SANJAY GHODAWAT UNIVERSITY
KOLHAPUR

Sanjay Ghodawat University (SGU) is established in the Academic Year 2017-18, as a State Private University under Govt. of Maharashtra Act No. XL of 2017 dated 3rd May 2017, with the approval of the UGC and the state Government. "For the true measure of giving is giving without measure." Spread across 150 Acres, Sou. Sushila Danchand Ghodawat Charitable Trust's Sanjay Ghodawat University (SGU) is situated in serene atmosphere amidst idyllic hills and lush green meadows to study in harmony with Nature. The Institution aspires to run along the lines of best-in- the-world education and become a world-class institution where teaching-learning process gets a far deeper meaning. SGU always stands as the guiding star of brilliance, quality and deliverance beyond expectations. Innovativeness and Creativity are the hallmarks of a genius enterprise and SGU stands to be a stage where these qualities would be nurtured, encouraged and blossomed.The genius is incomplete without the sense of social responsibility and SGU's ultimate goal remains the development of an attitude of gratitude that freely gives back without expectations.

The Sanjay Ghodawat University stands as a beacon of light to guide the younger generation of the day on the right path to fulfilment in career and life. The USP of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution orientedthinking promotion, stress on research and innovation,international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

The university will help students develop as a unique individual-to be educated as a whole person, intellectually, emotionally, socially, ethically, and spiritually.The educational program designs are worked out meticulously in line with best in class universities with special focus on:

- Flexible Choice Based Credit System
- OBE - Outcome Based Education System
- Experiential Learning
- Project Based Learning
- Case Based Learning
- Training need analysis based on Performance Appraisal System
- Active Learning tools for effective delivery

- Mentoring / Proctorship
- On line learning /Self learning platforms
- Flipped Classroom concept
- Effective Student Feedback Mechanism

VISION

Internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind.

MISSION

- To prepare students for life-long learning and leadership in a global academic culture
- To create intellectual manpower relevant to the industry and society at large
- To collaborate with institutions of international repute for academic excellence
- To promote research and development through conducive environment
- To encourage entrepreneurship and skill development programs

CORE VALUES

- Integrity
- Transparency
- Accountability
- Equality
- Empathy
- Stewardship

QUALITY POLICY

Sanjay Ghodawat University is committed to establish high standards in value-based quality education to enhance and nurture young minds to excel in their chosen profession and develop into socially responsible citizens through resourceful collaboration, innovation and research

CHOICE BASED CREDIT SYSTEM (CBCS)

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.

University Grants Commission has come up with the Choice Based Credit System (CBCS) programme in which the students have a choice to choose from the prescribed courses, which are referred as core, elective or minor or soft skill courses and they can learn at their own pace and the entire assessment is graded-based on a credit system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

Where the students can choose the prescribed courses, as the core, and elective or soft skill courses, from a range of options, rather than to simply consume what the curriculum offers. They can learn at their own pace and the assessments are graded based on a credit system. It provides an opportunity for students to have a choice of courses or subjects within a programmed resembling a buffet, against the mostly fixed set of subjects now being offered (except for the limited choice of electives in professional degrees and postgraduate programmers) with the flexibility to complete the programmed by earning the required number of credits at a pace decided by the students.

The UGC has always initiated measures to bring efficiency and excellence in the Higher Education System of India. The basic motive is to expand academic quality in all aspects, right from the curriculum to the learning-teaching process to examination and evaluation systems. However, so far multiple methods are followed by different universities across the country towards examination, evaluation and grading system. Considering this diversity, the implementation of the choice based credit system seems to be a good system in assessing the overall performance of a student in a universal way of a single grading system.

OUTCOME BASED EDUCATION (OBE) MODEL

Sanjay Ghodawat University (SGU) has implemented OBE model of education, which is a learner centered approach. SGU has witnessed a sea change in the entire academic systems with implementation of all three components of OBE – Design, Delivery and Assessment. The SGU model of autonomy focuses on experiential learning which believes in learning by doing. This is achieved through hands on experience, industrial assignments, mini projects and live problem solving and collaboration with industries.

SGU is set in to dynamics of transformation and witnessing a shift in focus from teaching to learning and entire academic system of SGU is designed to provide multiple learning opportunities for students to acquire and demonstrate the Knowledge, Skills and Attitudes (KSA) for rewarding career.

The Vision and Mission of the Management, contribution from eminent BOG members and knowledgeable members of Academic Council and Board of Studies, the motivation and drive of the Director, the relentless efforts of the fellow Deans and Head of Departments and all teaching and non teaching staff along with commitment to learning of students made it possible to successfully transform the institute and stand out to carve a niche for itself as an Institute of repute.

OBE is an approach of curriculum design and teaching that focuses on what students should be able to do (attained) at the end of course/ program. Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes (KSA). Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behavior a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular degree is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

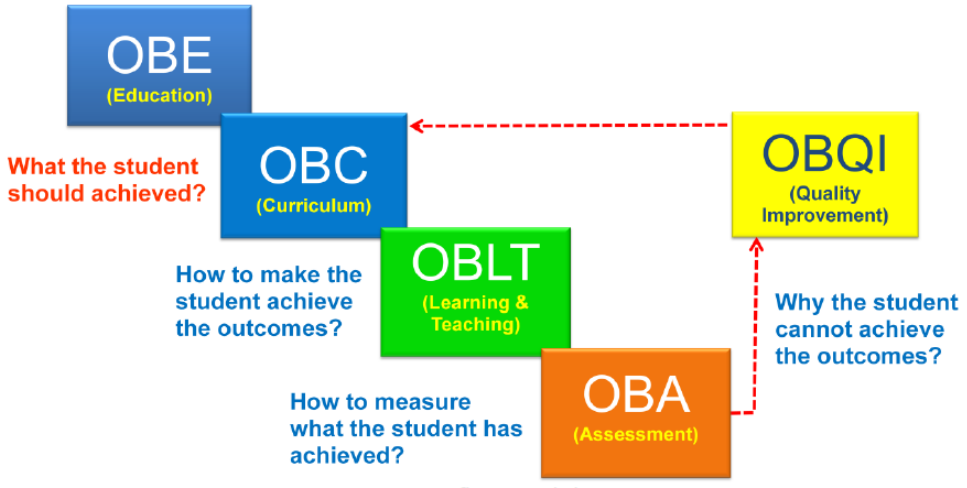
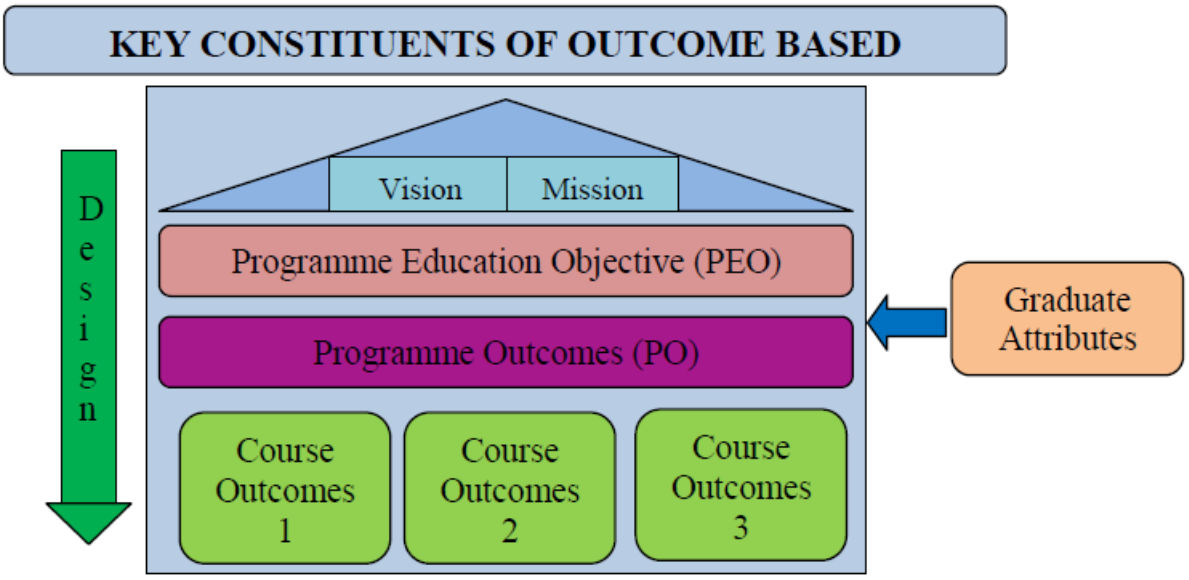


Figure 1: OBE flows and desciption

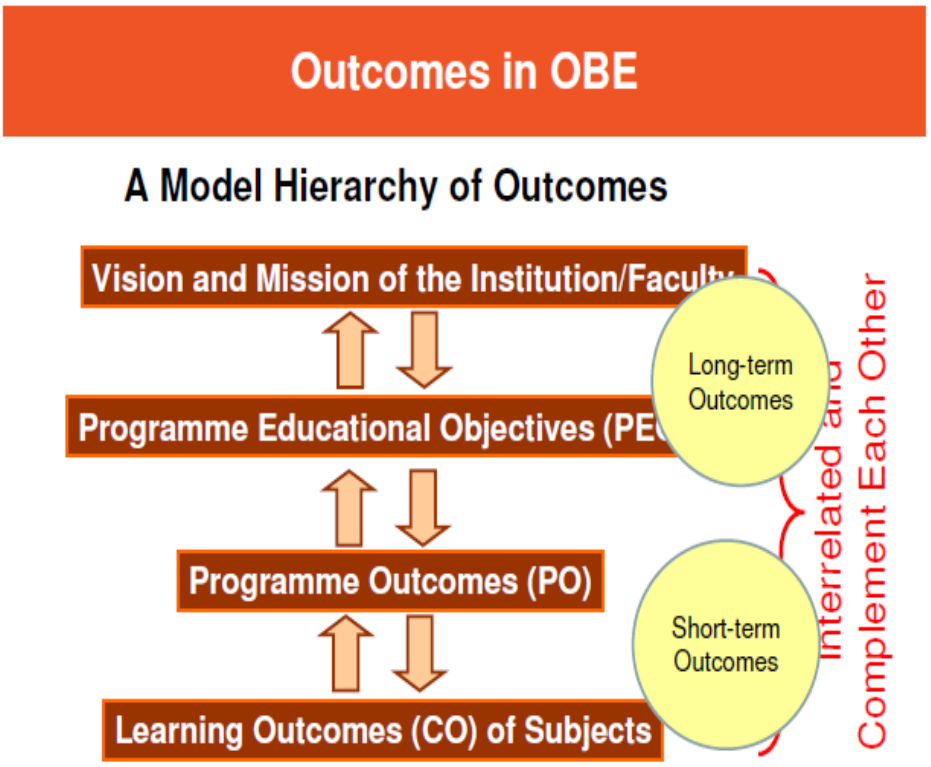


The OBE model measures the progress of the graduate in three parameters, which are

- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEO) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the Graduate attributes. Course outcomes are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester.

The various assessment tools for measuring Course Outcomes include Tests and End Semester Examinations, Tutorials, Assignments, Project work, Labs, Presentations, Employer/Alumni Feedback etc,. These course outcomes are mapped to Graduate attributes and Program outcomes based on relevance. This evaluation pattern helps Institutions to measure the Program Outcome. The Program Educational Objective is measure through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education records.



Special Features of OBE

- OBE is an educational process that focuses on what students **can do** or the **qualities** they should develop after they are taught.
- OBE involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.
- Both structures and curricula are designed to achieve those **capabilities** or **qualities**.
- Discourages traditional education approaches based on direct instruction of facts and standard methods.
- It requires that the students demonstrate that they have learnt the required skills and content.

