
CO 3	Interpret the restructured power systems across the world based on market architecture.	Understand
CO 4	Analyze the different pricing mechanisms to encourage efficient economic behavior	Analyze
CO 5	Examine transmission network usage pricing and loss allocation methods to ensure reliable and secure operation of power system.	Analyze
CO 6	Interpret congestion in transmission network with respect to ATC, TTC, TRM and CBM	Understand

IV. SYLLABUS

UNIT-I	OVERVIEW OF RESTRUCTURED POWER SYSTEM	Classes: 09

Regulation and deregulation, vertically integrated and deregulated power industry, market models, market clearing price(MCP), independent system operator(ISO), role of ISO, Ancillary service management, deregulation in Power Industry (Technical and Economic Issues).

UNIT-II	ECONOMIC CONSIDERATIONS IN RESTRUCTURED POWER SYSTEM	Classes: 09

Introduction, Consumer and Supplier behavior, Demand elasticity, Supply elasticity, Short-run and Long-run costs, various costs of production. Electricity pricing: Electricity pricing in generation, transmission and distribution, Introduction to Marginal cost, opportunity Costs, Dynamic pricing mechanism (ABT), Price elasticity of demand, Tariff setting principles, Distribution tariff for HT and LT consumers.

UNIT-III	GLOBAL AND INDIAN MODELS OF RESTRUCTURED POWER SYSTEM	Classes: 10

Global models of restructured power system: Market evolution and deregulation in UK, USA, South America, Nordic pool, China, PJM ISO, and New York market.

Indian power market evolution: Electricity Act 2003 and various national policies and guidelines, Ministry of Power, Role of CEA, CERC, state ERC, load dispatch centers etc., implications of ABT tariff on Indian power sector, introduction to Indian power exchange.

UNIT-IV	TRANSMISSION PRICING AND CONGESTION MANAGEMENT	Classes: 08

Transmission price components, various transmission pricing mechanisms, tracing of power, network usage and loss allocation; Introduction to congestion in transmission network, methods of congestion management.

UNIT-V	OASIS	Classes: 09

Introduction of OASIS, Structure of OASIS, Pooling of information, transfer capability on OASIS and various concepts like ATC, TTC, TRM, and CBM.

Text Books:

1. Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker. 2nd Edition, 1998.
2. Prayas Energy Group, Pune, "Know Your Power", A citizens Primer on the Electricity Sector, 2nd Edition,2002.

Reference Books:

1. Daniel Kirschen, GoranStrbac, "Fundamentals of Power System Economics", John Wiley & Sons Ltd.2004
2. Kankar Bhattacharya, Jaap E Daadler, Math H J Boolen, "Operation of Restructured Power Systems", Kluwer Academic Pub., 1st Edition,2001.
3. Steven Stoft, "Power System Economics: Designing Markets for Electricity", John Wiley and Sons, 1st Edition, 2002.
4. Sally Hunt, "Making competition work in electricity", John Wiely& Sons, Inc., 1st Edition,2002
5. Loi Lei Lai, "Power System Restructuring and Deregulation" John Wiley and Sons, 1st Edition,2001.

Web References:

1. https://www.nptel.ac.in/courses/108101005
2. https://epdf.tips/restructured-electrical-power-systems-power.

E-Text Books:

1. shodhganga.inflibnet.ac.in/bitstream/10603/17295/13/13_chapter3.pdf

SWARM INTELLIGENCE TECHNIQUES IN POWER SYSTEMS

PEC-III: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB14	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course gives a basic idea about the soft computing technique and also discusses about the discrimination of the capabilities of bio-inspired system and conventional methods in solving optimization problems and examines the importance of exploration and exploitation of swarm intelligent system to attain near global optimal solution. This course covers of various swarm intelligent systems like: Bee colony, ant colony etc. It will also help to employ various bio-inspired algorithms for power systems engineering applications.

II. COURSEOBJECTIVES:

The course should enable the students to:

I. Understand evolutionary algorithms like GA, PSO, ANT Colony and BEE colony etc.
II. Apply these evolutionary algorithms to solve power systems problems.
III. Explain solution of multi objective optimization using these algorithms.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Illustrate the capabilities of bio-inspired system and conventional methods in solving optimization problems	Understand
CO 2	Analyze the importance of exploration and exploitation of swarm intelligent system to attain near global optimal solution.	Apply
CO 3	Distinguish the functioning of various swarm intelligent systems for solving power system problems.	Apply
CO 4	Develop various bio-inspired algorithms for the power system engineering applications.	Apply
CO 5	Categorize the optimization problems using evolutionary techniques using genetic algorithms and particle swarm optimization.	Analyze
CO 6	Analyze the various search methods to for solving constrained and unconstrained optimization problems.	Analyze

IV.SYLLABUS:

UNIT-I	FUNDAMENTALS OF SOFT COMPUTING TECHNIQUES	Classes: 09

Definition classification of optimization problems unconstrained and constrained optimization optimality conditions Introduction to intelligent systems soft computing techniques conventional computing versus swarm computing classification of meta heuristic techniques single solution based and population based algorithms exploitation and exploration in population based algorithms, properties of Swarm intelligent Systems-application domain, discrete and continuous problems single objective and multi objective problems.

UNIT-II	GENETIC ALGORITHM AND PARTICLE SWARM OPTIMIZATION	Classes: 09

Genetic algorithms genetic algorithm versus conventional optimization techniques genetic representations and selection mechanisms, genetic operators different types of crossover and mutation operators bird flocking and fish schooling anatomy of a particle equations based on velocity and positions PSO topologies control parameters GA and PSO algorithms for solving ELD problems.

