Sanjay Ghodawat University

Kolhapur

School of Technology

Department of Electronics Engineering

B.Tech. Electronics& Communication Engineering

Curriculum

(Programme Structure and Course Contents)

Academic Year 2020 - 21

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. SushilaDanchand 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 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.

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.

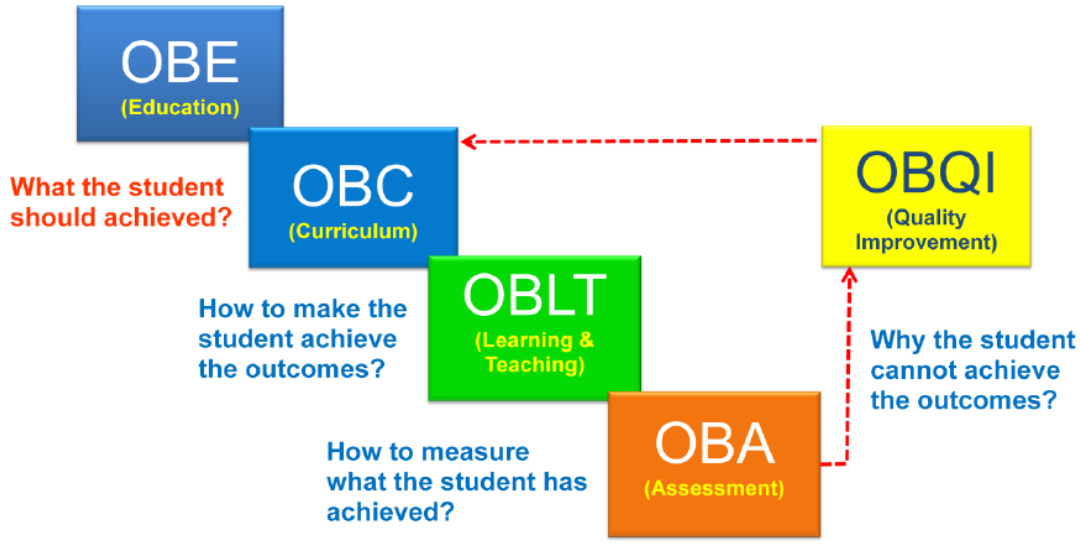
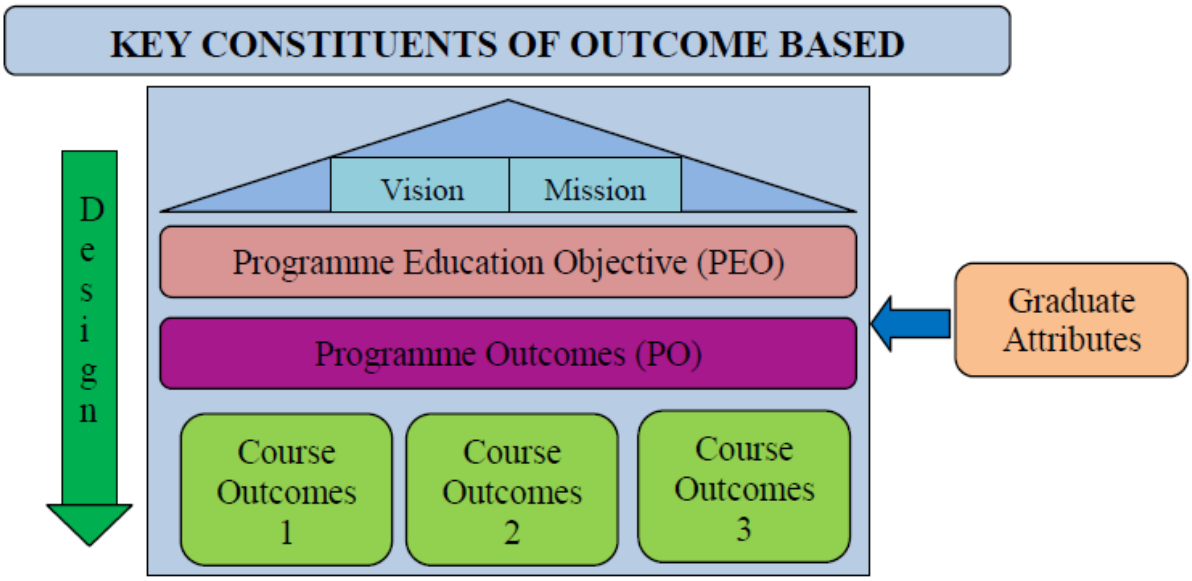