Sanjay Ghodawat University, Kolhapur

(Established as a State University under Government of Maharashtra Act No XL dated 3rd May 2017)

Academic and Examination Rules and Regulations

Approved in the second Academic Council Meeting held on 9th May, 2018 and to be implemented from academic year 2018-19. [Version R0]

Sanjay Ghodawat University Kolhapur

Kolhapur - Sangli Highway, A/p Atigre - 416 118, Tal. - Hatkanangale, Dist. Kolhapur, Maharashtra, India

(Implemented from Academic year 2018-19)

Academic and Examination Rules and Regulations

1.0 Preamble

The Sanjay Ghodawat University (SGU) stands as a beacon of light to guide the younger generation of the day on the right path to fulfillment in career and life. Outcome Based Education (OBE) model is adopted to enhance the effectiveness of teaching learning process and Credit Based semester system is implemented.

The focus of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

Vision of SGU is internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind. To achieve the vision SGU will develop state-of-the-art infrastructure that promotes conducive ambience promoting innovation and research. Create intellectual manpower relevant to the industry and society at large. Foster mutually beneficial partnership with alumni, industry and academia. Inculcate ethics and values to develop socially responsible citizens and promote entrepreneurship.

SGU is offering various programs through schools such as School of Technology, School of Commerce and Management, School of Sciences and School of Arts.

SGU has implemented the outcome based Education (OBE) system and Credit based Evaluation System in all the schools.

The rules and regulations mentioned in this document are applicable to all the Under Graduate (UG) and Post Graduate programs offered by the Sanjay Ghodawat University from the academic year 2018-19. The rules and regulations stated here under are subjected to revisions / refinements, updates and modifications and amendments by academic council (AC) from time to time and applicable to all batches including those already undergoing programs at different year and are binding on all stakeholders including students, faculty, parents and University authorities.

The academic programs of the University shall be governed by rules and regulations approved by the academic council from time to time. Academic council is the supreme and statutory academic body that governs all academic matters of the university and the decisions of the academic council are final and binding in the matters related to academics.

2.0 Definition of Terms

1. University: University means Sanjay Ghodawat University, Kolhapur

2. Academic Year: The period of the year during which students attend university for all academic activities, usually it starts from first of July and ends on 30th of June next year.

3. Semester**:** Academic Year is divided in to 2 parts called Semester, Odd Semester which starts from July and Even Semester which starts from January.

4. Duration of Semester: Total duration of semester is usually 20 weeks per semester including instructions, examination and evaluation. Total instructional days are 90 per semester.

5. **Course:** It is a Subject that is offered in a semester. The course may consist of Theory/Practical/Project/Seminar during semester. Usually taught by instructor in a class. e.g. Physics, Chemistry, Engineering Mechanics, Workshop etc.

6. **Program:** Collection of Courses is called Program. For example B Tech in Mechanical Engineering, M Tech in Civil Engineering, Bachelor of Business Administration. Bachelor of Science etc.

7. **Department:** Department is a unit of the school which offers one or more programs.

8. **Contact Hours:** Time of students in class/laboratory with instructor. Usually in the range of 20-30 Hrs./Week. For the purpose of uniformity one contact hour is measured as 60 minutes

9. **Academic Council (AC):** Means apex academic body governing the academic programs responsible for framing policy , rules and regulations.

10. **Board of Examination (BOE)**: Central body responsible for framing policy ,rules and regulations for Examination.

11. **Board of Studies (BOS):** Departmental academic body to govern the academics of programs(BOS)offered by department.

3.0 Curriculum:

Every program has a prescribed structure which , in general, is known as Curriculum. It prescribes courses to be studied in each semester. The booklet containing courses structure along with detail syllabus for each course of each program is updated periodically and made available on the website.

3.1 Semesters:

SGU implements a credit based semester system. The academic year is divided into two regular semesters. The semesters that begin in July are known as Odd semester and the semester that begin in January are known as Even semesters. Total duration of each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

3.2 Course Credit System/Structure:

In general, a certain quantum of work measured in terms of credits is laid down as the requirement for a particular program. Calculation of number of credits for a course in any semester is as per Table 3.1

Table 3.1: Calculation of number of credits for a course

Sr. No.	Course	Credits
1	Lecture of 1 hour/week	**1**
2	Tutorial of 1 hour/week	**1**
3	Practical / Laboratory / Drawing/mini-project of two hours/ week	**1**
4	Seminar (1 hour per week)	**1**

There are mainly two types of courses- viz. Theory courses and Laboratory courses. Generally a theory course consists of Lecture hours (L) and Tutorial hours (T). Tutorial hours may not be assigned to a particular theory course if it has a separate laboratory course. Laboratory course consists of practical hours (P) for which a student works in a Laboratory/Drawing Hall/Workshop. The other courses required to be taken by a student include seminar, mini project, and project at various levels of the program.

A student shall earn credits for a particular course by fulfilling the minimum academic requirements for attendance and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum evaluation requirements.

The total number of credits required for completing a program shall be mentioned in the course structure. The total number of credits in a semester which a student registers shall generally be 20--25. The maximum number of credits per semester shall not exceed 30

3.3 Audit Course:

3.3.1 A student may have to register for an audit course in a semester which could be institute requirement or department requirement.

3.3.2 An audit course may include either a) a regular course required to be done as per structure or required as pre-requisite of any higher level course or b) the programmes like practical training, industry visits, societal activities etc.

3.3.3 Audit course shall not carry any credits but shall be reflected in Grade Card as "PP"/"NP" depending upon the satisfactory performance in the semester evaluation as per the course curriculum structure.

4.0 Course Registration:

4.1 Every student must register for the courses that he/she wants to study for earning credits at the beginning of each semester on the prescribed dates announced from time to time and shall be mandatory for every student till he/she completes the program. Only after registration his/her name shall appear in the roll list of each of such courses.

4.2 Students shall be required to fill up a Course Registration Form which shall be made available to them by the Student section of Administration office after payment of required fees.

4.3 Registration, according to rules, should be carried out as per the schedule given in academic calendar. Late registration may be permitted only for valid reasons and on payment of late registration fees. In any case, registration must be completed before the prescribed last date for registration, failing which his/her studentship shall be liable to be cancelled. Students having dues outstanding towards the institute or hostel shall be permitted to register only after clearing such dues.

4.4 In-absentia registration may be allowed only in rare cases at the discretion of the Dean Academics and with prior permission.

4.5 For registration in an odd semester, the student must have earned all the credits of the pre-previous year and at least 75% 2/3rd of the credits previous year. For example, for registration of the 5th semester courses (i.e. 3rd year of program), a student must have earned all the credits of the first year and 2/3rd of the credit second year. Similarly for registration of the 7th semester courses (i.e. 4th year of program), a student must have earned all the credits of the second year and
2/3rd of the credits third year. However, if 2/3rd of the calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for taking decision related with this clause.

4.6 A student registered in odd semester shall be eligible to register for the courses offered in the even semester of that year irrespective of his/her SGPA or the number of credits earned by him/her in that odd semester.

5 .0 Lateral Entry for B Tech Programs

Post diploma students in engineering and B.Sc. Graduates can have lateral entry at third semester of the program. Such admissions are governed by the rules of regulatory bodies like AICTE New Delhi and Directorate of Technical Education Maharashtra state and Sanjay Ghodawat University for Admission criteria and shall undergo all academic requirements as specified by the Academic council.

For such students there shall not be First Year Performance Index (FYPI). Semester Performance Index (S GPA) and Cumulative Performance Index (CGPA) shall be calculated from the third semester onwards taking into consideration the courses undergone by them at Sanjay Ghodawat University Kolhapur.

Registration of the students not covered by the cases mentioned above shall be decided by the Academic Council. Such students shall undergo the academic program as specified by the Academic Council. Such odd entry students shall not be eligible for any medals or awards instituted by the institute.

6.0 Change of Program:

This is applicable to B Tech Programs only. Students shall be eligible to apply for Change of Program after completing the first two semesters. The following rules/ guidelines shall be used for considering their applications for change:

6.1 The change of program shall be permitted strictly on merit basis subject to the rules of admissions prevailing at the time of such change.

6.2 Students without fail grades and/or backlogs shall be eligible to apply for change of program and can give their choices in the order of preference.

6.3 The request for change of program by a student from program A to program B shall be considered if number of students of program B does not exceed the sanctioned capacity of program B and also the minimum strength required to run the program as decided by Academic Council.

6.4 All such transfers can be effected only once at the beginning of the second academic year of the 4-year UG program. No application for change of program during subsequent academic years shall be entertained.

7. Facilitation to Students:

7.1 Faculty Advisor:

On joining the institute, a student or a group of students shall be assigned to a faculty advisor who shall be mentor for a student throughout his/her tenure in the institute. A student shall be expected to consult the faculty advisor on any matter relating to his/her academic performance and the courses he/she may take in various semesters / summer term. A faculty advisor shall be the person to whom the parents/guardians should contact for performance related issues of their ward. The role of a faculty advisor is as outlined below:

The role of the Faculty Adviser is outlined below:

a. Guide the students about the rules and regulations governing the courses of study for a particular degree.

b. Advise the students for registering courses as per curriculum given. For this purpose the Faculty Adviser has to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which He/She can register during the semester as per the curriculum.

c. Approve the registration of the students.

d. Advice students to overload/ drop one or more courses/activities based on her/his academic performance as per the prescribed rules.

e. At the end of the first semester/year, the Faculty Adviser may even advise a reduced load program for a poorly performing student.

f. Pay special attention to weak students and carefully monitor performance of students recommended for slow track option.

g. Advice students for Course Adjustment / Dropping of courses during the Semester within the stipulated time frame given in the Academic calendar.

h. Advice students seeking semester drop either during the ongoing semester or before the commencement of the semester. FA has to ensure strict compliance of rules and regulations laid down for this purpose. Recommend the cases to the appropriate authorities for consideration.

i. Make revised plan of study for weak/bright students based on their semester wise performance.

j. Suggest modalities for course/credit requirements for the students recommended for exchange program.

k. Guidance and liaison with parents of students for their performance.

l. To ensure that students are not permitted to re•register for courses, which they have already passed.

m. Inform students that any academic activity (course / Lab. / seminar / project / noncredit requirement etc.) undergone without proper registration will not be counted towards the requirements of his/her degree.

n. Strictly warn students that if she/he fails to register during any semester without prior approval, his/her studentship is liable to be cancelled.

o. Keep the students updated about the Academic Administration of the University.

7 .2. Helping Weaker Students:

A student with backlog/s should continuously seek help from his/her faculty advisor, Head of the Department and the Dean of respective schools. Additionally he/she must also be in constant touch with his/her parents/local guardians for keeping them informed about academic performance. The university also shall communicate to the parents/guardians of such student at-least once during each semester regarding his/her performance in in-in various tests and examination and also about his/her attendance. It shall be expected that the parents/guardians too keep constant touch with the concerned faculty advisor or Head of the Department, and if necessary - the Dean of the respective school.

8. 0 Discipline And Conduct:

8.1 Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the university.

8.2 Any act of indiscipline of a student reported to the Dean, Student Development, shall be discussed in a Disciplinary Action Committee of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated.

8.3 If a student while studying in the university is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government he/she shall be liable to be expelled from the institute without any notice.

8.4 If a student is involved in any kind of ragging, the student shall be liable for strict action as per provisions in the Maharashtra anti-ragging act.

8.5 If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the university and fees paid shall be forfeited.

8.6 If a student is found guilty of malpractice in examinations then he/she shall be punished as per the recommendations of the Grievance Redressed Committee (CRC) constituted by Board of Examinations.

8.7 Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Sanjay Ghodawat University Kolhapur. The student must have valid ID card with him/her while in the University Campus.

8.8 Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another, student shall be subjected to disciplinary action.

8.9 The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

8.10 Students should switch off the Mobiles during the Instructional hours and in the academic areas of university Building, Library, Reading room etc. Strict action will be taken if students do not adhere to this.

8.11 During the conduct of any Tests and Examination students must not bring their mobiles. A student in possession of the mobile whether in use or switched off condition will face disciplinary action and will be debarred from appearing for the Test / Examination.

9.0 Academic Calendar

The academic activities of the institute are regulated by Academic Calendar and is made available to the students/ faculty members and all other concerned in electronic form or hard copy. It shall be mandatory for students / faculty to strictly adhere to the academic calendar for completion of academic activities.