UNIT-III	ANT COLONY OPTIMIZATION AND ARTIFICIAL BEE COLONY ALGORITHMS	Classes: 09

Biological ant colony system: Artificial ants and assumptions, Stigmergic communications pheromone updating local global pheromone evaporation ant colony system ACO models touring ant colony system max min ant system concept of elasticants.

Task partitioning in honey bees: Balancing foragers and receivers-Artificial bee colony (ABC) algorithms, binary ABC algorithms ACO and ABC algorithms for solving economic dispatch of thermal UNITs.

UNIT-IV	SHUFFLED FROGLEAPING ALGORITHM AND BAT OPTIMIZATION ALGORITHM	Classes: 09

Bat algorithm: Echolocation of bats behaviour of micro bats acoustics of echolocation movement of virtual bats, Loudness and pulse Emission, Shuffled frog algorithm-virtual population of frogs-comparison of memes and genes memeplex formation, memeplex updation, BA and SFLA algorithms for solving ELD and optimal placement and sizing of the DG problem.

UNIT-V	MULTI OBJECTIVE OPTIMIZATION	Classes: 09

Multi Objective optimization introduction concept of pare to optimality-Non-dominant sorting technique pare to Fronts best compromise solution-min-max method-NSGA-II algorithm and applications to power systems.

Text Books:

1. Xin-She Yang, „Recent Advances in Swarm Intelligence and Evolutionary Computation‟ Springer International Publishing, Switzerland, 4th Edition,2015.
2. KalyanmoyDeb,„Multi-ObjectiveOptimizationusingEvolutionaryAlgorithms‟,JohnWiley&Sons, 2ndEdition,2001.

Reference Books:

1. James Kennedy and Russel E Eberheart, „Swarm Intelligence‟, The Morgan Kaufmann Series in Evolutionary Computation, 2ndEdition, 2001.
2. Eric Bonabeau, Marco Dorigo and Guy Theraulaz, „Swarm Intelligence-From natural to Artificial Systems‟, Oxford university Press, 2nd Edition, 1999.
3. David Goldberg, „Genetic Algorithms in Search, Optimization and Machine Learning‟, Pearson Education, 2ndEdition, 2007.
4. Konstantinos E. Parsopoulos and Michael N. Vrahatis, „Particle Swarm Optimization and Intelligence: Advancesand Applications‟, Information Science reference, IGI Global, 2nd Edition, 2010.
5. N P Padhy, „Artificial Intelligence and Intelligent Systems‟, Oxford University Press, 2nd Edition, 2005.

Web References:

1. https://www.researchgate.net/publication/277571471
2. https://www.researchgate.net/publication/220834557.

E-Text Books:

1. file.scirp.org/pdf/IJCCE_2013072414532965.pdf
2. rtpis.org/documents/mypaper/RTPIS_publication_1284584660.pdf·.

INDUSTRIAL LOAD MODELLING AND CONTROL

PEC-III: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB15	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course deals with the Electrical energy scenario of Demand and load side management, Optimization and control algorithms and reactive power management of direct and interruptible load control, load profiling of cooling and heating loads and cool storage and control strategies, problem formulation, describe capacitive power units and power pooling, Illustrate optimal operating and control strategies of optimal operating condition and load management for industries.

II.COURSE 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 electricity pricing models.
IV. Study reactive power management in industries.

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Apply knowledge of engineering science including electrical circuits, control systems and electrical machines in industrial load modeling and Control.	Apply
CO 2	Determine the industrial load management in a power system to supply specific amount of demand.	Understand
CO 3	Outline the interruptible load control, Direct load control, controls power quality impacts for minimizing transmission line losses and Energy saving in industries.	Apply
CO 4	Analyze the cooling and heating loads, cool storage, control strategies in an industrial power system.	Analyze
CO 5	Design a capitative power unit in industrial load for imparting Knowledge of various controllers with its evolution, principle of operation and applications.	Apply
CO 6	Determine the optimal operating strategies of power capacitors for integrated load management and industries with economic Justification.	Apply

IV.SYLLABUS:

UNIT-I	ELECTRIC ENERGY SCENARIO	Classes: 09

Electric Energy Scenario, 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	DIRECT LOAD CONTROL INTERRUPTIBLE LOAD CONTROL	Classes: 09

Direct load control, interruptible load control, bottom up approach, scheduling, formulation of load models, optimization and control algorithms, case studies, reactive power management in industries, controls power quality impacts, application of filters, energy saving in industries.

UNIT-III	COOLING AND HEATING LOADS LOAD PROFILING	Classes: 10

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
Captive power UNITs, operating and control strategies, power pooling, operation models, energy banking, industrial cogeneration.		
UNIT-V	**OPTIMAL 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. CO Bjork "Industrial Load Management - Theory, Practice and Simulations", Elsevier, theNetherlands, 1st Edition, 1989.
2. CW Gellings and S NTalukdar, "Load management concepts," IEEE Press, New York, 2nd Edition,1986.

Reference Books:

1. Y. Manichaikul and F.C. Schweppe, "Physically based Industrial load", IEEE Trans. on PAS, 2nd Edition, 1981.
2. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 2nd Edition, 1989.
3. I.J.Nagarath and DPKothari, .Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi, 1stEdition, 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.researchgate.net/publication/257725360_Modelling.
2. https://www.ethesis.nitrkl.ac.in/5348/1/109EE0274.pd

E-Text Books:

1. https://www.pacontrol.com/.../Industrial-Automation-Pocket-Guide.pdf
2. https://www.matlabi.ir/wp-content/uploads/bank_papers/cpaper/c117.