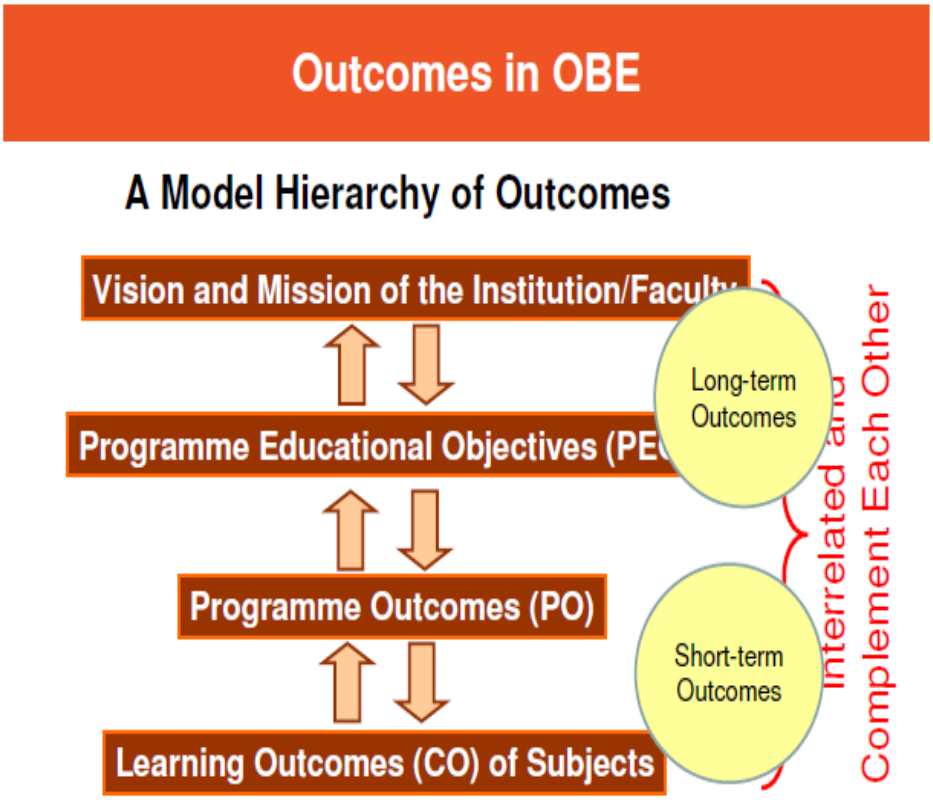
Figure 1: OBE flows and desciption



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) is 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 27th May, 2019 and to be implemented from academic year 2019-20. [Version R1]

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 20weeks per semester including instructions, examination and evaluation. Total instructional days are 90 per semester.
5. **Course:** It is a Subject that is 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. B Tech in Mechanical Engineering,
7. M Tech in Civil Engineering, Bachelor of Business Administration. Bachelor of Science etc.
8. **Department:** Department is a unit of the school which offers one or more programs.
9. **Contact Hours:** Time of students in class/laboratory with instructor. Usually in the range of 26-30 Hrs./Week. For the purpose of uniformity one contact hour is measured as 60 minutes
10. **Academic Council (AC):** Means apex academic body governing the academic programs responsible for framing policy, rules and regulations.
11. **Board of Examination (BOE):** Central body responsible for framing policy, rules and regulations for Examination.
12. **Board of Studies (BOS):** Departmental academic body to govern the academics of programs(BOS)offered by department.

3.0 Curriculum:

3.1. 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.

3.2. 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 semester. Total duration of each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

3.3. 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 separatelaboratory 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.

3.4 Audit Course:

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

3.4.2 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.

3.4.3 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% credits of the previous year. For example, for registration of the 5^{th} semester courses (i.e. 3^{rd} year of program), a student must have earned all the credits of the first year and 75% credits of the second year. Similarly, for registration of the 7^{th} semester courses (i.e. 4^{th} year of program), a student must have earned all the credits of the second year and 75% credits of the third year. However, if 75% 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 SGPI 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.

Forsuch students there shall not be First Year Performance Index (FYPI). Semester Performance Index (SGPI) and Cumulative Performance Index (CGPI) 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 Program 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.

7.0Facilitation 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 s/he 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 are 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

10.0 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, andBrother) 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 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.

11.0 Modes of Assessment:

11.1 Assessment of Theory Courses:

11.1.1 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).

11.1.2 The relative weightage for the theory courses having ESE shall be generally as shown in the Table 11.1.2

Table 11.1.2: Weightage for the theory courses in %

FET	CAT1	CAT2	ESE
20	15	15	50

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

11.1.3 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.

11.1.4 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.

11.1.5 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.

11.1.6 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

11.1.6 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.

11.1.7 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.

11.1.8 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.

11.2 Assessment of Laboratory Courses:

11.2.1 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.

11.2.2 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.

11.2.3 Student failed in ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted along with 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.

12.0 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.

12.1. Award of Grade (Regular Semester):

12.1.1 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.

12.1.2 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 12.1.2

Table 12.1.2: Grade Table for Regular Semester

Marks Obtained	Grade Letter GL	Grade Point	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

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

12.1.4 “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.

13.0 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.

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

13.2 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).

13.3 Th**e** performance of a student is less than 40% in FET, CAT1 and CAT2 Combined.

13.4 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.

13.5 Grade "X" may be given to a student if
13.5.1 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.

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

In 13.5.2 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).

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

13.6.1 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.

13.6.2 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 12.1.2 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.

13.6.3 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 in 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.

14.0 Award of Grades for Re-Examination:

14.1 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

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

14.3 50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

14.3.1 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,
- 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

14.4 Following rules apply for these cases:

14.4.1 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.

14.4.2 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 4th 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.

15.0 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 ≥ 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.

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

15.4.1 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.

$$\text{FYPI} = \frac{\sum_{1} C_i g_i}{\sum_{1} C_i}$$

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

15.4.2 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.

15.4.3 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.

15.4.4 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.

16.0 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 a confidential of valid reason may be referred to academic council for extending this limit by additional criteria.

17.0 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.

18.0Academic Progress Rules (ATKT Rules):

18.1 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 75% credits of the current year. If 75% 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 75% 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 mininum75% of the 45 Credits i.e. 33.15 (Rounded to 33 Credits). A student can go to next higher class with a maximum backlog of 12 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 75% 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 75% 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 75% happens to be a decimal, it is rounded to only integer part.

19.0 Semester Grade Report:

19.1 Semester grade report reflects the performance of a student in that semester (SGPI) and also his/her cumulative performance for the first year (FYPI) and also the cumulative performance since the third semester of his/her study (CGPA). 19.2 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.

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

20.0 Awardof 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 ≥ 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.

21.0 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 1/3rd 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.