10. Attendance:

10.1 Regular 100% attendance is expected from all students for every registered course in lectures, tutorial, laboratory, projects, mini-projects and other courses mentioned in program curriculum. Hence, attendance is compulsory and shall be monitored during the semester rigorously. Students shall be informed at the end of every month if they are failing short of attendance requirements.

10.2 A Maximum of 25% absence for the attendance may be permitted only on valid grounds such as illness, death in family of blood relations (Father, Mother, Sister, and Brother) and any other emergency reason which is beyond the control of the student and shall be approved by the authorities in respective departments.

10.3 If a student fails to put up 75% attendance individually in each course, the student will be put under X grade category and student will be debarred form attending the End Semester Examination (ESE) and Re-Exam for that semester in that course. However, student has an option to re-register for the course whenever it is offered next time or he can appear for 100% examination for which he will be awarded two grade penalties. Student's FET, CAT1 and CAT2 marks are treated as null and void.

10.4 The maximum number of days of absence for students participating in Co-curricular activities /Sports/ Cultural events during a semester shall not exceed
10. Any waiver in this context shall be on the approval of the Academic council
only after the recommendation by Dean Academics of the university.
The HOD and Dean of the respective school shall report and recommend to Academic Academic council the cases of students not having 75% attendance as per the records of course instructor. After rigorously analyzing these cases AC may take a decision to debar such student from End-Semester Examination (ESE) for that course. Such a student shall re-register for that course as and when it is offered next. ISE and MSE evaluations of such a student for this course during regular semester shall be treated as null & void.

10.5 A student remaining absent during ESE of a course either on medical ground (Accident and/or hospitalization of a student) or any other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing University at university/state level in sports/co- curricular activities shall be treated as per the rules of Sec 12.6.2 and 11.1.2

The critical cases of absenteeism which are not covered by any of the above clauses shall be reported by concerned Head of Department to Academic dean and all such cases the decision of Academic council is final**.**

10. Modes of Assessment:

10.1 Assessment of Theory Courses:

10.1.1 A student shall be evaluated for his/her academic performance in a theory course through Faculty Evaluation Theory (FET), Continuous Assessment Tests (CAT1 and CAT2) and End Semester Examination (ESE).

10.1.2 The relative weightage for the theory courses having ESE shall be generally as shown in the Table 10.1.2

Table 10.1.2: Weightage for the theory courses in %

FET	CAT1	CAT 2	ESE
20	15	15	50

The details of the weightage of each course shall be listed in the structures of each program.

10.1.3 FET shall be based on student's performance in assignments, quizzes, seminars, Course projects and field assignments, term papers, etc. The mode of FET shall be decided and announced by the Course Instructor at the beginning of the course.

10.1.4 CAT1 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that Semester. The test will be based on first two units of the course.

10.1.5 CAT2 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that semester based on unit 3 and unit 4 of the syllabus.

10.1.6 ESE is of three hours comprehensive examination having the weightage of 60% for unit 5 and 6 and 40% to unit 1 to unit 4. It is of 100 marks

10.1.7 All examinations and evaluations shall be compulsory. Credits for a course shall be awarded only if a student satisfies evaluation criteria and acquires the necessary minimum grade.

10.1.8 There shall be no re-examination for CAT1 and CAT2 of the courses having all the three components of evaluation viz. FET, CAT1 CAT2 and ESE. However, a student remaining absent for CAT1 and CAT2 for representing the institute in state level or university level sports/co-curricular activities (on prior recommendation and approval from) or on valid grounds such as illness, death in family or other emergency reason which is beyond control of a student (on approval by the head of department and dean of respective school shall be considered for Make- up examinations.

10.1.9 A student remaining absent for ESE of a course either due to medical reason (Accident and/or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to

representing college at university/state level in sports/co-curricular activities shall be awarded with grade "I". Such a student shall be allowed to appear for make-up examination scheduled along with re-examinations of other courses. The student shall apply to COE with proper documentary evidence to appear for make-up examination. After make-up examination, a student shall be entitled to an appropriate grade as per Table I of Sec. 10.1.2 based on his/her performance during the regular semester and in make-up examination.

10.2 Assessment of Laboratory Courses:

10.2.1 The assessment of laboratory course shall be continuous and based on turn-by- turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in viva -voce examinations uniformly distributed throughout the semester. Where ESE for the laboratory course is specified ESE shall be based on performing an experiment followed by an oral examination. The relative weightage for FEP and ESE for assessment of laboratory courses shall be 50% each for FEP and ESE and a minimum performance of 40% in both ISE and ESE separately shall be required to get the passing grade.

10.2.2 ESE for laboratory course shall normally be held before the ESE for theory courses and shall be conducted by a panel of examiners appointed by COE from the panel of experts approved by BOS. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with HOD of the respective department.

10.2.3 Student failed in ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted alongwith ESEs of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to POE i.e. Practical-Oral- Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He/She shall suffer one grade penalty.

11.0 The Grading System:

Absolute Grading System (AGS) is adopted based on absolute numerical marks obtained by the student during all stages of evaluation for a course.

11.1. Award of Grade (Regular Semester):

11.1.1 For every course registered by a student in a semester, he/she shall be assigned a grade based on his/her combined performance in all components of evaluation scheme of a course as per the structure. The grade indicates an assessment of the student's performance and shall be associated with equivalent number called a grade point.

11.1.2 The academic performance of a student shall be graded on a ten point scale.

The Absolute Grading System is followed. Letter grades, the guidelines for conversion of marks to letter grades and their equivalent grade points are as given in Table.

Table 11.1.2: Grade Table for Regular Semester

Marks Obtained	Grade Letter GL	Grade Point GP	Performance Description
90-100	**O**	**10**	Outstanding
80-89	**A+**	**09**	Excellent
70-79	**A**	**08**	Very Good
60-69	**B+**	**07**	Good
50-59	**B**	**06**	Above Average
45-49	**C**	**05**	Average
40-44	**P**	**04**	Pass
00-39	**F**	**00**	Fail
-	**Ab**	**00**	Absent
-	**X**	**00**	Detained (Failed)
-	**Satisfactory**	**-**	Pass in Non Credit Courses
-	**Un Satisfactory**	**-**	Failed in Non Credit Courses

11.1.3 A student shall pass the course if he/she gets any grade in the range "O" to "P".

11.1.4 "FF" grade shall be awarded to a student in a course if he/she gets less than 40% marks jointly in the FET, CAT1, and CAT2 & ESE for a theory course and in PET & ESE for a laboratory course. A course shall then be eligible to apply for re-examination. A student failed in laboratory course shall be eligible to apply only for 100% examination conducted with the laboratory examinations of the subsequent semester. In both cases, a student has to suffer one grade penalty.

12 Assignment of X Grade

Grade "X" in a regular course shall be given to a student if he/she falls in any of the following categories.

12.1 A student does not maintain the minimum 75% attendance in any of the theory or laboratory courses.

12.2 A student has not completed most of the Evaluations like FET, CAT1 and CAT2 due to non-medical reasons (for example when a student has missed all or most of the components of internal evaluation conducted by the instructor in that semester).

12.3 The performance of a student is less than 40% in FET, CAT1 and CAT2 Combined.

12.4 A student is guilty of any academic malpractice during semester (Such cases shall be dealt by Grievance Redressed and Discipline Committee).

In above four cases grade "X" shall be declared one week before ESE and intimated to the Academic Office and COE immediately thereafter. Such a student shall not be permitted to take the ESE of that course.

12.5 Grade "X" may be given to a student if

12.5.1 A student eligible for ESE remains absent for ESE of a course with no written intimation to Exam Cell within four days after the respective ESE is over.

12.5.2 A student is guilty of any academic malpractice during examination. (Such cases shall be dealt by Grievance Redressal Committee).

In 12.5.2 grade "X" in that course shall be declared after Grievance Redressed Committee confirms the academic malpractice.

In above two cases when a student gets "X " grade in a course, then this shall be treated as "FF" for the purpose of calculation of Semester Performance Index (SGPI) and First Year Performance Index (FYPI) or Cumulative Performance Index (CGPI).

12.6 Following rules apply to the student who has obtained grade "X" in a regular semester:

12.6.1 A student obtaining grade "X" in a course in a regular semester or during examination shall be not be allowed to appear for End semester examination and also Re ESE conducted before the beginning of the next semester. His/her FET, CAT1 and CAT2 evaluations for all courses shall be treated as null and void. He/She needs to re-register for courses of that semester in the next academic year whenever they are offered and undergo all evaluations along with fresh regular students for which he will get one grade penalty.

12.6.2 Grade "I" shall be declared in a theory/laboratory course if a student has satisfactory performance FET, CAT1, CAT2 and has fulfilled the 75% attendance requirement, but has not appeared for ESE due to genuine reasons. Such students shall be eligible for the make-up examination of ESE only on medical grounds/valid reasons and on production of authentic medical certificate or other supporting document/s (as required by the University) to the COE within ten days after the respective examination is over. The application form with requisite amount of fees must be submitted to the Exam Cell before the last date of filling such application forms for make-up examinations. These examinations shall be based on 100% syllabus and shall be scheduled before the commencement of the subsequent semester for theory courses and along with ESEs of laboratory courses of the subsequent semester. A student with "I" grade when appears for the make-up examination shall be eligible to obtain a regular performance grade ("O" to "F") as per Table 11.1.2 depending on his/her overall performance in FET, CAT1 ,CAT2 and make-up examination. If a student fails to appear for make-up examination too, a grade "XX" shall be awarded to him/her. Thus "I" is only a temporary grade and shall be replaced by a valid grade only after make-up examination.

12.6.3 There shall be a few audit courses as per the policies of the institute or as decided by DPC of respective program. The grade "PP" (Passed)/ "NP" (Not Passed) shall be awarded for such courses depending upon the performance of a student evaluated by the faculty in-charge. No grade points shall be associated with these grades and performance in these courses shall be not taken into account i n the calculation of the performance indices (SGPI, CGPI). However, the award of the degree shall be subject to obtaining a "PP" grade in all such courses.

13. Award of Grades for Re-Examination:

13.1 A student who has obtained grade "F" in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester. In such cases FET, CAT1 and CAT2 marks are carried forward and a student has to suffer one grade penalty

13.2 A student shall apply for re-examination before the last date of such application and shall appear for re-examination.

13.3 50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

13.4 **A** student who has obtained "F" grade in ESE of a regular semester and has not availed re-examination option or a student who has obtained "F" grade in both ESE and re-examination shall be eligible to choose one of the two options below to clear his/her backlog:

- Re-registration for the next regular semester course whenever that course is offered.
- Appearing for ESE of the course when conducted...

A student detained in a regular semester due to either a) by obtaining "X" grade or b) by involvement in academic malpractice or c) by breaking the institute code of conduct and discipline can re-register for the course when offered next

Following rules apply for these cases:

13.5 In first case i.e. Re- registration the earlier performance of a student in all the evaluations of that course shall be treated as null and void. The student has to undergo all the evaluations after re-registration.

14. Grades for Third and Subsequent attempts:

If A student opts for ESE or Re ESE who previously had obtained grade "F" in a course in two attempts, his/her FET, CAT1 and CAT2 performance of the regular semester shall be considered for evaluation and He/She has to suffer two grade penalty for the third attempt and for 4^{th} and subsequent attempts shall be awarded a grade "P" or "F" or "X" based on his/her performance.. However, if a student takes more than three chances (regular examination being the first chance, re-examination being the second chance, to clear a course, then the maximum passing grade that he/she can get shall be only "P". Thus a student has to suffer a grade penalty by accepting a lower grade than that obtained in the regular examination, re-examination, or examination for a re-registered course.

15. CALCULATION OF PERFORMANCE INDICES:

15.1. Semester Grade Point Average (SGPA)

The performance of a student in a one specific semester is indicated by SGPA. SGPA is a weighted average of the grade points obtained in all courses registered by the students during the semester. SGPA can be calculated by following equation.

$$SGPA = S_i = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where, i = 1,2,3…….n are number of courses during semesters. C = No of credits associated with that course and P = Grade point earned in that course. SGPA will be rounded off to two decimal places.