AI TECHNIQUES IN POWER SYSTEMS

PEC-IV: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB16	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course introduces the differences between conventional power system and restructured power system. The course provides restructuring experiences of different countries with special focus on Indian power system. It elaborates the design of power markets, market architectural aspects, changes in operational aspects with new operational challenges like congestion management. It provides an insight to develop economically efficient power system.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The basic knowledge regarding activation function, learning rules and various neural networks.
II. The knowledge of crisp set, fuzzy set and fuzzy logic controllers
III. The genetic algorithms in the tuning of controllers.
IV. The controllers using simulation software fuzzy logic toolbox & NN toolbox.

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Understand the concepts of biological foundations of artificial neural networks for learning techniques	Understand
CO 2	Analyze the associative models in neural networks for correlations between data cases in the space of models.	Analyze
CO 3	Identify the neural networks control schemes for closed-loop performance in terms of small tracking errors and bounded controls.	Apply
CO 4	Evaluate fuzzy logic and its controllersforfuzzy rule base, data base and inference engine.	Evaluate
CO 5	Analyzethe knowledge of genetic algorithm for for solving both constrained and unconstrained optimization problems	Analyze
CO 6	Develop applications of AI Techniques in electrical engineering for power generation, control, and transmission devices used by electric utilities.	Apply

IV.SYLLABUS:

UNIT-I	NEURAL NETWORKS	Classes: 09

Neural Networks: biological neurons, Artificial neurons, activation function, learning rules, feed forward networks, supervised and unsupervised learning, Perceptron network, linear separability, back propagation networks algorithms, radial basis function networks.

UNIT-II	ASSOCIATIVE MODELS AND CONTROL SCHEMES IN NN	Classes: 09

Auto & hetero associative memory, bi-directional associative memory, self organizing feature maps, Hopfield networks, Neural networks for non -linear system, schemes of Neuro control, system identification, forward model and, inverse model, case studies.

UNIT-III	FUZZY LOGIC AND ITS CONTROLLERS	Classes: 09

Fuzzy set: Crisp set, vagueness, uncertainty and imprecision, fuzzy set, fuzzy operation, properties.

Crisp versus fuzzy relations, fuzzy relations, fuzzy Cartesian product and composition, composition of fuzzy relations Fuzzy to crisp conversion, structure of fuzzy logic controller, database, rule base, inference engine.

UNIT-IV	GENETIC ALGORITHMS	Classes: 09

Genetic Algorithms (GA): Working principles, terminology, importance of mutation, comparison with traditional methods, constraints and penalty function, GA operators, real coded GAs.

UNIT-V	APPLICATIONS OF AI TECHNIQUES	Classes: 09

Applications of neural network, fuzzy system, genetic algorithms for power systems and power electronics systems-designing of controllers using simulation software, NN tool box & fuzzy logic toolbox.

Text Books:

1. Jack M.Zurada, "Introduction to Artificial Neural Systems", Jaico publishing house 1st Edition,2006
2. Simon Haykin, "Neural Networks – A comprehensive foundation", Pearson Education Asia, 1st Edition,2002

Reference Books:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill International Edition, USA, 1stEdition, 1997.
2. Awrence Fausatt, "Fundamentals of neural networks", Prentice Hall of India, New Delhi, 1st Edition, 1994.
3. Bart kosko, "Neural Networks and Fuzzy Systems", Prentice Hall of India, New Delhi, 1stEdition, 1994.
4. Zimmerman H.J., "Fuzzy set theory – and its applications", Kluwer Academic Publishers, 1st Edition, 1994.
5. Kalyanmoy Deb, "Optimization for Engineering Design", prentice hall of India first edition, 2ndEdition, 1988.
6. David E Goldberg, "Genetic Algorithms in search, optimization and machine learning", Pearson Education, 1st Edition,2009.
7. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication, 1st Edition,1998.
8. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com, 1st Edition,2002.

Web References:

1. https://ocw.mit.edu/.../lecture-notes/Lecture1Final.pdf
2. https://zohaibjahan.blogspot.com/2014/11/free-download-artificial

E-Text Books:

1. https://bookboon.com/en/artificial-intelligence-ebooks
2. https://smtebooks.eu/book/9719/artificial-intelligencE

POWER QUALITY

PEC-IV: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB17	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course deals with the basic concepts power quality problems, mitigation techniques used to improve power quality in distribution system. This course is designed to construct study of characterization of voltage sag magnitude and three phase unbalanced voltage sag. This course also concludes with the behavior of power electronics loads, induction motors and synchronous motors.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The different terms of power quality.
II. The power quality issues for short and long interruptions.
III. The study of characterization of voltage sag magnitude and three phase unbalanced voltage sag.
IV. The behavior of power electronics loads, induction motors, synchronous motor etc. by the power quality issues.
V. The mitigation of power quality problems by using VSI converters.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Identify the Power Quality problem by applying the techniques to mitigate them.	Apply
CO 2	Analyze the methodology to improve the power quality for sensitive loads by various custom power devices.	Analyze
CO 3	Analyze the difference between failure, outage and Interruptions for reliability evaluation to power quality	Analyze
CO 4	Analyze the voltage sag and swell based power quality problem in Single phase and three phase system for deenergization of large load.	Analyze
CO 5	Identify the Power Quality problems in Industry power systems for harmonic distortions in the nonlinear loads.	Apply
CO 6	Evaluate power quality monitoring and classification mitigating techniques for the quality of voltage and current produced by a power plant.	Evaluate

IV.SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Introduction of the power quality (PQ): Problem, terms used in PQ voltage, 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.