22.0 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

Syllabus Structure

Semester V									
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	Evaluation Scheme for Theory and Practical			
						Compo-nent	**Exam**	**WT**	**Pass Min (%)**
ECE301 (PC)	Digital Signal Processing	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE303 (PC)	Linear Integrated Circuits and Applications	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 305 (PC)	Electromagnetics Field Theory	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 307 (PE**)**	Program Elective-I	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 309 (PC**)**	DSP Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ECE 311 (PC**)**	LICA Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ECE 313 (PC**)**	EMF Tutorial	-	-	2	1	Pr (100)	FEP	50	40
ECE 315 (PE**)**	Program Elective-I Lab	-	-	2	1	Pr (100	FEP	50	40
							POE	50	40
ECE 317 (PC**)**	Software Proficiency Program-I	-	-	4	2	Pr (100)	FEP	100	40
ECE 319 (UC)	Foreign Language	3	-	-	NC	Pr (100)	FEP	100	40
	Total	**15**	**00**	**12**	**18**	**Total Hrs.: 27, Total Credits: 18**			

Semester VI									
Course Code	**Course Title**	**L**	**T**	**Pr**	**C**	Evaluation Scheme for Theory and Practical			
						Compo-nent	**Exam**	**WT**	**Pass Min (%)**
ECE 302 (PC)	Mechatronics	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 304 (PC)	Power Electronics	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 306 (PC)	Embedded Systems	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 308 (PE**)**	Program Elective-II	3	-	-	3	Th (100)	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
ECE 310 (PC**)**	Power Electronics Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ECE 312 (PC**)**	Embedded Lab	-	-	2	1	Pr (100)	FEP	50	40
							POE	50	40
ECE 314 (PC**)**	Mechatronics Lab	-	-	2	1	Pr (100)	FEP	50	40
ECE 316 (PE**)**	Program Elective-II Lab	-	-	2	1	Pr (100	FEP	50	40
							POE	50	40
ECE 318 (PC**)**	Software Proficiency Program-II	-	-	2	1	Pr (100)	FEP	100	40
ECE 320 (UC)	Scholastic Aptitude	3	-	-	NC	Pr (100)	FEP	100	40
ECE 322 (UC)	Internship Training	-	-	-	1	Pr (100)	FEP	100	40
ECE 324 (UC)	Mini Project		-	2	1	Pr (100)	FEP	100	40
	Total	**15**	**00**	**12**	**19**	**Total Hrs.: 27, Total Credits: 19**			

SEM – V

ECE 301: Digital Signal Processing

Course	Third Year Engineering			Course Code		ECE 301	
Semester V				Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Ms.S.C.Deshmukh Dr. N.B. Bahadure			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is the basic knowledge of Signals & Systems.					

Course Outcomes

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

301.1	**Apply**[3]DFT as an analytical tool.
301.2	**Analyze**[4] LTI systems using FFT algorithms.
301.3	**Design**[6]and **Implement**[6] FIR and IIR filters.
301.4	**Describe**[2]digital signal processing applications

Course Contents:

Unit No.	Digital Signal Processing	No. of Hours

Section I

1. **Discrete Fourier Transform** — **06**

Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, IDFT, Relationship of DFT

with DTFT and Z-transform, Properties of DFT, Circular Convolution, use of DFT in linear filtering, filtering long duration sequences:overlap-save and overlap-add method.

2. **Fast Fourier Transform**

Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). Radix-2 FFT algorithm for the computation of DFT and IDFT– decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm, and chirp-z transform. **07**

3. **FIR Filter Design**:

Characteristics of Practical Frequency -Selective filters, Characteristics of FIR filters. Linear Phase FIR filter design using windowing method: Rectangular window, hamming window, hanning window, kaiser window. FIR filter design using frequency sampling method. **07**

Section II

4. **IIR Filter Design:**

Design of IIR filters from analog filters, design of IIR filter using Impulse Invariant and Bilinear Transformation method. Characteristics of commonly used analog filter: Butterworth filter. Frequency transformations. **07**

5. **Structures for FIR and IIR systems:**

Structures for FIR Systems- Direct Form structure, Cascade Form structure, structures for IIR systems- Direct Form-I and II realization, Cascade Form and Parallel Form structures. **06**

6. **Applications of DSP:**

Basic block diagram of DSP system, Applications: Speech processing, Speech Analysis, Speech coding, Digital processing of Audio signals, Radar Signal processing, Introduction to DSP processor: comparison between general purpose and DSP processors. **07**

Text Books:	1. John G. Proakis, D.G.Manolakis, "Digital Signal Processing-Principles, Algorithms and Applications" Pearson publication, 4th Edition, 2007. 2. P. Ramesh Babu, "Digital Signal Processing" Scitech publication,4th Edition, 2013.

Reference Books:	1. Salivahanam,AVallavaraj, C.Guanapriya,"Digital Signal Processing" TMH, 2000. 2. S.K.Mitra," Digital Signal Processing" TMH, 3rd Edition, 2013. 3. Texas Instrument DSP processor datasheet.

ECE 309: Digital Signal Processing Lab

Course Code		**DSP LAB ECE 309**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Ms.S.C.Deshmukh Dr.N.B. Bahadure			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is the basic knowledge of Signals & Systems.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 309	**DSP Lab** Minimum 10 Experiments based on syllabus. 1. Generation of DT signals. 2. Computation of DFT and IDFT using standard formula. 3. Computation of DFT and IDFT using MATLAB inbuilt functions. 4. Computation of linear Convolution. 5. Computation of Circular Convolution. 6. Compute linear Convolution using Overlap-Add method. 7. FIR filter design using windowing method (Rectangular, Hamming, Hanning) 8. FIR filter design using Kaiser Window. 9. FIR filter design using frequency sampling method. 10. Butterworth IIR filter design using Impulse invariant method. 11. Study of DSP Applications.

ECE 303: Linear Integrated Circuits and Applications

Course		**Final Year Engineering**		**Course Code**			**ECE 303**
Semester V				**Evaluation Scheme for Theory**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Ms.P.R.Narvekar Mr.P.G.Kamble			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is to possess the fundamental knowledge of electronic components and devices, their characteristics etc.					