15.2 Cumulative Grade Point Average (CGPA)

The total cumulative performance of a student at the end of specific semester is indicated by CGPA. An up-to-date assessment of the overall performance of a student for the courses from the first semester onwards till completion of the program shall be obtained by calculating Cumulative Grade Point Average (CGPA).

CGPA is a weighted average of the SGPA obtained in all semesters by the students during the semesters. CGPA can be calculated by following equation.

$$CGPA = \frac{\sum_{j=1}^{n} C_j S_j}{\sum_{j=1}^{n} C_j}$$

Where, j = 1,2,3…….n are number of semester during program. C = Total No of credits in the semester for which CGPA is to be calculated.

CGPA will be rounded off to two decimal places.

Conversion of CGPA to percentage marks for CGPA $\geq$ 4.5 can be obtained using equations. Percentage marks = (CGPA x 10) – 7.5.

15.3 For the students acquiring "I" grade (which is only a temporary grade) in any of the courses, SGPA, CGPA shall be calculated only after make-up examination.

16. First Year Performance Index (FYPI): (Applicable For B. Tech Programs Only)

16.1 For a student registered in Sanjay Ghodawat University Kolhapur right from the First semester, First-Year-Performance-Index (FYPI) shall be calculated as weighted average of the grade points obtained in all the courses registered by him/her in semesters I and II only.

$$\text{FYPI} = \frac{\sum_i C_i g_i}{\sum_i C_i}$$

Where summation is for all the courses registered by a student in first two semesters. FYPI shall be calculated when for the second semester is calculated. FYPI shall be rounded off to two decimal places.

16.2 FYPI shall reflect all the courses undergone by a student in the first year including the courses in which he/she has failed. FYPI may get modified in the subsequent semesters whenever a student clears his/her first year backlog courses.

16.3 If a student has been awarded "I" grade in the regular semester course of the first year then, FYPI shall be calculated after the make -up examination on the basis of the grade obtained by that student in a make-up examination.

16.4 If a student has obtained grade "F" or "X" at any time in any of the courses registered by him, then zero grade points corresponding to these grades shall be taken into consideration for calculation of FYPI.

17 Maximum Duration for Completing the Program

Maximum duration for completing any program UG/PG offered by Sanjay Ghodawat University is respective program duration plus two additional years.

Maximum duration for getting the B. Tech degree for students admitted in the first semester of UG program is, program duration plus two additional years (i.e. 12 Semesters and 6 academic years) For lateral entry student academic admitted in the third semester shall be (10 Semester and 5 Years).

The maximum duration of the program includes the period of withdrawal, absence and different kind of leaves permission to student but excludes the period of rustication of the student from the university however genuine case an confidential of valid reason may be referred to academic council for extending this limit by additional criteria

18 NFTE (Not Fit For Technical Education) (Applicable to B Tech program only)

It is mandatory for the student to earn all credits of first year specified for semester I & II or eligible for ATKT as per the rules to seek admission to semester III of second year in three years from the date of admission to avoid NFTE. If a student fails to become eligible for admission to Semester III in three year form the date of his admission, he shall be declared as "Not Fit for Technical Education" leading to discontinuation of his/her registration with the university. Such cases should be put up in the academic council.

19. Academic Progress Rules (ATKT Rules):

19.1 A student shall be allowed to register for the courses of the next year's odd semester only if he/she has earned all the credits of the previous year and has earned at least $2/3^{rd}$ credits of the current year. If $2/3^{rd}$ calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for deciding the eligibility for ATKT.

At the end of 1st year a student shall be allowed to keep terms (ATKT) to 2nd year of study provided he/she attends course work prescribed for 1st year with prescribed attendance and successfully earned at least $2/3^{rd}$ of the total credits specified for 1st year program.

For Example: Total credits for B. Tech first year 2017-18, are 45 (Total of Semester I and II). A Student should earn minimum $2/3^{rd}$ of the 45 Credits i.e. A student can go to next higher class with a maximum backlog of $1/3^{rd}$ credits of semester I & II of the first year.

Student, who fails to earn those credits, cannot register for next semester, either it can re- registrar for the course and credits or can use the next opportunity to earn the credits when exams are conducted. **.**

(b) At the end of 2nd year a candidate shall be allowed to keep terms to 3rd year of study provided he/she attends course work prescribed for 2nd year with prescribed attendance, and successfully cleared 1st year program and at least $2/3^{rd}$ of total credits prescribed for 2nd year program.

(c) At the end of 3rd year a candidate shall be allowed to keep terms to final year of study provided he/she attendants course work prescribed for 3rd year with prescribed attendance, and should have completed 2nd year program and $2/3^{rd}$ of total credits prescribed for 3rd year program.

All such candidates fulfilling the above criteria shall be declared as FAILED, ATKT.

A student shall be allowed to take admission for odd semester of next academic year only if he/ she have earned all the credits of the previous year and $2/3^{rd}$ happens to be a decimal, it is rounded to only integer part.

20. Semester Grade Report:

20.1 Semester grade report reflects the performance of a student in that semester (SGPI) and also his/her cumulative perfor mance for the first year (FYPI) and also the cumulative performance since the third semester of his/her study (CGPA).

20.2 The semester grade card issued at the end of each semester/ summer term to each student shall contain the following.

- The credits for each course registered for that semester.
- Any audit course/s undertaken by a student in a Semester.
- The letter grade obtained in each course.
- The total number of credits earned by a student for the first year separately.
- The total number of credits earned by a student since the 3rd semester onwards.
- SGPI, FYPI, CGPI.
- A list of backlog courses, if any.
- Remarks regarding eligibility of registration for the next semester.

20.3 Semester grade card shall not indicate class or division or rank however a conversion from grade point index to percentage based on C GPI shall be indicated on the final grade card of the program.

21 Award of Degree:

Following rules prevail for the award of degree.

- A student has registered and passed all the prescribed courses under the general institutional and departmental requirements.
- A student has obtained CGPI $\geq$ 4.75.
- A student has paid all the institute dues and satisfied all the requirements prescribed.
- A student has no case of indiscipline pending against him/her.
- Academic Council shall recommend the award of degree to a student who is declared to be eligible and qualified for above norms.

22 Grace Marks

- Maximum total grace marks will be 1 % of the total theory credit courses x 100 subjected
- To maximum 6 marks in that semester.
- Grace marks will be given candidate for change in grades for theory credit courses i.e. from
- Fail to pass grade only and will be reflected in final ESE marks.
- The grace marks are applicable only for maximum $1/3^{rd}$ courses (rounded to higher Integer part i.e. if there are 4 theory courses then 4/3 = 1.33 = 2 courses).
- Maximum grace marks will be distributed in maximum courses
- Benefit of grace marks is not applicable for any medal/award.
- Applicable to theory and (Theory + Practical Courses). If is not applicable for Practical courses.
- Scheme for grace marks only can be used when the student will pass in all courses of that semester.

23. CGPA Improvement Policy for Award of Degree:

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.75 to improve his/her grade by allowing him/her to appear for ESE examinations of maximum two theory courses of seventh semester. Such examinations shall be scheduled along with re-examinations/make-up examinations. However, CGPA shall be limited to 4.75 even though the performance of a student as calculated through modified CGPA becomes greater than 4.75.

Conclusions:

The academic policies regarding conduct of programs in Sanjay Ghodawat University Kolhapur are published in this document. The Academic Council shall reserve the right to modify these policies as and when required from the point of view of achieving academic excellence. In special and abnormal cases (i.e. the cases not covered through above rules) the decision of the (Chairman, Academic Council shall be final and shall be binding on all concerned.

Chairman
Academic Council

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Semester V									
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	Evaluation Scheme for Theory and Practical			
						Component	**Exam**	**WT %**	**Pass (%)**
ELE301 (PC)	Signals & Systems	3	1	-	4	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE303 (PC)	AC Machines	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE305 (PC)	Power System Analysis	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE307 (PC)	Microcontroller & IOT	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE309 (PE)	Program Elective -I	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE311 (PC)	AC Machines Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE313 (PC)	Power System Analysis Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE315 (PC)	Micro controller & IOT Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE317 (PE)	Program Elective –I Lab	-	-	2	1	Pr (100)	FEP	100	40
ELE319 (PC)	Software Proficiency Program-I	-	-	2	1	Pr (100)	FEP	100	40
ELE321 (UC)	Foreign Language	3	-	-	NC	Th (100)	FET	100	40
	Total	18	**01**	**10**	**21**	**Total Hrs.: 29, Total Credits: 21**			

Details of Program Electives

Program Electives	Vertical 1	Vertical 2	Vertical 3
	Renewable Energy	**Energy Audit & Management**	**Electrical Vehicle Technology**
Program Elective I	Solar Energy Conversion System	General Aspects of Energy Management & Energy Audit	Special Electrical Machines & Control

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight Age PC: Program Core, NC: Non Credit Course (Pass/Fail), AU: Audit Course (Pass/Fail), Th: Theory, WT: Weightage, PC: Program Core, PE: Program Elective, UC: University Core, ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts, FET: Faculty Evaluation Theory, FEP: Faculty Evaluation Practical, POE: Practical Oral Examination, CAT I: Continuous Assessment Test I, CAT II: Continuous Assessment Test II, ESE: End Semester Examination.

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ELE 301: Signals & Systems

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] the different types of the signals & systems.
CO2	**Discuss**[2] Fourier Analysis of Continuous Signals and Discrete Signals.
CO3	**Determine**[4] Continuous & Discrete systems using ZSR, ZIR and Convolution.
CO4	**Analyze**[4] the systems using Laplace Transform & Z Transform.

Unit I

Introduction to signals & systems: Continuous and discrete signal: Introduction, standard signals, Signal Representation, signal operations, classification of signals, continuous and discrete systems: classification of systems, system models of electrical systems.

(08 Hrs)

Unit II

Time Domain analysis of Continuous & Discrete Time system: Continuous & discrete systems: zero state response, zero input response, Impulse Response and convolution sum and convolution integral, graphical representation of convolution, FIR and IIR systems.

(7 Hrs)

Unit III

System Analysis using Laplace transform: Laplace transform: A brief introduction to Laplace transform, its properties and Inverse Laplace transform, transfer function analysis, solution of LTI differential equation and Stability in S Domain.

(06 Hrs)

Unit IV

System Analysis using Z- transform: A brief introduction to z-transform, its properties and inverse z-transform, transfer function analysis, solution of LTI difference equation and stability in z-domain.

(06 Hrs)

Unit V

Fourier Domain Analysis of continuous signals: Representation of Continuous time Periodic signals - Trigonometric Fourier series & Exponential Fourier series, Properties of Fourier series, Dirichlet's condition, Parseval's theorem, Fourier transform and its properties, Fourier spectrum.

(07 Hrs)

Unit VI

Fourier Domain Analysis of discrete signals & Sampling: A brief introduction to discrete Fourier series, D.T.F.T., Properties of D.T.F.T., D.F.T. & its Properties, Sampling, Sampling methods, Nyquist Theorem, Anti-aliasing Filter, representing CT signals by samples, sampling DT signals.

(08 Hrs)

List of Tutorials: Students has to solve numerical on the followings

1. Classification of Signals & Systems
2. Identify whether the signal is causal, Non causal, Periodic, Aperiodic, Energy and Power signals
3. Identify whether the system is causal, Non causal, static& dynamic.
4. Problems on ZIR &ZSR
5. Convolution of continuous & discrete signals
6. Laplace transform & its inverse
7. Z transform & its inverse
8. Fourier series problems
9. Discrete time Fourier transform
10. Sampling of various signals & systems.

Text Books:

1. B.P.Lathi, "*Linear systems and signals*", Oxford University Press, 2nd edition, 2005.
2. Simon Haykin and Barry Van Veen, "*Signals and systems*", Wiley Publications.

Reference Books:

1. M. J. Roberts, "Signals and systems", Tata McGraw Hill publications.
2. C. T. Chen,"Signals and systems", Oxford Publications, 3rd edition, 2004.
3. Alok Barua,"Analog Signal Processing: Analysis & Synthesis", Wiley Publications.
4. Gabel, "Signals & Linear Systems", Wiley Publications, 3rd edition.
5. Krishnaveni,"Signals and Systems", Wiley Publications

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ELE303: AC Machines
(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Understand**[2] the construction and principle.
CO2	**Describe**[2]staring, speed control and testing.
CO3	**Analyze**[4]the effects of excitation and mechanical inputs
CO4	**Evaluate**[5] performance characteristics.