UNIT-III	SINGLE AND THREE-PHASE VOLTAGE SAG CHARACTERIZATION	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.

Text Books:

1. Math H J Bollen, "Understanding Power Quality Problems", IEEE Press, 1st Edition, 2007.
2. Sastry Vedam Mulukutla Sarma, "Power Quality VAR Compensation in Power Systems", R, CRC Press, 1st Edition, 2004.

Reference Books:

1. G T Heydt, "Electric Power Quality", (West Lafayette, IN, Stars in a circle Publications, 1st Edition, 1994.
2. R Sastry Vedam Mulukutla Sarma, "Power Quality VAR Compensation in Power Systems", CRC Press, 1st Edition, 2000.
3. A Ghosh, G Ledwich, "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic, 1st Edition, 2002.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

POWER SYSTEM PLANNING AND RELIABILITY

PEC-IV: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB18	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The Power system reliability course will provide students with a fundamental knowledge on the reliability evaluation of engineering systems with emphasis on electric power systems. Models and methodologies for power systems reliability assessment will be studied. Application of probability theory for design and management of power generation, transmission and distribution systems using SCADA.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The generation system model and recursive relation for capacitive model building.
II. The equivalent transitional rates, cumulative probability and cumulative frequency.
III. The understanding of risk, system and load point reliability indices.
IV. The basic and performance reliability indices.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Apply concepts of the probability theory for power systems reliability evaluation	Apply
CO 2	Apply probability methods to formulate and probabilistically simulate simple electric energy systems for computing reliability indices and production costs	Apply
CO 3	Evaluate generation capacities by pooling all sources of generation with all loads	Analyze
CO 4	Analyze distribution system networks with indices to improve power system performance	Analyze
CO 5	Illustrate optimal solutions for improvising power transfer capability, enhancing power quality and reliability	Apply
CO 6	Justify the basic tasks of Supervisory Control Systems (SCADA)as well as their typical applications in industries	Evaluate

IV. SYLLABUS

UNIT-I	LOAD FORECASTING	Classes: 09

Objectives of forecasting: Load growth patterns and their importance in planning, load forecasting Based on discounted multiple regression technique, weather sensitive load forecasting, determination of annual forecasting, use of AI in load forecasting.

UNIT-II	GENERATION SYSTEM RELIABILITY ANALYSIS	Classes: 09

Probabilistic generation and load models: Determination of LOLP and expected value of demand not served, determination of reliability of ISO and interconnected generation systems.

UNIT-III	TRANSMISSION SYSTEMS RELIABILITY EVALUATION	Classes: 09

Deterministic contingency analysis: Probabilistic load flow, fuzzy load flow probabilistic transmission system reliability analysis.

Determination of reliability indices like LOLP and expected value of demand not served.

UNIT-IV	EXPANSION PLANNING	Classes: 09

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India, capacitor placer problem in transmission system and radial distributions system.

UNIT-V	DISTRIBUTION SYSTEM PLANNING OVERVIEW	Classes: 09

Introduction, sub transmission lines and distribution substations, design primary and secondary systems, distribution system protection and coordination of protective devices.

Text Books:

1. Roy Billinton and Ronald Allan Pitam: Reliability Evaluation of Power Systems, 1st Edition,1996.
2. RL Sullivan: Power System Planning, McGraw Hill International, 1st Edition,1977.

Reference Books:

1. Wheel Wright and Makridak is: Forecasting methods and Applications, John Wiley, 1st Edition,1992.
2. J Endremyl: Reliability Modelling in Electric Power Systems, John Wiley, 1st Edition,2005.
3. X. Wang & J.R. McDonald, “Modern Power System Planning”, McGraw Hill Book Company,1994.
4. T. Gonen, “Electrical Power Distribution Engineering”, McGraw Hill Book Company,1986

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com
5. https://www.iare.ac.in

E-Text Books:

1. https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

ARTIFICIAL INTELLIGENCE LABORATORY

II Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB19	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

I. COURSEOVERVIEW:

This course deals with the load flow analysis, state estimation and other power system problems. It will also evaluate the economic dispatch of coordinated thermal unit. This course also concludes with artificial intelligence technique like fuzzy logic artificial neural networks and GA algorithms.

II. COURSEOBJECTIVES:

The students will try to learn:

I. The different state estimation techniques.
II. The best artificial intelligence technique for a given Power System problem.
III. The economic dispatch of coordinated thermal unit.
IV. The usage of modern tools like fuzzylogic, artificial neural networks and ANFIS for power system problems
V. The various evolutionary algorithms to power system problems.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Analyze the best artificial intelligence technique for a given Power System problem	Remember
CO 2	Identify the modern tools like fuzzy logic, artificial neural networks and GA algorithms for power system problems	Analyze
CO 3	Apply Evolutionary Techniques in Power Systems	Apply
CO 4	Develop economic dispatch of thermal plants using different control techniques	Analyze
CO 5	Examine load flow analysis and state estimation using neural networks	Apply
CO 6	Analyze the best artificial intelligence technique for a given Power System problem	Evaluate

I

LIST OF EXPERIMENTS

Expt. 1	**LOAD FLOW ANALYSIS**
Load flow analysis using neural network.	
Expt.2	**STATE ESTIMATIONS**
State estimations using neural network.	
Expt.3	**CONTINGENCY ANALYSIS**
Contingency analysis using neural network.	
Expt.4	**POWER SYSTEM SECURITY**
Power system security using neural network.	