Course Outcomes

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

303.1	**Identify**[1] Op-amp configurations, frequency response and compensation techniques
303.2	**Demonstrate**[2] knowledge of basic linear and non-linear applications of op-amp by solving differential equations and design oriented numerical.
303.3	**Design**[5] different op.amp circuits for different applications
303.4	**Analyze**[4] active filters, multivibrators and signal generators

Course Contents:

Unit No.	**Linear Integrated Circuits and Applications**	**No. of Hours**

Section I

1.	**Op-amp fundamentals:**	
	Block Diagram of Op-Amp , DC and AC analysis, current mirror circuit, Study of μA 741: Ideal & Practical Op-amp specifications, Open loop & close loop frequency response	**06**
2.	**Op-amp circuits with resistive feedback:**	
	Concept of feedback & their types,Op-Amp Configurations Open Loop & Closed Loop Inverting, Non inverting and Differential amplifier , I to V and V to I converters, Summing amplifier, Subtractor, Integrator, Differentiator, Instrumentation Amplifier.	**07**
3.	**Active Filters :**	
	Introduction: Types of Filters, Design & frequency response of First & Second Order Butterworth Low Pass, High Pass, Band Pass, Band Reject, & All Pass Filters.	**07**

Section II

4.	**Oscillators:**	
	Introduction , Types of oscillators, Design & operation of RC phase Shift, Wein Bridge, Hartely, Colpitts oscillators	**06**
5.	**Op-amp applications:**	
	Comparators, Zero Crossing Detector, Window detector, Schmitt trigger, peak detector, precision rectifier, sample and hold circuit, clippers and clampers.	**07**
6.	**Wave generators:**	
	opamp as multivibrators and swquare wave generator, triangular wave generator & saw tooth wave generator, V to F and F to V Converters,IC8038 as Function Generator	**07**

Text Books:

1. Ramakant. A.Gayakwad ― Op-Amps & Linear Integrated Circuits, 3rd Edition, PHI, 2002.
2. Sergio Franco ―Design with op-amp & Analog Integrated Circuits, 3rd Edition, Tata McGraw Hill, 2002.
3. S.Salivahanan&Bhaaskaran ―Linear Integrated Circuits, 1st Edition, Tata McGraw Hill, 2007.

Reference Books:

1. National Analog & Interface products Data book—National Semiconductors, 1999.
2. T.R Ganesh Babu, ―Linear Integrated Circuits‖ 3rd Edition, Scitech Publication, 2010.
3. David. A. John & Ken Martin ―Analog Integrated Circuit Design‖, Student Edition, Wiley, 2011.
4. Rashid ―Microelectronics Circuits Analysis & Design1st Edition, Cengage Learning, 2009.

ECE 311: LICA Lab

Course Code		LICA LAB ECE 311		Evaluation Scheme for Practical			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Ms.P.R.Narvekar Mr.P.G.Kamble			Date:-	15/01/2020	
Prerequisites		Fundamentals of digital electronics.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 311	**LICA Laboratory** Minimum 10 experiments based on syllabus. 1. Build and test V-I & I-V Converter 2. Build and test Instrumentation Amplifier using LM 324 3. Assemble first order low pass butterworth filter using op-amp and plot the frequency response 4. Build and test Wein Bridge Oscillator using opamp 5. Build and test RC Phase shift Oscillator using opamp 6. Build and test Comparator & Zero Crossing Detector using opamp 7. Build and test Schmitt Trigger using opamp 8. Build and test Precision rectifier using opamp

	9. Build and test astablemultivibrator using op-amp 10. Build and test square wave generator using opamp 11. Build and test Triangular wave generator using opamp 12. Design Function Generator using IC 8038

ECE 305: Electromagnetic Field Theory

Course		**Final Year Engineering**		**Course Code**		**ECE 305**	
Semester V				**Evaluation Scheme for Theory**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
3 hr/wk	1	-	4	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr.P.B.Nikam , Mrs.S.K.Apte			Date:-	15/01/2020	
Prerequisites		Vector Algebra.					

Course Outcomes

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

305.1	Learn fundamentals of Electrostatic and Magneostatics fields.
305.2	Apply different laws from electromagnetics to field analysis.
305.3	Understand Maxwell's equation and apply them for applications of wave propagation.
305.4	Solve the problems involving transmission line properties.
305.5	Develop mathematical skills related with vector calculus and integrals.

Course Contents:

Unit No.	**Electromagnetic Field Theory**	**No. of Hours**
	Section I	
1.	**Review of Vector Algebra & Coordinate system:** Vector algebra, Co-ordinate systems, del operator, line, surface and volume integrals, Gradient, divergence and curl, charge distributions, Coulomb's law.	**07**

2.	**Electrostatic fields:** Electric field intensity, E due to line and surface charge, Flux density and Gauess law, Divergence theorem, Electric potential (V), Electric dipole and moment.	**07**
3.	**Boundary conditions and Current Density:** Nature of dielectrics, Boundary condition in different media, Current and current density, Method of image for point charge.	**07**

Section II

4.	**Magneostatics:** Biot-Savart's law, Ampere's law, inconsistency in Ampere's law & J, Stroke's theorem, Vector magnetic potential, Faraday's law.	**06**
5.	**Maxwell's equations:** Static and Non-static Maxwell's field equation in point and Integral form, Poynting vector, Wave equation in free space, different medium conditions for wave propagation.	**06**
6.	**Transmission Lines:** Field theory and Circuit theory, Transmission line equation, Parameters of transmission line, Characteristics of transmission line, Smith chart.	**07**

Text Books:

1. W.H. Hyte- Engineering Electromagneticsx, 8th edition, TMH, 2010.
2. N.M.Sadiku - Electromagnetics Theory, 6th edition, Oxford publication, 2015.

Reference Books:

1. J.D.Krause - Electromagnetic with applications, 3rd edition, MGH Pub, 2013.
2. Griffiths, David- Introduction to Electrodynamics,4th edition, 2012.