Unit I

Single Phase Induction Motors: Construction, Principle of operation, Double revolving field theory, speed-torque characteristics, Equivalent circuit, Phasor diagrams, Starting methods, Split-phase starting, Resistance starting, Capacitance starting, Shade pole starting, Applications.

(05 Hrs)

Unit II

Three Phase Alternator: Construction, types, practical rating of Alternator, winding factors, production of emf and its equation, armature reaction (at unity, lagging zero and leading zero power factor), Synchronous reactance, synchronous impedance, phasor diagram, load characteristics (resistive, inductive & capacitive) Equivalent circuit of Alternator,

(08 Hrs)

Unit III

Testing of three phase Alternator: OC test & SC test on Synchronous Generator, short circuit ratio, Methods of pre-determination of regulation- Synchronous impedance, ampere turn, Potier triangle. Two reaction theory–analysis and its application for the pre-determination of regulation of salient pole machine, Slip test, phasor diagram. Hunting and oscillations, Losses and efficiency, power flow diagram. Need of parallel operation, conditions for parallel operation, synchronizing procedures.

(07 Hrs)

Unit IV

Synchronous Motor: Theory of operation, method of starting, phasor diagrams at Unity, lagging and leading power factor, variation of current and power factor with excitation. Hunting and its suppression, determination and pre-determination of V and inverted V curves, Operation of Synchronous motor as Synchronous Condenser, Application of three phase synchronous motor.

(06 Hrs)

Unit V

Three Phase Induction Motor: Constructional details, Types of rotor, working and Principle of operation of three phase induction motors. Rotor quantities (emf ,current, frequency, p.f), torque equation, starting torque, running torque and maximum torque, Factors affecting torque, condition of maximum torque, maximum-output, slip for maximum-output, Torque-slip characteristics. Phasor diagram, equivalent circuit. Need of starters, Types of starters (DOL, Auto transformer, star delta and rotor resistance starters).

(8 Hrs)

Unit VI

Testing and Speed control methods of Induction Motors: Speed control methods from stator side (Stator voltage control Stator Frequency control, Pole changing) & rotor side (rotor resistance control). No load and blocked rotor tests- determination of equivalent circuit parameters, Pre-determination of performance from equivalent circuits and circle diagram. Losses & efficiency of 3 phase induction motor, power flow diagram. Applications of 3 phase Induction motors. Operation of induction motor as generator.

(08 Hrs)

Text Books:

1. S. K. Bhattacharya, Electrical Machines, Tata Mc-Graw-Hill publication IIIrd Edition
2. B. L. Theraja, Electrical Technology Vol.II, S. Chand Publications
3. I. J. Nagrath, D. P. Kothari, Electrical Machines, Tata Mc-Graw-Hill publication IVth Edition

Reference books:

1. A. E. Fitzgerald, Electric Machinery, Mc-Graw Hill publications VIth Edition
2. P S Bhimbhra, Electrical Machinery, Khanna Publications
3. Ashfaq Hussain, Electrical Machines, DhanpatRai& Sons
4. Alexander Langsdorf , Theory of Alternating Current Machines, TMH, 2nd Edition
5. M.G.Say, Performance & Design of AC Machines, CBS Publishers, 3rd Edition

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ELE305: Power System Analysis
(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] the Representation of Power System components in P.U.
CO2	**Describe**[2] Stability issues and solutions.
CO3	**Calculate**[3]the Sequence network components and Draw Sequence Network of Power System.
CO4	**Analyze**[4] the Unsymmetrical and Symmetrical fault.

Unit I

Representation of Power system Components: Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System. Modeling of Generator, transformer, transmission line and load.

(08Hours)

Unit II

Symmetrical Fault (Three Phase) Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine (On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers. (08Hours)

Unit III

Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System, Measurement of sequence Impedance of Synchronous Generator.

(08 Hours)

Unit IV

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults (Numerical)

(06 Hours)

Unit V

Power Flow Analysis: 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, Formation of admittance matrix, Iterative solution using Gauss-Seidel and Newton-Raphson method.

(06 Hours)

Unit VI

Stability Analysis: Classification of power system stability, Rotor angle stability, Swing equation, Swing curve, Power-Angle equation, Equal area criterion, Critical clearing angle and time, Classical step-by-step solution of the swing equation.

(06 Hours)

Text Books:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill, Sixth reprint, 2010
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010

Reference Books:

1. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
2. J.Duncan Glover et al, Power System Analysis and Design, Cengage, 4th Edition, 2008

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ELE 307: Microcontroller & IoT

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Describe**[2] the internal architecture, pin-out, addressing modes of 8051.
CO2	**Explain**[2] Assembly language programming.
CO3	**Explain**[2] basics & *programming of arduino for IOT*
CO4	**Design**[4] external peripherals to Interface.

Unit I

8051 Architecture : 8051 architecture- features, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Structure in 8051, Types of Special Function Registers, Pins Of 8051. 8051 Addressing Modes. **(08Hrs)**

Unit II

8051 Instruction Set: Instruction Set: Data transfer instructions, Arithmetic instructions, Logical Instructions (Boolean), Program Control Instructions (jumps), Bit manipulation Instruction, Timers: Block diagram, modes and associated SFRs, Serial Communication (UART): Block diagram, modes and associated SFRs. **(08Hrs)**

Unit III

Assembly Programming Examples: Copy block, shift block, count no. of nulls, find checksum, sum of natural numbers, sum of a series, Fibonacci series,Count 1s in a byte, find largest / smallest integers of an array. Bubble sorting, Sum of a series. **(06Hrs)**

Unit IV

Interfacing: Interfacing- external memory, keyboard, display devices:LCD, DAC/ADC, dc motor, stepper motor. **(06Hrs)**

Unit V

Introduction to IOT: Concept, Importance, Interdisciplinary, Challenges, Various applications/smart objects, Major Players/Industry, Standards CASE STUDIES: Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Retail, Logistics, Industry, Health and lifestyle.

(08Hrs)

Unit VI

Arduino : Interoperability in IoT, Introduction to Arduino board, Programming with Arduino, Integration of Sensors and Actuators with Arduino.

(06Hrs)

Reference Books:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, "The 8051 Microcontroller, and Embedded Systems", PHI Learning, 2002.
2. 8051 Microcontroller: Internals, Instructions, Programming and Interfacing, Subrata Ghoshal, Peasrson Publications.
3. Internet of Things: A Hands-On Approach By Arshdeep Bahga, Vijay Madisetti Adrian McEwen and Hakim Cassimally" Designing the Internet of Things "Wiley,2014.

ELE309.1: Solar Energy Conversion System

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] basics of Solar Energy Conversion System
CO2	**Understand**[2] the characteristics of PV system
CO3	**Analyze**[4] the concept of Maximum Power Point Tracking
CO4	**Develope**[6] the strategies for controlling the power in PV system

Unit I

Photovoltaic Principles: Solar Cell Physics: P-N junction: Homo and Hetro junctions, Metal-semiconductor interface: the photovoltaic effect, equivalent circuit of solar cell, Analysis of PV cells: Dark and illumination characteristics: Merits of solar cell, Efficiency limits, Variation of efficiency with band-gap and temperature, Efficiency measurement; High efficiency cells, Types of solar cells.

(08 Hrs)

Unit II

Solar Cells and Modules: The function of solar cells from semiconductor physics. Different solar cell technologies and fabrication methods. Concepts for increasing efficiency based on loss analysis. Wavelength sensitivity. Module function and characteristics, Shading of cells and modules.

(08 Hrs)

Unit III

Solar Photovoltaic Module Array: Connection of PV module in series and parallel, Estimation and Measurement of PV module power, Selection of PV Module, Thermodynamic description of solar collectors, Optical properties of solar collectors and technologies for fabrication Solar thermal system for different applications. Storage of solar generated heat.

(08 Hrs)

Unit IV

Characteristics and MPPT of PV System: Characteristics of PV system, V-I Characteristics, P-V Characteristics, Variation in characteristics due to the changes in Sun light intensity and temperature, Characteristics of shaded PV system. Introduction to Maximum Power Point Tracking (MPPT), Types of MPPT methods in PV system.

(08 Hrs)

Unit IV

Batteries in PV system: Battery function, Types of batteries, Battery parameters, Selection of battery, Series parallel combination of batteries, Application of batteries in Solar PV system, Battery maintenance and Measurements, Battery fault detection and test, Battery installation for PV system.

(07 Hrs)

Unit VI

Design and Types of PV system: Case studies of off grid and on grid solar energy conversion system, Specification of Inverter and charger, Design methodology for Solar PV system, Design of off grid solar power plant, Design and development of solar street light and solar lantern, Maintenance of solar PV system, Net metering.

(08 Hrs)

Text Book:

1. Chetan Singh Solanki, *"Solar Photovoltaics: Fundamentals, Technologies And Applications"*, 3rd Edition, Kindle Edition
2. Weidong Xiao, "Photovoltaic Power System: Modeling, Design, and Control, John Wiley & Sons, 2017.

Reference:

1. Prof. Umannad, IISC Banglare "NPTEL Course on *"Design of Photovoltaic System"*

ELE 309.2: General Aspects of Energy Management & Energy Audit

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
3	-	-	3	Theory	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO 01	**Demonstrate**[2] skills required for energy audit and management.
CO 02	**Identify**[3] the energy conservation/saving opportunities in different electric system
CO 03	Suggest[5] cost-effective measures towards improving energy efficient and energy conservation.
CO 04	**Create**[6] energy flow diagrams and energy audit report

Unit I

Energy Scenario: Introduction, Types of Energy, Global primary energy reserves & commercial energy production (Statistics), Indian energy scenario, Energy needs of growing economy, Energy intensity on purchasing power parity, Electricity pricing in India, Energy security, Energy conservation & its importance, Introduction of Energy Conservation Act and Electricity Act 2003.

(07 Hrs)

Unit II

Basics of Energy and its various Forms: Introduction, Electrical basics-DC & AC currents, electricity tariffs, Thermal energy basics-temperature, pressure, heat, humidity. Viscosity, heat transfer.

(07 Hrs)

Unit III

Energy Management & Audit: Definition & Objective, Types of energy audit, Steps of energy audit, Benchmarking, Energy performance, Instruments and material for energy audit, BEE Regulations 2008.

(07 Hrs)

Unit IV

Material and Energy Balance: Introduction, Components of Material and Energy Balance, Basic principle of Material and Energy Balance, Classification of processes, Level and Procedure of material balance, Energy balance, Energy analysis and Sankey diagram.

(07 Hrs)

Unit V

Energy Action Planning & Financial Management: Introduction, Responsibilities and Duties of Energy Manager, Energy policy and planning, Management tools for effective implementation, financial analysis techniques (Payback period, ROI, NPV, IRR) Cash flow.

(07 Hrs)

Unit VI

Energy Monitoring, Targeting and Project Management: Introduction, Setting up Monitoring & Targeting, Key elements of Monitoring & Targeting system, Data and information sources. Project Management- Project development cycle, Project planning technic.

(07 Hrs)

Text Books / Reference Books:

1. "General Aspects of Energy Management & Energy Audit", Guide book for NCE by Bureau of Energy Efficiency, 4th edition 2015.
2. S.C. Tripathi "Utilization of electrical energy" Tata McGraw Hill 2011.
3. W.R. Murphy and Mackay, "Energy Management" B.S. Publication.

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Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE 309.3 Special Electrical Machines and Control

(Ver 1.0, PE, School of Technology)

Lectures	Tutorials	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass%
3	-	-	3	Theory	FET	20	Min 40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Understand**[2] the constructions and operating principle of special motors.
CO2	**Explain**[2] the control concept of special motor
CO3	**Apply**[3] the basic principle of power converters in special motor.
CO4	**Develop**[3] the control methods and operating principle of EV Control.