Expt.5	**AGC - SINGLE AREA SYSTEM / TWO AREA SYSTEM**
Fuzzy logic based AGC for single area system and two area systems.	
Expt.6	**SMALL SIGNAL STABILITY ANALYSIS**
Fuzzy logic based small signal stability analysis.	
Expt.7	**ECONOMIC DISPATCH THERMAL UNITS**
Economic dispatch of thermal UNITs using conventional and ANN algorithms.	
Expt.8	**ECONOMIC DISPATCH THERMAL UNITS**
Economic dispatch of thermal UNITs using conventional and GA algorithms.	
Expt.9	**ECONOMIC DISPATCH THERMAL UNITS**
Economic dispatch of thermal UNITs using conventional and Fuzzy logic.	
Expt.10	**ECONOMIC DISPATCH OF THERMAL PLANTS**
Economic dispatch of thermal plants using conventional and ANN algorithms.	
Expt.11	**ECONOMIC DISPATCH OF THERMAL PLANTS**
Economic dispatch of thermal plants using conventional and GA algorithms.	
Week-12	**ECONOMIC DISPATCH OF THERMAL PLANTS**
Economic dispatch of thermal plants using conventional and Fuzzy logic.	
References:	
1. Chakrabarti, Abhijit, “Power System Dynamics and Simulation”, PHI Learning, 2nd Edition,2012. 2. Barret J P, “Power System Simulation”, Chapman and Hall, 2nd Edition,2013.	
Web Reference:	
1. http://www.iare.ac.in	

POWER SYSTEMS LABORATORY

II Semester: **EPS**

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB20	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

I. COURSEOVERVIEW:

The main objective of the course is to provide an overview of the principles of basic protection circuits such as earth tester, different type of relays, breakdown strength of air gap, soil resistivity, millivolt drop test. It will also help students to formulate different type of protection scheme.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The parameters, surge impedance loading and reactive power compensation of transmission lines.
II. The concept of various transmission line protection schemes.
III. The simulate and study feeder protection and generator protection circuits.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Determine earth resistance by using crank type earth tester.	Analyze
CO 2	Explain the concept of electrical integrity of connections and contacts in a circuit breaker using milli-volt drop test.	Analyze
CO 3	Apply the concept of soil resistivity as function of salinity and time.	Apply
CO 4	Analyze internal fault protection of single-phase transformer using merz price protection.	Analyze
CO 5	Examine the alternator during over voltage, under voltage, over and under frequency by using respective relays.	Analyze
CO 6	Determine earth resistance by using crank type earth tester.	Analyze

I

LIST OF EXPERIMENTS

Expt. 1	**EARTH TESTER**
Determination of earth resistance by using crank type earth tester.	
Expt. 2	**MILLI VOLT DROP TEST**
Measurement of contact resistances of different combinations of test objects.	
Expt. 3	**SOIL RESISTIVITY**
Measurement of soil resistivity as a function of salinity and time.	
Expt. 4	**MICROPROCESSOR BASED OVER CURRENT RELAY**
Determination of performance characteristics of microprocessor based over current relay.	

Expt. 5	**ELECTROMECHANICAL OVER CURRENT RELAY**
Determination of performance characteristics of electromechanical over current relay.	
Expt. 6	**BREAKDOWN STRENGTH OF AIR BY HORN GAP**
Determination of breakdown voltage of air using horn gap apparatus at atmospheric conditions.	
Expt. 7	**POWER ANGLE CHARACTERISTICS OF SYNCHRONOUS MACHINE**
Study the power angle characteristics of synchronous machine by synchronizing to the grid.	
Expt. 8	**MERZ PRICE PROTECTION IN SINGLE PHASE TRANSFORMER**
Study the Merz price protection of single phase transformer and determine the characteristics of percentage biased relay.	
Expt. 9	**DIFFRENTIAL PROTECTION SCHEME IN SYNCHRONOUS GENERATOR**
Study of differential protection in three phase ac generator.	
Expt. 10	**NEGATIVE SEQUENCE PROTECTION IN ALTERNATOR**
Study the numerical type negative sequence protection in a given alternator.	
Expt. 11	**OVER FREQUENCY AND UNDER FREQUENCY PROTECTION**
Study the generator protection during over and under frequency cases with suitable relays.	
Expt. 12	**PERFORMANCE OF ALTERNATOR AGAINST INTERNAL FAULTS**
Study the performance of synchronous machine and its protection scheme during internal faults.	

Reference Books:

1. Paithankar, S RBhide, “Fundamentals of Power System Protection”, PHI, 1st Edition, 2003.
2. CLWadhwa, “Electrical Power Systems”, New Age international (P) Limited, 6th Edition, 2010.
3. VK Mehta, “Principles of power systems”, S Chand Publications, 4th Edition, 2009.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.iare.ac.in
4. https://www.deltaww.com

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: 30	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 30		

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Interpret** the technique of determining a research problem for a crucial part of the research study.	Remember
CO2	**Examine** the way of methods for avoiding plagiarism in research.	Apply
CO3	**Apply** the feasibility and practicality of research methodology for a proposed project.	Apply
CO4	**Make use of** the legal procedure and document for claiming patent of invention.	Understand
CO5	**Identify** different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP.	Understand
CO6	**Defend** the intellectual property rights throughout the world with the involvement of world intellectual property organization	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 07

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: 05

Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT-III	RESEARCH PROPOSAL	Classes: 06
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: 06**
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: 06**
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 New Technological Age", 2016 2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008		
E-Text Books:		
1. http://nptel.ac.in/courses/107108011/		

SCADA SYSTEM AND APPLICATIONS

PEC-V: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB22	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course provides an exposure to technology of automation and control as widely seen across a typical power system network. It contains a wide range of topics from typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, features and other devices used for interfacing with real time systems. The course also includes the applications of SCADA systems in monitoring, control and management of energy in transmission and distribution networks of a power system and other industries.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Understand what is meant by SCADA and its functions.
II. Explain SCADA communication to get an insight into its application.