ECE 313: EMF Tutorials

Course Code		EMF TUT ECE 313		Evaluation Scheme for Tutorial			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	2 hr/wk	-	1	Th. (100)	FEP	OE	40
					-	50	40
Prepared by		Mr. P.B.Nikam			Date:-	15/01/2020	
Prerequisites		Fundamentals of electromagnetics.					

List of Tutorials

Tutorials based each chapter min. 10 should be conducted.	
ECE 313	**EMF Tutorials** 1. Calculation of areas, line, surface and volume integrals. 2. Problems on scalar and vector products. 3. Numerical based on Coulomb's law. 4. Numerical based on Gauess law. 5. Numerical based on Divergence theorem. 6. Numerical based on Biot-Savarts law. 7. Numerical based on Ampere's law. 8. Numerical based on Stroke's theorem. 9. Numerical based on Transmission lines. 10. Numerical based on overall conduction.

ECE 317: Software Proficiency Program-I

Course Code		SPP-I LAB ECE 317		Evaluation Scheme for Practical			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	4hr/wk	1	Pr. (100)	FEP	100	40
Prepared by		Mr.A. G. Bhosale			Date:-	15/01/2020	
Prerequisites		Knowledge of analog & digital circuits and digital signal processing.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 317	**SPP-I Laboratory** Minimum 10 experiments based on syllabus. Experiments based on Proteus software 1. Rectifiers and Transistorized Amplifiers 2. Opamp based Amplifiers and Summing, Scaling and Averaging Amplifiers 3. Window Detector and LDR based Alarm Circuit 4. Logic Gates, Flip-Flop as a Counter and Counting and Display Unit 5. PCB Designing Experiments based on MATLAB software 6. Program using branching statement 7. Program using looping statement 8. Program for matrix manipulation 9. Program using user defined function 10. Program for File handling & string manipulation 11. Program for creating & Displaying GUI 12. Simulink introduction

Program Elective – I

(Vertical - Communication)

ECE 307: Wave Propagation and Antennas

Course	Final Year Engineering			Course Code		ECE 307	
Semester V				Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr. P.B.Nikam			Date:-	15/01/2020	
Prerequisites		Electromagnetic engineering concepts.					

Course Outcomes

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

307.1	Classify different types of Wave propagations.
307.2	Identify losses in wave propagation.
307.3	Calculate different wave propagation properties.
307.4	To realize importance of basics of antenna systems to differentiate applicability of each type.
307.5	Solve various problems of parameters of Antenna.

Course Content

Unit No.	Wave Propagation and Antennas	No. of Hours

Section I

1. **Wave analysis:** Review of Maxwell's equations, application of Maxwell's equation to wave propagation – free space wave equation, skin depth, Reflection of a wave. **06**

2. **Ground Wave Propagation:** Specification of Ground, Space and Ionosphere propagation, Ground wave – Wave tilt, field strength, Spherical earth propagation, Tropospheric waves, Space wave field strength (Numerical expected) **07**

3. **Ionospheric Propagation:** The Ionosphere, R.I. of Ionosphere, Reflection and Refraction of waves by ionosphere, different variations in ionosphere, Faraday's rotation, atmospheric calculations. **07**

Section II

4. **Fundamentals of Antenna:** Basic radiation mechanism, antenna parameters – radiation density, intensity, beam efficiency, directivity, gain, pattern, aperture, effective height, field zones, Friss transmission formulae. Array of two isotropic sources – same amplitude same phase and same amplitude opposite phase. **07**

5. **Basic Antennas:** Yagi-uda antenna, Loop antennas, Biconical antenna, Rumesay's principle, Log periodic antenna, log spiral antenna. **06**

6. **Microstrip Antennas:** Introduction, basic properties, radiation mechanism, Feeding methods, Rectangular Microstrip antenna analysis. **07**

Text Books:	1. Antenna Theory – C.A. Balanis Wiley Publication, 3rd edition, 1993. 2. Kennedy Davis-Electronic Communication system, Pearson Education India, 5th edition, 2011. 3. J.D.Krause - Antenna Theory, TMH, 4th edition, 2017.

Reference	1. K.D.Prasad - Antenna & Wave Propagation, Satya publication, 5stedition,

Books:	2009. 2. G.S.N. Raju - Antenna and Wave propagation, Pearson publication, 1st edition, 2004.

ECE 315: Antenna LAB

Course Code		**Antenna LAB ECE 315**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr. P.B.Nikam			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is the basic knowledge of Electromagnetics.					

List of Experiments

List of Experiments to meet minimum requirement of course content

1. Calculation of Beam width, FNB & gain of Dipole antenna.
2. Calculation of Beam width, FNB & gain of Disk cone antenna.
3. Calculation of Beam width, FNB & gain of Biconical antenna.
4. Calculation of Beam width, FNB & gain of Yagi-Uda antenna.
5. Simulation of Dipole antenna.
6. Simulation of Yagi-Uda antenna.
7. Simulation of Microstrip antenna.
8. Radiation intensity calculation on Matlab.
9. Directivity calculation on Matlab.
10. 2-D and 3-D pattern calculation on Matlab.