Unit I

Stepper Motors: construction- theory of operation-windings in stepper motor, mono filar and bifilar windings modes of excitation-torque equation-static and dynamic characteristics-no of teeth-steps per revolution and no of poles-single phase stepping motors, different types-comparison-applications, advantages and disadvantages of stepper motor (Related to EV).

(06 Hrs)

Unit I

Switched Reluctance Motors: Principle of Operation-Conventional and special types of rotor, Constructional features, Principle of operation, Torque prediction Characteristics, Power controllers Control of SRM drive- Sensor less operation of SRM – Applications.

(08 Hrs)

Unit III

Microprocessor based controller for SRM: Sensor less control. Synchronous Reluctance Motors-Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – Phasor diagram, motor characteristics.

(06 Hrs)

Unit IV

Brushless DC Motor: Brushless DC motors-construction, types, torque generation, principle of operation, motor characteristics-torque equation, position sensing, drive circuits-power circuits variable speed operation, applications.

(08 Hrs)

Unit V

Permanent Magnet Synchronous Motor: Types of PMSM, Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self-control, Vector control, Current control schemes. Sensor less control.

(07 Hrs)

Unit VI

Power Converters in EV: Review of converters, Operation of Converters for BLDC Motor, Operation of Converters in PMSM motor, and Comparison of converters used in BLDC and PMSM.

(07 Hrs)

Text Books:

1. T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Claredon press, London.

Reference Books:

1. R.Krishnan, 'Switched Reluctance motor drives', CRC press, 2001.
2. T.Kenjo, 'Stepping motors and their microprocessor controls', Oxford University press, New Delhi.
3. T.Kenjo and S.Nagamori, 'Permanent magnet and Brushless DC motors', Clarendon press, London.
4. R.Krishnan, 'Electric motor drives', prentice hall of India.
5. D.P.Kothari and I.J.Nagrath, ' Electric machines', Tata Mc Graw hill publishing company, New Delhi, Third Edition.
6. Bimal K. Bose, 'Modern Power Electronics & AC Drives'. Prentice Hall India Ltd.

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ELE 311: AC Machines Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	50	40
					POE	50	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Apply**[3] the tests on A.C Machines
CO2	**Analys**[4] the performance characteristics
CO3	**Evaluate**[5] the efficiency and equivalent circuit parameters

List of Experiments:

1. Study of three phase induction motor starters
2. Brake load test on single Phase Induction Motor.
3. Brake Load test on three Phase SCIM
4. Indirect load test on three Phase SCIM
5. Indirect load test on SRIM
6. No Load Blocked Rotor test on three phase Induction Motor
7. Direct load test on Alternator
8. Voltage regulation of Alternator by direct load test
9. Voltage regulation of Alternator by EMF Method
10. Voltage regulation of Alternator by MMF Method
11. Slip test on three Phase Alternator
12. Parallel operation of alternator

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ELE 313: Power System Analysis Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	50	40
					POE	50	40

Course Outcomes: At the end of this lab students will able to

CO1	**Express**[2] the P.U. Representation.
CO2	**Analyze**[4] the Symmetrical and Unsymmetrical Fault Analysis.
CO3	**Analyze**[4] Load flow analysis.

List of Experiments:

1. Per Unit Representation using MATLAB.
2. Determine the symmetrical fault current of transmission line under no load condition.
3. Calculate the sequence voltage and sequence currents for symmetrical components.
4. Determine Single Line to Ground Fault by Using MATLAB.
5. Determine Double Line to Ground Fault by Using MATLAB.
6. Calculate Line to Line Fault by Using MATLAB.
7. Perform load flow analysis using Gauss- Seidel method
8. Perform load flow analysis using Newton-Raphson method.

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ELE315: Microcontroller & IoT Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	50	40
					POE	50	40

Course Outcomes: at the end of this lab, students will able to

CO1	**Implement**[3] the logic for performing various tasks.
CO2	**Simulate**[3]and Debug Assembly programs.
CO3	**Interface**[5] external peripherals to 8051 for developing small systems.

List of Experiments:

1. Perform arithmetic operation using 8051
2. Perform block Transfer from internal memory location to external memory location.
3. Perform the experiment of counting No. of Nulls in an array.
4. Count number of 0's and 1's in a byte
5. Arrange given array in Ascending or Descending order(Bubble Sorting)
6. Find largest & smallest number in given array
7. Generate Fibonacci Series
8. Interfacing of 7 Segment Display to 8051
9. Interfacing of 16x2 LCD Display to 8051
10. Experiments on digital input and digital output on Arduino Uno board and using LED and Buzzer
11. Implement Electric bulb and Fan automation using LDR sensor and Relay module
12. Implement a program to Send Data to the IoT cloud.

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ELE 317.1: Solar Energy Conversion System Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Understand**[2] the series and parallel connection of PV system
CO2	**Experiment**[3] the characteristics of PV system
CO3	**Analyze**[4] the working of power converters in EV applications

List of Experiments:

1. Series and Parallel operation of PV system
2. Characteristics of PV system
3. Testing of PV Cell
4. Study of optimum point for various solar irradiation
5. Study of Optimum Point for various temperature effect
6. Characteristics of shaded PV system
7. Buck converter control in PV system
8. Buck Boost converter control in PV system
9. Performance Analysis of PV system : Case study
10. Installation of PV system.

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ELE 317.2: General Aspects of Energy Management & Energy Audit Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Use**[3] various tools for energy management.
CO2	**Execute**[3] Preliminary Energy Audit.
CO3	**Analyse**[4] energy consumption in various sectors.

List of Experiments:

1. Study of energy management tools.
2. Assessment and calculations of energy generated by Solar PV or other renewable sources / Diesel generator.
3. Measurement of electrical parameters by using Power Analyser.
4. Study of any one of the following
    a. Performance Assessment of fans and blowers by using Annemo Meter.
    b. Flow Meters for pumping system analysis.
5. Study of any one of the following
    a. Pressure measuring equipment's.
    b. Smart meters and advanced energy meters.
6. Execute Preliminary Energy Audit for the following (Group activity)
    a. Laboratory
    b. Educational Institute
    c. Commercial Establishment
    d. Small scale industry
    e. Residential Building
    f. Agricultural Equipment's
    g. Municipal Corporations
7. Case study on Energy & Material balance.
8. Study on energy consumption in industry case study.

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ELE 317.3 Special Electrical Motors & Control Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Explain**[2] the operation of Motors for EV application
CO2	**Understand**[2] the working of Motors for EV application
CO3	**Analyze**[4] the working of motors and power converters in EV applications

List of Experiments:

1. Operation and Characteristics of Stepper Motors Motor
2. Operation and Characteristics of Switched Reluctance Motors Motor
3. Operation and Characteristics of BLDC Motor
4. Operation and Characteristics of PMSM Motor
5. Design of Motor in Electrical Vehicle (2 wheeler)- Case Study
6. Design of Motor in Electric Vehicle (4 Wheeler)- Case Study

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ELE319: Software Proficiency Program-I

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Analyze**[4] different operations using MATLAB
CO2	**Develop**[6] the model and simulate the problem

List of Experiments:

1. Overview of MATLAB (Introduction, Variables, Arrays, Matrices, MATLAB Operators: Arithmetic, Relational, Logical, MATLAB Graphics, Branching and Looping, Fundamentals of Simulink, Commonly used Blocks, Basic Electrical Engineering Applications.)
2. Study of basic Matrix operations (addition, subtraction, multiplication & division)
3. Generation of various signals and sequences (Periodic and A periodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp etc
4. Solving linear equations
5. Study of AC signal waveform and Analysis. (Voltage and current waveforms in Resistive, inductive and capacitive circuit with AC input)
6. Find Laplace transform and inverse Laplace transform
7. Obtain the transfer function
8. Determine the step response for a given transfer function
9. Determine the ramp response for a given transfer function
10. Study the voltage and current relationship in a series RLC circuit using Sim Power System
11. Simulation of single phase half wave rectifier with R load
12. Simulation of single phase half wave rectifier with RL load

Reference Books

1. Rao V. Dukkipati,"*MATLAB: An Introduction with Applications*", New Age International Publishers, 1st Edition.
2. Amos Gilat, "*MATLAB, an Introduction with Applications*", Wiley. Fifth Edition
3. Dr. ShailendraJain,"*Modeling and simulation using MATLAB – simulink*", Wiley, Second Edition,
4. Agam Kumar Tyagi,"*MATLAB & Simulink for Engineers*", Oxford, 1st Edition.
   Stephen J. Chapman, " *MATLAB Programming for Engineers*", fourth Edition.

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Semester VI									
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	Evaluation Scheme for Theory and Practical			
						Component	**Exam**	**WT**	**Pass (%)**
ELE302 (PC)	Control System	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE304 (PC)	Electrical Drives	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE306 (PC)	Electrical Machine Design	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE308 (PC)	Switch Gear & Protection	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE310 (PE)	Program Elective-II	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ELE312 (PC)	Control System Lab			2	1	Pr (100)	FEP	50	40
ELE314 (PC)	Electrical Drives Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE316 (PC)	Electrical Machine Design Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE318 (PC)	Switch Gear & Protection Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ELE320 (PE)	Program Elective-II Lab	-	-	2	1	Pr (100)	FEP	100	40
ELE322 (PC)	Software Proficiency Program-II	-	-	2	1	Pr (100)	FEP	100	40
ELE324 (PC)	Internship Training	-	-	-	1	Pr (100)	FEP	100	40
Total		**15**	**00**	**12**	**22**	**Total Hrs.: 27, Total Credits: 22**			

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Details of Program Electives

Program Electives	**Vertical 1**	**Vertical 2**	**Vertical 3**
	Renewable Energy	**Energy Audit & Management**	**Electrical Vehicle Technology**
Program Elective II	Wind Energy Conversion System	Energy Efficiency in Electrical & Thermal Utility	Battery Management System

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight Age PC: Program Core, NC: Non Credit Course (Pass/Fail), AU: Audit Course (Pass/Fail), Th: Theory, WT: Weightage, PC: Program Core, PE: Program Elective, UC: University Core, ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts, FET: Faculty Evaluation Theory, FEP: Faculty Evaluation Practical, POE: Practical Oral Examination, CAT I: Continuous Assessment Test I, CAT II: Continuous Assessment Test II, ESE: End Semester Examination.

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ELE302: Control System
(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] the functions of components in control system.
CO2	**Compare**[2]different types of controllers.
CO3	**Analyze**[4] the system stability using Root locus and Bode plot.
CO4	**Develop**[4] the model of different mechanical and electrical systems.

Unit I

Introduction to Control System: Introduction to control system, block diagram, components of control system& their functions, types of control systems, types of feedback, feedback and its effects.

(06Hrs)

Unit II

Mathematical Modeling of Systems: Mathematical representation of simple mechanical, electrical, thermal, hydraulic system. Transfer function – Armature & field control of DC servo motor, Block-diagram and Signal-flow-graph representation of systems and their reduction, concept& use of transfer function, Representation of system in state space.

(08Hrs)

Unit III

Controllers: Study of different types of controllers, Response to various input signals, Effects of controllers on system performance, Tuning of controllers, Ziegler-Nichols methods for controller tuning.

(06Hrs)

Unit IV

Time domain analysis: Time response of first order, second order systems. Analysis of steady state error, Type of system and steady state error, Time response specifications. Effect of parameter variation on open loop and closed loop system response, sensitivity. Effect of feedback on system response, stability and disturbance.

(08Hrs)

Unit V

Stability Analysis: Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterion. Root locus method for analysis of system stability.

(06 Hrs)

Unit VI

Frequency domain analysis: Concept of frequency domain behavior, Bode Plot for analyzing system in frequency domain. Frequency domain performance specifications. Correlation between time domain and frequency domain specification. Introduction to lag and lead compensation, Nyquist Analysis.

(08Hrs)

Text Books:

1. NatarajanAnanda, Babu P. Ramesh "*Control Systems Engineering*", SciTech Publication, 3rdEdition ,2011
2. Nagrath& M. Gopal "*Control System Engineering*", Anshan Publication,4th Edition 2008
3. 3.Norman S. Nice, "Control *System Engineering*", John Wiley Publication, 5th Edition 2012

Reference Books:

1. Smarajit Ghosh, "*Control Systems Theory & Applications*", Pearson Education 2007
2. Katsuhiko Ogata, "*Modern Control Engineering*", Prentice Hall, 2010.
3. M.Gopal, "*Control System principles and design*", Tata McGraw Hill education,4th Edition,2014.