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Demonstrate the basic functionality, merits and demerits of PLC and SCADA systems for supervisory control of an industrial system	Understand
CO 2	Develop the ladder diagram and functional block diagrams for interfacing PLC with SCADA system.	Apply
CO 3	Identify the typical components of SCADA systems used for interfacing with real time systems	Apply
CO 4	Analyze the different types of architectures and communication technologies ofa typical SCADA system	Analyze
CO 5	Make use of SCADA systems for controlling, security and energy management of a power system networks	Apply
CO 6	Appraise the superiority of SCADA systems in operation, controlling, and monitoring of oil, gas, water and power industries.	Evaluate

IV. SYLLABUS

UNIT-I	INTRODUCTION TO SCADA AND PLC	Classes: 09

Data acquisition system, evaluation of SCADA, communication technologies, monitoring and supervisory functions; PLC: Block diagram, programming languages, ladder diagram, functional block diagram, applications, interfacing of PLC with SCADA.

UNIT-II	SCADA SYSTEM COMPONENTS	Classes: 10

Industries SCADA system components: Schemes, remote terminal UNIT (RTU), intelligent electronic devices(IED), communication network, SCADA server, SCADA / HMI systems.

UNIT-III	SCADA ARCHITECTURE AND COMMUNICATION	Classes: 08

SCADA architecture: Types, advantages and disadvantages of each system, single unified standard architecture-IEC 61850.

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

UNIT-IV	OPERATION AND CONTROL	Classes: 09

SCADA Operation and Control: Operation and control of interconnected power system, automatic substation control, SCADA configuration, energy management system, system operating states, system security, state estimation UNIT.

UNIT-V	SCADA APPLICATIONS	Classes: 09

SCADA Applications: 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, 2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.

Reference Books:

1. William T. Shaw, "Cyber Security for SCADA systems", Penn Well Books, 2006.
2. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
3. Sunil S Rao, "Switchgear and protections", Khanna Publications, 2nd Edition, 2000.
4. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for Electric Power", PennWell1999.

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.

FLEXIBLE AC TRANSMISSION SYSTEMS

PEC-V: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB23	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW

This course introduces the application of a variety of high power-electronic controllers for active and reactive power in transmission lines. Students are exposed to the basics, modeling aspects, control and scope for different types of FACTS controllers.

II. OBJECTIVES:

The students will try to learn:

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

III. COURSEOUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Recall the basics of power transmission capability and role of power electronic converters in transmission interconnections	Understand
CO 2	Identify the suitable VSC and CSC for high pulse operation of FACTS controllers	Apply
CO 3	Interpret the impact of shunt compensation on voltage stability, transient stability and power oscillation damping.	Apply
CO 4	Evaluate the performance of SVC and STATCOM to see how they are involved in enhancing the dynamic performance and transient stability	Analyze
CO 5	Model the static synchronous compensator, series compensators GSC, TSSC and TCSC for improving the power systems dynamics	Apply
CO 6	Recall the basics of power transmission capability and role of power electronic converters in transmission interconnections	Evaluate

IV. SYLLABUS

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 FACTS controllers.

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
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. Hingorani H G and Gyugyi. L "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems" New York, IEEE Press, 1st Edition, 2000.
2. PadiyarKR,"FACTSControllersinPowerTransmissionandDistribution"NewAgeInt.Publishers, 2nd Edition, 2007.

Reference Books:

1. Zhang, Xiao-Ping, Rehtanz, Christian, Pal, Bikash "Flexible AC Transmission Systems: Modeling and Control", Springer, 1st Edition,2012.
2. Yong-Hua Song, Allan Johns, "Flexible AC Transmission Systems", IET, 1st Edition, 1999.

Web References:

1. https://www.researchgate.net
2. https://www.aar.faculty.asu.edu/classes
3. https://www.facstaff.bucknell.edu/
4. https://www.electrical4u.com

E-Text Books:

1. https://www.site.uottawa.ca
2. https://www.galerybooks.com
3. https://www.jntubook.com/
4. https://www.freeengineeringbooks.com

ELECTRICAL TRANSIENTS IN POWER SYSTEMS

PEC-V: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB24	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

The purpose of this course to enable the students about different types of power system transients, their phenomena and protective equipment used. The course mainly focus on the behavior of travelling waves for lines terminated by different conditions, lightning, switching and temporary over voltages, modelling of overhead lines, parameters of underground cables and the computation of power system transients using the Electro Magnetic Transient Program (EMTP).

II.COURSE OBJECTIVES:

The students will try to learn:

I. The reasons for occurrence of transients in a power system.
II. The change in parameters like voltage & frequency during transients.
III. The lightning phenomenon and its effect on power system.
IV. The various protective devices against transients.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	Discuss the behavior of travelling waves for a line terminated by open circuit, short circuit and lumped reactive elements to find the reflection and refraction coefficients.	Analyze
CO 2	Use the Bewley's lattice diagram in travelling wave analysis under different loading conditions to design the protective equipment's for lines.	Apply
CO 3	Discuss the energizing transients and methods to control the over voltages, line dropping and rejection.	Analyze
CO 4	Compute the resistance, inductance and capacitance of a transmission line using the concepts of Geometric Mean Radius (GMR) and Geometric Mean Distance (GMD).	Analyze
CO 5	Compute the cable series impedance and shunt admittance of self-contained single core and three core cables.	Analyze
CO 6	Examine the power system transients using Electro Magnetic Transient Program (EMTP)	Analyze

IV. SYLLABUS

UNIT-I	REVIEW OF TRAVELLING WAVE PHENOMENA	Classes: 09

Lumped and Distributed Parameter: Wave equation, reflection, refraction, behaviour of travelling waves at the line terminations, lattice diagrams, attenuation and distortion.