Program Elective – I

(Vertical - Signal Processing)

ECE 307: Audio-Video Engineering

Course		Third Year Engineering		Course Code			ECE 307
Semester V				Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Ms.S.C.Deshmukh Mr.K.D.Salunkhe			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is the basic knowledge of analog electronics, digital electronics and communication.					
Course Outcomes							
At the end of the course the students should be able to:							
307.1	**Describe**[2] picture and sound transmission and reception.						
307.2	**Explain**[2]colour composite video signal.						
307.3	**Describe**[2] principle of digital TV system and studio acoustics.						
307.4	**Compare**[5] various display technologies						

Course Contents:

Unit No.	Audio-Video Engineering	No. of Hours
	Section I	
1.	**Fundamentals of television system:** Picture and sound transmission and reception ,aspect ratio, horizontal and vertical resolution, video bandwidth and interlaced scanning , composite video, signal, H & V sync details, CCIR-B standards, VSB transmission and channel bandwidth	**07**
2.	**Color signal transmission and reception:** Colour TV camera , Colour Picture Tubes, picture tubes purity & convergence, automatic degaussing , Composite colour signals, compatibility considerations, frequency interleaving process, colour mixing theory, characteristics of colour, colour difference signals, chromaticity diagram , colour signal transmission- bandwidth and modulation of color difference signals, color TV system :NTSC , PAL – D & SECAM	**07**
3.	**Digital TV Transmission and Reception:** Digital system hardware, Signal quantization and encoding, Digital signals and parameters, Digital Satellite Television, Digital T.V. Receiver system, Merits of Digital TV receiver.	**06**
	Section II	
4.	**High Definition TV:** Component coding, MAC signals ,MAC encoding format ,scanning frequencies D2-MAC Packet Signal , Duo binary Coding ,HDTV Standards & compatibility ,colorimetric characteristics & parameters of HDTV systems	**06**
5.	**Studio Acoustics and Advancements in Audio Technology:** Studio acoustics and reverberation, acoustic chambers, P.A.System for auditorium, Cordless microphone system, special types of speakers and microphones, Satellite Radio.	**07**
6.	**Advanced TV systems** LCD TV System :LCD Technology , LCD Matrix types & operations	**07**

, Plasma TV System : Plasma & conduction of charge ,Plasma TV screen ,Signal processing in Plasma TV, Plasma color Receiver, LED TV, DTH Receiver System ,CCTV, working of block converter,: IR Remote control.

Text Books:	1. R.R. Gulati, "Monochrome and Color TV", 2nd revised Edition, New Age International Publication, 2005. 2. R.R. Gulati, "Modern Television Practice – Principles, Technology and Service", 4th Edition, New Age International Publication, 2007.

Reference Books:	1. A.M.Dhake, Television & Video Engineering, McGraw Hill Education Limited, 1999. 2. R G Gupta, "Audio video systems", Technical Education, 1995. 3. Bali and Bali, "Audio video systems principles, practices and troubleshooting" KhannaPub., 2014.

ECE 315: Audio Video Engineering Lab

Course Code		**AVE LAB ECE 315**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Ms.S.C.Deshmukh Mr.K.D.Salunkhe			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is the basic knowledge of analog, digital Electronics and Communication					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 315	**AVE Lab** Minimum 10 experiments based on syllabus. 1. To Study composite video signal. 2. To Study color composite video signal 3. To Study RF tuner section 4. To Study VIF section of color TV receiver 5. To Study SIF section of color TV receiver. 6. To Study horizontal section of color TV receiver 7. To Study vertical section of color TV receiver. 8. To Study H sync and V sync details. 9. To Study chroma section of color TV receiver. 10. .To Study digital TV receiver. 11. To Study CCTV. 12. To Study theory of LCD, LED, and Plasma technology. 13. To Study P.A. System

Program Elective – I

(Vertical -Embedded Electronics)

ECE 307: Electronic Product Design

Course	Third Year Engineering			Course Code		ECE 307	
Semester V	A.Y. :- 2020-2021			Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr. A. G. Bhosale			Date:-	15/01/2020	
Prerequisites		The prerequisites for this course are knowledge of analog and digital circuits.					

Course Outcomes

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

CO1	**Design**[5] a digital measurement system using conventional components and discrete IC's.
CO2	**Digitize**[3] the systems by the use of microcontrollers and **Use**[1] phase locked loop for modulation and demodulation of analog signals for communication
CO3	**Design**[5] an entire instrumentation system for measuring various physicalquantities and controlling the process variable using analog controllers like ON-OFF, Proportional and PID controllers.
CO4	**Make use of**[3] LM3524 IC for Switched Mode Power Supply (SMPS) in different configurations such as step-up, step-down and invert mode.

Course Contents:

Unit No.	Electronic Product Design	No. of Hours

Section I

1. **Digital Voltmeter**

Design of 4-digit numeric display circuit, Design of 3 ½ digit DVM, Study of IC 7107/7106. **05**

2. **Phase Locked Loop**

Design of digital phase locked loops (CD 4046 & NE 565), It's use in frequency synthesizer, frequency & phase demodulation, Amplitude modulation, Dual Tone Multi Frequency Encoder (DTMF). **05**

3. **Sensor Signal Conditioning**

Circuits for following sensors to get output in standard range

1) Temperature – RTD, Thermocouple, Semiconductor LM 35, AD549 and 1N4148

2) Strain gauge type transducers of 350 ohm/120 ohm bridge configuration **07**

3) Variable capacitor transducer signal conditioning using Voltage to Time and Voltage to Frequency conversion.

4) V to I and I to V converters for standard input and output ranges – 0 to 2V (DVM), 0 to 5 V(Micro controller), 4 to 20 mA (Industrial)

5) Optical encoders

Section II

4. **Analog Controllers**

Process controllers using transducers: ON/OFF controller, proportional controller, PID controller **08**

5. **Digital Controllers**

Algorithm implementation for any 8-bit Micro controller based process controllers. **08**

6. **Switched Mode Power Supply**

Introduction to SMPS, Study of IC LM3524, Design of SMPS using LM 3524, Step up, Step down, Invertmode. **07**

Text Books:	1. Mickel Jacob, Industrial Control Electronics, Prentice Hall, 1988. 2. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Fourth

	edition, Pearson Education, 2015.

Reference Books:	1. N.C. Goyal and R.K. Khetan, A Monograph on Electronics Design Principles, 5th edition, Khanna Publishers, 2006.