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Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE 304: Electric Drives
(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Understand**[2] the basic operation of Electrical Drives.
CO2	**Use**[3] the control strategies in electrical machines.
CO3	**Analyze**[4] the operation power converter in Electrical Machines.
CO4	**Develope**[4] the different control strategies.

Unit I

Introduction of Electrical Drive: Concept of Electrical drive, Classification of Electrical drives, Parts of Electrical drive, Types of loads and their characteristics, Motor load interaction, Review of Torque-Speed Characteristics of drives including Motoring and Braking. Four quadrant operation of Electric Drives. Closed Loop Control of Drives

(06 Hrs)

Unit II

Control of DC Drives: DC Motor Drives:-DC motor and their performance-Braking - Transient analysis - Ward Leonard drives - Transformer and uncontrolled rectifier control - controlled rectifier fed DC drives - Chopper controlled DC drives - Time ratio control and current limit control - Single, two and four quadrant operations - Effect of ripples on the DC motor performance.

(08 Hrs)

Unit III

Induction Motor Drives: Induction Motor Drives-Stator control-Stator voltage and frequency control – VSI,CSI and cyclo-converter fed induction motor drives –open loop and closed VVVF control - Rotor resistance control and slip power recovery schematic control of rotor resistance using DC chopper-Vector Control basic concepts.

(08 Hrs)

Unit IV

Synchronous Motor Drives: Introduction, review of synchronous motor types & operation, Speed Control of Synchronous Machines in self-control mode and true synchronous mode, Load-commutated Inverter Fed Synchronous Motor Drive, Closed loop Speed control of Synchronous Motor using Load commutated Inverter, Operation of Voltage Source Inverter Fed Synchronous Motor Drive.

(07 Hrs)

Unit V

Control of Special Electrical Drives: Types and Control of Switched Reluctance Motor, Permanent Magnet Synchronous Motor, Brushless DC Motor, Stepper Motor, Traction motor.

(07 Hrs)

Unit VI

Digital Control of Electric Drives : Digital Control and Drive Applications-Digital technique in speed control of electric drive system-Advantages and limitations - microcontroller based control of drives- selection of drives and control schemes for electrical vehicle Application, paper mills, lifts and cranes.

(06 Hrs)

Text Books:

1. S. Sivanagaraju, M. B. Reddy, A. M. Prasad, “Power Semiconductor Drives”, PHI, Delhi
2. G. K. Dubey ,”Fundamentals of Electrical Drives”,CRC Press, II edition
3. Vedam Subrahmanyam, “Electric Drives: Concepts & Applications”, Tata Mc-Graw-Hill

Reference books:

1. Ned Mohan, “Electrical Machines & Drives, A First course”, Wiley Publications
2. Ned Mohan, “Power Electronics: Converters, Applications & Design”, Wiley Publications III edition
3. Dr. B.K.Bose, “Power Electronics & Variable frequency drives: Technology & applications”, Wiley Publications.
4. M. H. Rashid,”Power Electronics: Circuits, Devices, and Applications, Prentice Hall, III edition
5. P. C. Sen,”Principles of Electric Machines & Power Electronics”, Wiley Publications, II edition

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ELE 306: Electrical Machine Design

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Discuss**[2] the basic design concepts of Electrical machines and transformer.
CO2	**Analyze**[4] three phase Induction Machine design parameters.
CO3	**Analyze**[4] three phase Synchronous Machine design parameters.
CO4	**Design**[6] of Electrical machines.

Unit I

General:-Materials - Different types of material, Types of enclosures, Modes of Heat dissipation, Heating & Cooling curve, Calculation of Heating & cooling time constants, calculation of short time & continuous rating of electrical machine, temp. rise & rating of machines.

(06 Hrs)

Unit II

DC Machine: Introduction, Classification, Constructional details, derivation of output equation, choice of specific electric & magnetic loadings, selection of no. poles, core length , armature diameter, length of air gap, No. of armature slots, slot dimensions, losses & efficiency

(06Hrs)

Unit III

Three phase Induction Motor: Introduction, classification, comparison of single phase & three phase AC Machine, Main dimension, construction, stator & rotor design, output equation, length of air gap.

(08Hrs)

Unit IV

Synchronous Machine: Introduction, construction and types, output equation, choice of magnetic & electric loading. Main dimensions, stator & rotor core, slots, calculation of reactance & armature reaction, voltage regulation.

(06 Hrs)

Unit V

Single phase Transformer Design: Classification of transformer, Comparison of core type & shell type, single phase three phase transformer connections, core cross section, cooling of transformer. Transformer insulation using oil & other materials. Output equation.

(08Hrs)

Unit VI

Three Phase Transformer Design: Design for minimum cost, minimum loss or maximum efficiency, Design of core (rectangular core, square & stepped cores),selection of core areas & type of core, choice of flux density, window space factor, window dimensions, overall dimensions, simplified steps for transformer design. No load currents, No load current of single phase transformer, No load current of three phase transformer.

(08Hrs)

Text Books:

1. M.G. Say, "*Theory and Performance and Design of A.C. Machines*", ELBS London, 3rd Edition.
2. A. K. Sawhney, "*A Course in Electrical Machine Design*", 6th edition, DhanpatRai& sons New Delhi
3. K. G. Upadhyay, "*Design of Electrical Machines*", new age publication.
4. R. K. Agarwal, "*Principles of Electrical Machine Design*", S. K. Katariya and sons.
5. IndrajitDasgupta, "*Design of Transformers*", TATA Mc-Graw Hill Publication Chang-liang Xia, "*Permanent Magnet Brushless DC Motor Drives & Controls*", John Wiely& Sons Singapore Pte.Ltd., 1st edition, 2012.

Reference Books:

1. K.L. Narang, "*A Text Book of Electrical Engineering Drawings*", SatyaPrakashan, New Delhi.
2. A Shanmugasundaram, G. Gangadharan, R. Palani, "*Electrical Machine Design Data Book*", 3rdEdition, Wiley Eastern Ltd., New Delhi
3. Vishnu Murthy, "*Computer Aided Design for Electrical Machines*", B.S. Publications.
4. Krishnan Ramu, "*Permanent Magnet Synchronous & Brushless DC motor drives*"

Sanjay Ghodawat University Kolhapur
Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE308: Switchgear and Protection
(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Understand**[2] the basic operation of Circuit Breakers.
CO2	**Describe**[2] the basics & types of Relays.
CO3	**Apply**[3] the Protection scheme for various power system conditions.
CO4	**Categorize**[4] .various types of protection schemes.

Unit I

Circuit Breakers: Fuse: Rewirable and HRC fuse, fuse characteristics, application and selection of fuse. Voltage -current characteristics of arc, Principles of DC and AC arc interruption, high resistance and current zero interruption, arc voltage, Transient Restriking Voltage(TRV), Recovery voltage, RRRV, current chopping, resistance switching, capacitive current interruption. Classification of circuit breakers, brief study of construction and working of bulk oil and minimum oil CB, Air break and Air Blast CB, SF6 and Vacuum CB, HVDC breakers, ratings of CB and testing of CB.

(08 Hrs)

Unit II

Relays: Selectivity, sensitivity, reliability and speed of operation of a relay, CT burden calculation, attracted armature, balanced beam, moving coil relays, theory and construction of induction disc and induction cup relays, numerical relays, microprocessor based relaying, application of solenoid type relay.

(06 Hrs)

Unit III

Over current Protection: & Differential Protection: Plug setting, time setting, radial feeder and ring mains protection, earth fault and phase fault, Directional relay, and microprocessor based over current relay. Circulating current and opposed voltage principles, percentage differential relay, line protection, carrier aided protection scheme.

(07 Hrs)

Unit IV

Transformer protection: Problems associated with percentage differential protection, harmonic restraint and harmonic blocking schemes, restricted earth fault protection, Buchholz relay for incipient faults.

(07 Hrs)

Unit V

Generator Protection: Stator earth fault, phase fault, stator current unbalance (NPS) protection, Rotor overheating, earth fault protection, excitation failure and protection against motoring, generator-transformer unit protection.

(07 Hrs)

Unit VI

Distance protection & Over voltage Protection: Distance protection: Impedance, reactance and admittance characteristics, relay settings for 3-zone protection, out of step blocking scheme, blinder relay, numerical relays for transmission line protection, microprocessor based impedance, reactance and mho relays. Over voltage Protection: Causes of over voltages, surge arrestors and absorbers, metal oxide (ZnO) arrestors, insulation co-ordination in a power system.

(07 Hrs)

Text Books:

1. Prof. Dr. S. A. Soman, IIT Bombay, “A Web Course on Digital protection of power system”.
2. Y. G. Paithankar, S. R. Bhide., “Fundamentals of power system protection” Prentice hall, India, second edition, 2010."

Reference Books:

1. Sunil S. Rao, “Switchgear protection and power system” Khanna Publishers, 13th edition, 2008.
2. A.G.Phadke, J.S.Thorp, “Computer relaying for power systems” research studies press ltd. England John Wiley & sons Inc. New York.

Sanjay Ghodawat University Kolhapur
Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE 310.1: Wind Energy Conversion System

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] basics of Wind Energy Conversion System (WECS)
CO2	**Understand**[2] the characteristics of Wind Turbine
CO3	**Analyze**[4] the methods of Maximum Power Point Tracking
CO4	**Develop**[6] the strategies for controlling the power in WECS

Unit I

Wind Resources and Types: Nature of the Wind and Geographical Variations, Variation of wind in the year, Variation of wind speed, the effects and Turbulence, Prediction and forecasting of wind, Types of Wind Turbine- Horizontal and Vertical axis wind turbine. Effects of blade in Wind Turbine.

(06 Hrs)

Unit II

Aerodynamics Theory: Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor and Blade), Types of loads, Sources of loads

(06 Hrs)

Unit III

Horizontal Axis Wind Turbine and Characteristics: Importance of horizontal axis wind turbine, Region of operation for various wind velocity, Factors changing the wind turbine characteristics, Power Versus Speed Curve, Importance of power coefficient and tip speed ratio, Concept of yaw control, pitch angle control and tip speed ratio control.

(08 Hrs)

Unit IV

Maximum Power Point Tracking (MPPT): Applications of Electrical machines, Introduction and importance of MPPT, Types of MPPT- Look up table Method- Power Versus Speed, Torque Versus Speed, Hill Climb Searching (HCS) methods and their merits and demerits .

(08 Hrs)

Unit V

Design of Horizontal Axis Wind Turbine: Diameter of the Rotor, Rating of Machine related to diameter, Relation between optimum rated wind speed and annual mean, Rotational speed and influence of blade weight, Optimum rotational speed and noise constrain, Number of blade, teetering, Different types of power control, Braking system. Rotor position with respect to tower. Tower stiffness.

(08 Hrs)

Unit VI

Recent Trends in Wind Turbine: Multi rotor wind turbine- characteristics and operation of three rotor wind turbine,-Merits and Demerits. Introduction to airborne Wind Turbine- Operating principle and Types.

(06 Hrs)

Text Book:

1. Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi “Wind Energy Hand Book”, John Wiley & Sons, Ltd 2001.

Reference books:

1. S.M.R. Kazmi, H. Goto, H.J. Guo et al., "Review and critical analysis of the research papers published till date on maximum power point tracking in wind energy conversion system", Proc. IEEE Energy Conversion Congress and Exposition (ECCE), pp. 4075-4082, 2010.
2. Muhammad Saeed”, Man-HoeKim, “Aerodynamic performance analysis of an airborne wind turbine system with NREL Phase IV Rotor” Energy Conversion and Management” Volume 134, 15 February 2017, Pages 278-289
3. N. S. Sandhu, S. Chanana, “Comparative Analysis of Conventional and Multi-Rotor Wind Turbines” International Journal of Circuits, Systems and Signal processing, Volume 12, 2018, Pages 246-255.
4. John D. Sorensen and James N. Sorensen “Wind Energy Systems Optimizing Design and Construction for safe and Reliable Operation”, Elsevier Science & Technology
5. Benjamin Wayne “Wind Energy Science and Engineering”, Syrawood Publishing House

Sanjay Ghodawat University Kolhapur
Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE 310.2: Energy Efficiency in Electrical & Thermal Utility
(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Explain**[2] various furnace system and optimal utilization of furnace.
CO2	**Select**[3] energy saving techniques for various electrical systems and motors.
CO3	**Apply**[3] knowledge of ECBC to building design.
CO4	**Describe**[3] energy conservation opportunities in boiler and cogeneration system.