UNIT-II	LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES	Classes: 10

Lightning over voltages: interaction between lightning and power system ground wire voltage and voltage across insulator; switching overvoltage: Shortline or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary over voltages: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT-III	PARAMETERS AND MODELLING OF OVERHEAD LINES	Classes: 08

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors: Equivalent GMR and equivalent radius.

Modal propagation in transmission lines: modes on multiphase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on untransposed lines; effect of ground return and skin effect; transposition schemes.

UNIT-IV	PARAMETERS OF UNDERGROUND CABLES	Classes: 09

Distinguishing features of underground cables: technical features, electrical parameters, overhead lines versus underground cables; cable types: Series impedance and shunt admittance of single core self-contained cables, impedance and admittance matrices for three phase system formed by three single core self-contained cables, approximate formulas for cable parameters.

UNIT-V	COMPUTATION OF POWER SYSTEM TRANSIENTS - EMTP	Classes: 09

Digital computation of line parameters: Why line parameter evaluation programs; Salient features of mt line: Constructional features of that affect transmission line parameters, elimination of ground wires bundling of conductors; Principle of digital computation of transients: features and capabilities of EMTP; steady state and time step solution UNITs: basic solution methods.

Text Books:

1. Allan Greenwood, “Electrical Transients in Power System”, Wiley& Sons Inc. New York, 1st Edition,1991.
2. Harold A Peterson, “Transient in Power Systems”, McGraw Hill,1st Edition,1966.

Reference Books:

1. Kuffel and Abdullah, “High Voltage Engineering”, PHI, 1st Edition, 2000.
2. Rakesh D Begamudre, “EHV AC Transmission Engineering”, PHI, 1st Edition, 2006.
3. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2004.
4. Hermann W. Dommel, EMTP Theory Book, second Edition, Microtran Power System Analysis Corporation, Vancouver, British Columbia, Canada, May 1992, Last Update: April1999.

Web References:

1. https://www.EMTP Literature fromwww.microtran.com
2. https://www.smartech.gatech.edu/bitstream/handle/1853/14488
3. https://www.weibull.com/basics/reliability.htm

E-Text Books:

1. https://www.download.springer.com/static/pd
2. https://www.web.mit.edu/energylab/www/pubs/el99-005wp.pdf

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		

I. COURSE OVERVIEW:

This course covers the fundamentals of data analysis, such as data gathering or data mining this course covers concepts of data analysis, regression analysis, organization structures, forecasting techniques and decision analysis. The *data analytics* tools help in the data mining processes from loading to transformation, aggregation, automated parameter, and process optimization.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The role of business analytics within an organization.
II. The relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate

III COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	Analyze data using statistical and business analytics technology	Analyze
CO2	Solve business problems and to support managerial decision making	Apply
CO3	Choose business decision Strategies with the without outcome probabilities	Apply
CO4	Perform statistical analysis on variety of data	Apply
CO5	Experiment Data using Business Analytics Technology	Apply

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		
BCSB26	Open Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students develop a comprehensive understanding of industrial safety principles and practices. They are equipped with the skills to identify, assess, and manage workplace hazards, promoting a culture of safety in their future engineering careers.

II. COURSE OBJECTIVES:

The students will try to learn:

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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe the theories of accident causation and preventive measures of industrial accidents.	Understand
CO 2	Summarize the functions of maintenance department and application tools used for maintenance	Understand
CO 3	Recall the corrosion and its prevention methods	Remember
CO 4	Outline the fault tracing methods of various types of equipment	Understand
CO 5	Explain the Periodic and preventive maintenance of mechanical and electrical equipment	Understand

IV. SYLLABUS

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. H. P. Garg, "Maintenance Engineering", S. Chand and Company.		
Reference Books		
1. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication. 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		

I. COURSE OVERVIEW:

The course allow students to possess a solid understanding of optimization techniques and their applications. They are equipped with the skills to formulate and solve optimization problems, analyze and interpret results, and make optimal decisions in various domains such as operations management, logistics, finance, and engineering.

II. COURES OBJECTIVES:

The students will try to learn:

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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall the basics of operation research	Understand
CO2	Explain the characteristics and scope of OR	Understand
CO3	Outline and formulate mathematical problems	Understand
CO4	Select optimal problems solving techniques for a given problem using LP	Apply
CO5	Solve transportation, travelling sales man and Assignment problems	Apply

IV. COURSE OUTCOMES:

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		

I. COURSE OVERVIEW:

The course allow students to have a comprehensive understanding of cost management principles and practices in engineering projects. They are equipped with the skills to plan, estimate, control, and communicate project costs effectively, contributing to the successful delivery of projects within budgetary constraints

II. COUSRE OBJECTIVES:

The students will try to learn:

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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Summarize the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept.	Understand
CO 2	Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.	Understand
CO 3	Interpret the meaning and different types of project management and project execution, detailed engineering activities.	Understand
CO 4	Understand the project contracts, cost behavior and profit planning types and contents, Bar charts and Network diagram	Understand
CO 5	Analyze by using quantitative techniques for cost management like PERT/CPM.	Analyze

IV. SYLLABUS:

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		

I. COURSE OVERVIEW:

In this course, students will gain insight into the manufacturing processes for composites, from choosing appropriate reinforcement fibers to integrating them with suitable matrices. They will develop an understanding of the challenges and considerations involved in achieving desired strength properties. This knowledge will enable them to evaluate and optimize the manufacturing processes for different types of composites based on specific application requirements.