ECE 315: Electronic Product Design Lab

Course Code		**ES LAB ECE 312**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	100	40
Prepared by					Date:-	15/01/2020	
Prerequisites		The prerequisites for this course are knowledge of analog and digital circuits.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 315	**EPD Laboratory** 1. Design of 3 ½ digit DVM using TTL ICs. 2. Study of 7107/7106. 3. Design of frequency synthesizer using 565 PLL. 4. Design of frequency synthesizer using CD 4046 PLL. 5. Design of ON-OFF controller 6. Design of Proportional controller. 7. Design of PID controller. 8. Design of microcontroller based controller. 9. Design of SMPS using LM3524. 10. Design of I to V & V to I converters. Note: Above experiments can expected to be performed on simulation software like Proteus, Multisim, Orcad, Matlab or any open source available.

SEM – VI

ECE 302: Mechatronics

Course	Third Year Engineering			Course Code		ECE302	
Semester VI				Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr. S.M.Hirikude&Mr.P.S.Bidkar			Date:-	15/01/2020	

Course Outcomes

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

302.1	**Discuss**[2]basic mechanical operations and processes.
302.2	**Implement**[4]different actuators according to the need.
302.3	**Analyze**[5] various controllers for specific applications.
302.4	**Understand**[1]development of PLC software.
302.5	**Design**[5]electromechanical system using CNC machines.

Syllabus

Units	Description	Hours
I	**Basicsof Mechatronic system**: Introduction to mechatronics,design of process,systems,(block diagram approach),generalized measurement system-examples,Control system-open loop and closed loop system-advantages.	6
II	**Actuators and Mechanisms**: Introduction, Need of actuators, types of actuators, construction and operation of Electromechanical actuators-d.c motors, brushed d.c motor, A.C motors-stepper motors, piezoelectric actuators, hydraulic actuators, pneumatic actuators, chemical actuators-advantages, Bearings: types of bearings - slide bearing, rolling element, magnetic, Gears: types of gears-spur,bevel,helical,worm gears.-working,gear ratio.	7

III	**Process Controllers**:Controllerprinciples,Two position controller(ON/OFF controller),Proportional controller,Integralcontroller,Derivativecontroller,PIcontroller,PID controller-block diagram,Pneumaticcontroller,Implementation of above controller using op-amp.	7
IV	**Programmable logic controllers**:Introduction to PLC,Basic structure of PLC,principle of operation,PLC programming-ladder diagrams,examples on digital logic gates,PLC vs Computer.	7
V	**Introduction to CNC machine**: Introduction, NC machines-working, construction, advantages, CNC machines-construction, working,advantages,comparison between conventional/NC/CNC machines,machine tool(structure),DNC machine-working and advantages.	7
VI	**Design of Mechatronics system:** Introduction,Mechatronics approach into design,Case examples-any four,futuretrends,smart homes.	6

Text Books:	1. K.P.Ramachandran ,G.K. Vijayraghavan,Mechatronics Integrated mechanical electronic system,Willey India, 5th edt.,2008 . 2.W. Bolton,Mechatronic, Pearson, 4thedt., 2010. 3.Reis Webb,Programmable logic controller,Prentice Hall, 2003.

Referance Books:	1.. NitaigourPremchandMahalik, Mechatronics principles, Concepts and application, ,MCGraw hill 2nd edition, 2016. 2.AppuKuttam , Mechatronics, Oxford publications, 2007.

ECE 314: Mechatronics Lab

Course Code		**LAB ECE 314**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr. P. S. Bidkar Mr. A. G. Bhosale			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is to possess the fundamental knowledge of electronic components and devices, their characteristics etc.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 314	**Laboratory** 1. Automotive lighting system 2. Charging system 3. Engine cooling systems 4. Automotive wiper system 5. Study of Automobile batteries 6. ECU communication an over view 7. Vehicle communication protocol 8. Controller Area Network

ECE 304: Power Electronics

Course	Final Year Engineering			Course Code			ECE 304
Semester V				Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr. P. S. Bidkar Dr.P. D. Patil			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is to possess the fundamental knowledge of electronic components and devices, their characteristics etc.					

Course Outcomes

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

304.1	**Explain** the basics and operations of power semiconductor devices.
304.2	**Analyze**&**design** power electronic turn on and turn off circuits.
304.3	**Design** various configurations of 1 phase & 3 phase-controlled Rectifiers with different types of loads
304.4	**Describe** the steady state analysis of single-phase inverters and cyclo- convertor.
304.5	**Solve** the DC power control problems using chopper circuits.
304.6	**Apply** the knowledge of modern tools that are used to solve the problems in industrial power electronics

Course Contents:

Unit No.	Power Electronics	No. of Hours

Section I

1. **Semiconductor Power Devices-** Characteristics of power diodes, power MOSFET, IGBT, SCRs, TRIAC, DIAC, LASCR and GTO. Rating of power devices, series and parallel connections of SCRs, static & dynamic equalizing circuits, String efficiency, De-rating factor, SCR protections- dv/dt, di/dt, over voltage and over current protection. **07**

2. **Turn ON and Turn Off Methods of SCR-** study of single phase firing circuits, Basic DC firing circuit, R firing circuit, RC firing circuit, UJT firing circuit, Ramp and pedestal firing circuit, microprocessor base firing circuit. Firing circuit of TRIAC using DIAC. Forced commutation circuits - Parallel Capacitance, resonant turn off, external pulse commutation, auxiliary thyristors/IGBT/ MOSEFT and load commutation, natural commutation. (Class A to F) **07**

3. **Rectifier**

   a)Types of power converter circuits. Controlled Rectifier Circuits:-

   b) Single Phase: - Half wave, full wave, half controlled (semi-convertors) and full controlled converters with R&RL Load, advantages and disadvantages of each, significance of freewheeling Diode. Calculations of performance parameters. Numerical based on Single phase rectifier. c) Three Phase:- Half wave, full wave, fully controlled converters with Resistive Load only. **07**