Unit I

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

(08 Hrs)

Unit II

Lighting System: Introduction, Basic parameter and terms in lighting system, Light source and types of lamps, Illuminance level for various task and calculation, General energy saving opportunities, Energy efficient lighting control, Standards and labeling programs.

(06 Hrs)

Unit III

Energy Conservation in Building: Introduction**,** Energy conservation Building Code**,** ECBC guideline on Building envelope, ECBC guideline on heat ventilation and AC system, ECBC guideline on service hot water, ECBC guideline on electric power, Building energy management system, star rating of building.

(07 Hrs)

Unit IV

Boilers and Cogeneration System: Introduction, Indian boiler regulation, Boiler system, types and classification, Performance evaluation of Boilers, feed water treatment, blow down, energy conservation opportunities, Principle and need of Cogeneration, Types of Cogeneration Factors influencing Cogeneration choice.

(08Hrs)

Unit V

Cooling Tower: Introduction, Types of cooling tower, Cooling tower performance, efficient system operation, Flow control strategies, Energy saving opportunities in cooling tower.

(06 Hrs)

Unit VI

Furnaces: Types and classification, Factors affecting the furnace efficiency, General fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery, optimum capacity utilization.

(07 Hrs)

Text Books / Reference Books:

1. Guide book for National Certification Examination for Energy Managers/Energy Auditors Book 2 – Thermal Utilities.
2. Guide book for National Certification Examination for Energy Managers/Energy Auditors Book 3- Electrical Utilities.
3. Guide book for National Certification Examination for Energy Managers/Energy Auditors Book 1-General Aspects.
4. S.C. Tripathi “Utilization of electrical energy” Tata McGraw Hill 2011.
5. W.R. Murphy and Mackay, “Energy Management” B.S. Publication.

Sanjay Ghodawat University Kolhapur
Curriculum Structure & Syllabus for Third Year B.Tech Electrical Engineering Program R0

ELE 310.3 Battery Management Systems

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40

Course Outcomes: At the end of this course students will able to

CO1	**Understand**[2] energy storage devices and its types.
CO2	**Explain**[2] charging and discharging of battery.
CO3	**Understand**[2] battery charger design and thermal management.
CO4	**Analyse**[4] power converters for battery management.

Unit I

Energy Storage Systems: Energy storage systems in EV, Battery electro-chemistry, Cell and battery voltages, Charge (or Amp hour) capacity, Energy stored, Specific energy, Energy density, Specific power, power density, Amp hour (or charge) efficiency, Energy efficiency.

(06 Hrs)

Unit II

Types of Batteries: Battery design and construction, Electrochemical Batteries, Lead Acid Batteries, Nickel-based Batteries, Sodium-based Batteries, Lithium Batteries, Metal Air Batteries, Fuel cells, Ultra capacitors.

(07 Hrs)

Unit III

State of Charge in Batteries: Cell/module level: cell voltage, cell/module temperature, Pack level: current, pre-charge temperature, bus voltage, pack voltage, charging and discharging, State of Charge estimation; State of Health estimation, Power estimation, Energy estimation.

(07 Hrs)

Unit IV

Thermal Management for Batteries and Power Electronics: Introduction - Thermal control in vehicular battery systems: battery performance degradation at low and high temperatures - Passive, active, liquid, air thermal control system configurations for HEV and EV applications - Battery Heat Transfer.

(07 Hrs)

Unit V

Power Converters: DC-DC converter, Inverters, Sensors, Micro controller/DSP. Scalar control, Vector control, Programming tools - IDE, compiler, Assembler, loader, Dynamometer.

(08 Hrs)

Unit VI

Battery Charger Design: Battery Chargers: Charge equalization, Conductive (Basic charger circuits, Microprocessor based charger circuit). Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods.

(07 Hrs)

Text Books:

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery management Systems -Design by Modelling" Philips Research Book Series 2002.

Reference Books:

1. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010.
2. James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
5. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.

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ELE312: Control System Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Understand**[2] the different transfer function in systems.
CO2	**Analyze**[4] the various responses of system for different inputs.
CO3	**Compare**[5] the different techniques of system stability.

List of Experiments:

1. Formation of transfer functions by different methods.
2. Response analysis of first & second order system.
3. Finding time domain specifications for a given system.
4. Change of poles & zeros in system response.
5. Stability analysis using Root locus technique.
6. Stability analysis using Bode plot.
7. Conversion of State space to transfer function & vice versa.
8. DC position control system.
9. Type 0, 1, 2, control system.
10. Frequency response of lead/lag compensator using bode plot.

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ELE 314: Electrical Drives Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	50	40
					POE	50	40

Course Outcomes: At the end of this lab students will able to

CO1	**Understand**[2] the operation of different power converters.
CO2	**Analyze**[4] different speed control techniques.
CO3	**Develop**[4] the control strategies for electrical motors.

List of Experiments:

1. Fully controlled rectifier fed DC motor.
2. Three phase half controlled rectified fed DC motor Drives.
3. V/f control of Induction motor.
4. Step down chopper fed DC motor drives.
5. H-Bridge fed DC motor Drive.
6. Sine PWM inverter fed Induction motor.
7. Step up chopper fed DC motor.
8. AC voltage controller fed AC motor.
9. CSI fed Induction Motor Drive.

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ELE 316: Electrical Machine Design Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass (%)
-	-	2	1	Practical	FEP	50	40
					POE	50	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Differentiate**[2] DC & AC machines assembly.
CO2	**Analyze**[4] construction of machines.
CO3	**Design**[6] of various machine's assembly.

List of Experiments:

1. Design of DC Armature winding.
2. Design of AC Armature winding.
3. Core and yoke design of single phase transformer.
4. Core and yoke design of three phase transformer.
5. Stator winding design of three phase induction motor.
6. Design of squirrel cage induction motor rotor.
7. Design of slip ring induction motor rotor.
8. Design of salient pole type synchronous generator.
9. Design of field winding of synchronous generator.
10. Design of starter for DC Shunt motor.
11. AutoCAD design of three phase transformer.

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ELE 318: Switchgear and Protection Lab

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass (%)
-	-	2	1	Pr. (100)	FEP	50	40
					POE	50	40

Course Outcomes: At the end of this lab students will able to

CO1	**Understand**[2] the operation of different power system protection schemes.
CO2	**Analyze**[4] different relay characteristics.
CO3	**Analyze**[4] the working of microprocessor based relays.

List of Experiments:

1. Construction of various circuit Breakers.
2. Generator and transformer protection schemes.
3. Construction and working of induction disc type relays.
4. Current versus time characteristics of an IDMT over current or E/F relay.
5. Experimental realization of Directional over current relay.
6. Experimental realization of microprocessor based over current relay.
7. Experimental realization of microprocessor based impedance relay.
8. Experimental realization of microprocessor based Directional over current relay.

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ELE 320.1: Wind Energy Conversion System Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass
-	-	2	1	Pr (100)	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Understand**[2] the operation & characteristics of Wind Turbine in Different Region
CO2	**Calculate**[3] the optimum points of wind power and Important of MPPT
CO3	**Analyze**[4] the wind turbine power flow in power converter

List of Experiments:

1. Power versus speed characteristics of wind turbine
2. Various region of operation in Wind Turbine
3. Analyze and verify the optimum points wind turbine
4. Pitch Angle Control of wind turbine
5. Power flow of wind power in Grid Connected WECS
6. Power flow of wind power in standalone WECS
7. Effect of pitch angle control in low wind speed
8. Realization of optimum power coefficient and tip speed ratio in WECS
9. Industrial Visit to Wind Energy Power Plant.

ELE 320.2 : Energy Efficiency in Electrical & Thermal Utility Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Learning Outcomes: At the end of this lab, students will able to

CO 1	**Estimate**[4] the requirement of capacitance for power factor improvement.
CO 2	**Plan**[6] energy conservation for cogeneration plant.

List of Experiments /Tutorials:

1. Analysis and interpretation of Electricity Bills.

   Students should calculate electricity charges for

   a) Residential consumer

   b) Commercial Consumer
2. Computing efficiency of DC motor/Induction Motor/Transformer.
3. Study of capacitance requirement for power factor improvement.
4. Study of various energy efficient equipment (LED lighting devices, Energy Efficient motors, Electronics ballast etc.).
5. Study of the various energy conservation methods.
6. Case study on co-generation plant.
7. Study of temperature measuring devices for analysis of heating systems.
8. Calculating the efficiency of boiler / blowers / compressors etc.
9. Case study on Industrial visit with an aim of

   (i) Studying various energy management systems prevailing in a particular industry/Organization

   (ii) Identifying the various energy conservation methods useful in a particular industry

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ELE 320.3: Battery Management System Lab

(Ver 1.0, PE, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass %
-	-	2	1	Practical	FEP	100	40

Course Outcomes: At the end of this lab, students will able to

CO1	**Explain**[2] the operation of batteries for EV application
CO2	**Understand**[2] the charging and discharging of battery
CO3	**Analyse**[4] the battery charger design.

List of Experiments:

1. Study of the all battery parameters.
2. Study the characteristic of electrochemical battery.
3. Study the characteristic of Lead Acid battery
4. Study the characteristic Ultra capacitors
5. Study the characteristic of lithium ion battery
6. Design of battery Electrical Vehicle (2 wheeler)- Case Study
7. Design of battery Electric Vehicle (4 Wheeler)- Case Study
8. Design of Charging Station

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ELE322: Software Proficiency Program-II

(Ver 1.0, PC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass (%)
-	-	2	1	Practical	FEP	100	40

CO1	**Understand**[2] the writing skill of documents
CO2	**Develop**[6] the system model using suitable software

List of Experiments:

1. Introduction to LaTeX on Windows using TeXworks
2. Report writing using LaTeX.
3. Introduction to Mi-power, power world simulator.
4. Design IEEE 3-Bus power system using Mi-power/Power world simulator
5. Matrix Operations using Scilab.
6. Vector Operations using Scilab.
7. Schematic Creation and Simulation using eSim..
8. Setting Parameters for PCB designing using eSim.
9. Device Model creation and Simulation using eSim.

References:

1. George Grätzer ‘Practical LaTeX’, Springer Publication.
2. Dr. Nilesh B. Bahadure,Sankalp Verma, ‘A document preparation and typesetting system’,notionpress.com
3. Tejas Sheth, ‘Electronic SCILAB: A Practical Introduction to Programming and Problem Solving’ Kindle Edition.
4. User manuals of SCILAB, CSC-IIT BOMBAY.
5. eSim User Manual version 1.1.0 , IIT,Bombay.
6. Websites: http://www.iitb.ac.in/, https://spoken-tutorial.org/, https://esim.fossee.in/resource/book/esimusermanual.pdf

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ELE324: Internship Training
(Ver 1.0, UC, School of Technology)

Lect.	Tut.	Practical	Credits	Evaluation Scheme			
				Component	Exam	WT%	Pass (%)
-	-	2	1	Practical	FEP	100	40

Course Outcomes: After the end of this course students will be able to

CO1	**Demonstrate**[3] communication, interpersonal skills
CO2	**Apply**[3] theoretical concepts to field work

Students are required to undergo internship of ***three*** **weeks** during vacation at the end of semester V and the same will be evaluated in semester VI.

The aim of this course is to use the internship experience to enable students to develop their engineering skills and practice. The students will be assessed for academic credit. The internships should be aligned with computer science and engineering program and its areas of specialization. Students will experience a real-life engineering workplace and understand how their engineering and professional skills and knowledge can be utilized in industry. They will also be able to demonstrate functioning engineering knowledge, both new and existing, and identify areas of further development for their future careers.