II. COUSE OBJECTIVES:

The students will try to learn:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the basic mechanical behavior of composite materials and make sound prediction on the likely behavior of new combinations of materials.	Understand
CO 2	Explain the properties of and applications of fibers, particle reinforcements and make use of rule of mixtures	Understand
CO 3	Interpret Manufacturing of Metal Matrix Composites, Properties and applications.	Understand
CO 4	Understand Manufacturing of polymer Matrix Composites, Properties and applications	Understand
CO 5	Recall the concepts of failure criteria of strength	Remember

IV. SYLLABUS:

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		

I. COURSE OVERVIEW:

In this course, students will gain insights into the principles associated with effective energy management using biomass resources. They will understand the different conversion technologies and their applications in sustainable energy systems. By applying these principles in their daily lives, students will be able to make informed decisions regarding energy consumption, resource utilization, and environmental sustainability.

II. COURSE OBJECTIVES:

The students will try to learn:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Remember
CO 2	Explain the energy generation technologies from waste treatment plants and disposal of solid waste by aerobic composting and incineration process.	Understand
CO 3	Illustrate the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Analyze
CO 4	Understand the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 5	Outline the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Create

IV. SYLLABUS:

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 program 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		

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Interpret the technique of determining a research problem for a crucial part of the research study	Apply
CO 2	Examine the way of methods for avoiding plagiarism in research	Understand
CO 3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO 4	Make use of the legal procedure and document for claiming patent of invention.	Apply
CO 5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

IV. SYLLABUS:

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		

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.	Understand
CO 2	Understand how to react effectively to natural, manmade, and planetary hazards	Understand
CO 3	Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.	Analyze
CO 4	Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery	Understand
CO 5	Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities	Remember

IV. SYLLABUS:

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. 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		

I. COURSE OVERVIEW:

In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand the basic Sanskrit grammar	Understand
CO 2	Formulate simple sentences	Apply
CO 3	Apply order and roots	Apply
CO 4	Understand Ancient Sanskrit literature about science & technology	Understand
CO 5	Develop logical thinking being a logical language in technical concepts	Apply

IV. SYLLUBUS:

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		

I. COURSE OVERVIEW:

In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE 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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand the significance of ethical human conduct and self-development	Understand
CO 2	Adopt value-based living and holistic technologies to save nature	Apply
CO 3	Inculcate positive thinking, dignity of labor and religious tolerance	Apply
CO 4	Develop the overall Character and Competence through self-management	Analyze
CO 5	Practice Self-control. Honesty through Studying effectively all religious messages	Apply

IV. SYLLABUS:

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		

I. COURSE OVERVIEW:

The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.	Understand
CO 2	Understand the Constitutional Rights and and duties	Understand
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary	Understand
CO 4	Analyse the decentralization of power between central, state and local self-government.	Analyze
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	Apply

IV. SYLLABUS:

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		

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II.COURSE OBJECTIVES:

The course should enable the students to:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the Methodology and conceptual framework of teachers education	Understand
CO 2	Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	Understand
CO 3	Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners	Understand
CO 4	Classify the importance of class room practice, curriculum and learning in Professional Development.	Understand
CO 5	Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	Understand

IV. SYLLABUS:

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.

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		

I. COURSE OVERVIEW:

In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to: (Same as R18)

CO 1	Understand Ashtanga yog and its impartance	Understand
CO 2	Identify the Dos and Do nots of Life by practicing the Yam and Niyam	Analyze
CO 3	Interpret the Shaucha and its components	Understand
CO 4	Make use of breathing techniques and Asan and Pranayam	Understand
CO 5	Develop healthy mind in a healthy body thus improving social health also	Apply

IV. SYLLABUS:

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		
BCSB39	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:

The students will try to learn:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Summarize steps to develop personality with stable mind, pleasing manners and determination.	Understand
CO 2	Identify day to day work and duties for developing peace and prosperity as depicted in Geeta.	Analyze
CO 3	Formulate the daily life style by depicting the verses from Bhagavatgeetha.	Analyze
CO 4	Outline the verses of Shrimad Bhagavad Geetha for holistic development.	Create
CO 5	Demonstrates personality development by verses of Bhagavatgeetha.	Create

IV. SYLLUBUS:

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

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE orUniversity**

   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 ownDegrees?**

   No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. **WhatisthedifferencebetweenaDeemedUniversityandanAutonomyCollege?**

   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 becomeAutonomous?**

   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. **WhowillcheckwhethertheacademicstandardismaintainedimprovedafterAutonomy?How will it bechecked?**

   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 academicexcellence?**

   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 ownConvocation?**

   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 degreecertificate?**

   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 betteremployability.

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 externalassessment.

12. **Is it possible to have completeInternal Assessment for Theory or Practical's?**
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 GradeSystem?**
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 GradeSystem?**
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.

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

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 up to 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 makeup 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 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 JNTUniversity?

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	Expulsion from the examination hall and cancellation of performance in that subject and

	question paper during the examination or answer book or additional sheet, during or after the examination.	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 2019-2020 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 init.

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