Section II

4. **Inverters** - Single phase bridge inverters, principle and operation of three phase inverters, 120^0 and 180^0 mode of conduction. Advantages and disadvantages of both. Voltage control techniques, harmonic elimination methods -PWM Technique IGBT MOSFET based. Single phase Cyclo-converter working and its application. **07**

5. **Choppers**: - Principles of chopper, time ratio control and current limit control techniques, Voltage commutated chopper circuit, Jones chopper, Morgan‟s chopper, step-up and step down chopper. Speed control of DC motors using chopper, speed control of DC motor using phase controlled rectifiers **07**

6. **Applications of Power Electronics : -**
   a) Non-drive applications Induction heating and Dielectric heating, Switched mode power supply (SMPS), Uninterrupted power supply (UPS).
   b) Introduction to PLC fundamentals, block diagram of PLC, Ladder diagram with examples, PLC programming –physical components vs. program components. Introduction to SCADA, Architecture and its applications **07**

Text Books:	1. Power electronics, Dr. P.S.Bhimbra : Khanna Publishers 5th edition 2012 2. Power electronics, P. C. Sen : TMH Publication 4th edition 1991 3. Programmable Logic Controllers, John R .Hackworth, Federick D. Hackworth: Pearson Education, 2011.

Reference Books:	1. Power Electronics - Converters : Applications and Design", Mohan N., Undeland and Robbins John Wiley and Sons., Inc., New York, 1995 2. "Power Electronics Circuits, Devices and Applications", M. H. Rashid, Prentice Hall India, Second Edition,1993.

ECE 310: Power Electronics Lab

Course Code		**PE LAB ECE 310**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr. P. S. Bidkar Dr.P. D. Patil			Date:-	15/01/2020	
Prerequisites		The prerequisite for this course is to possess the fundamental knowledge of electronic components and devices, their characteristics etc.					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
	Laboratory
ECE 310	1. Study of MOSFET, IGBT, SCRs, TRIAC, DIAC characteristics. 2. Study of firing circuits of SCR (R, RC, UJT firing). 3. Study of firing circuits of SCR using PIC microcontroller. 4. Study of commutation circuits (Class A to F). 5. Study of single phase rectifier(Semi converter)

	6. Study of single phase full wave rectifier. 7. Study of AC power control using TRIAC/SCR. 8. Study the 1 phase bridge invertor circuit. 9. To study the step up chopper. 10. Study of PLC and ladder diagram programming

ECE 306: Embedded Systems

Course	Third Year Engineering			Course Code		ECE 306	
Semester V	A.Y. :- 2020-2021			Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr.A. G. Bhosale Mr. M. P. Mattada			Date:-	15/01/2020	
Prerequisites		The prerequisites for this course are knowledge of microcontrollers and digital circuits.					

Course Outcomes

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

306.1	**Recognize**[1] the embedded systems and its features
306.2	**Develop**[5] the programs for using internal and external peripherals
306.3	**Identify**[3] the types and use of various communication/networking standards
306.4	**Elaborate**[4] the concept of RTOS and its services

Course Contents:

Unit No.	Embedded Systems	No. of Hours

Section I

1. **LPC 2148 Microcontroller**

ARM7TDMI-S microcontroller, LPC-2148: Architecture details, I/O ports, Timers, PWM module, ADC and Interrupts. **07**

2.	**Interfacing External Peripherals to LPC 2148** Interfacing and Embedded C programming for LED's, LCD, Relay, Switch, Matrix keyboard, Stepper motor and Multiplexed Seven Segment display.	**07**
3.	**Introduction to Embedded Systems** Embedded system (ES) definition, Characteristics of Embedded systems, Components of an Embedded system, Embedded system design issues and metrics.	**06**
	Section II	
4.	**Embedded Processor** Difference between CISC and RISC,ARM Architecture Details: RISC architecture design philosophy, Pipelining, register banking, CPSR and SPSR, Exceptions, ARM data flow model.	**07**
5.	**Communication / Networking standards for Embedded Systems** Inter Integrated Circuit (I2C), Serial Peripheral Interface (SPI), Universal Serial Bus (USB), Ethernet network, Controller Area Network (CAN).	**06**
6.	**Real Time Operating Systems** Introduction to RTOS concept, embedded software architectures: Round robin, round robin with interrupts, Function queue scheduling and real time operating system, RTOS basics, Shared data and re-entrancy, Tasks and task states, Context Switching, Pre-emptive and non-preemptive Schedulers, semaphores and shared data using semaphores, Priority Inversion, Deadly embrace, Inter task communication, Introduction to RTOS programming using uCOS-II.	**07**

Text Books:	1. David E. Simon, An Embedded Software Primer, 1st edition, Pearson Education, Asia Publication, 2002. 2. Andrew N., Dominic Sloss, and Chris Wright, ARM System Developers Guide Designing & Optimizing System Software, Morgan Kaufmann, Elsevier, 2004.

Reference Books:	1. Raj Kamal, Embedded Systems, Third edition, McGraw Hill Education, 2017. 2. Phillips A. Laplante, Real- Time Systems Design and Analysis, 3rd edition, Wiley India edition, 2004.

3. Dr. K V K K Prasad, Embedded/ Real-Time Systems: Concepts, Design & Programming, Dreamtech Press, 2003.
4. ARM Reference Manual.
5. Jean J. Labrosse, MicroC/OS-II: The Real-Time Kernel, 2nd Edition, CRC Press, 2002.

ECE 312: Embedded Systems Lab

Course Code		ES LAB ECE 312		Evaluation Scheme for Practical			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr.A. G. Bhosale Mr. M. P. Mattada			Date:-	15/01/2020	
Prerequisites		Knowledge of assembly and C programming					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 312	**ES Laboratory** Minimum 10 experiments based on syllabus. 1. Interfacing LED's to LPC2148 2. Tone generation using LPC2148 3. Square wave generation using timer & interrupt of LPC2148 4. Stepper Motor interfacing with LPC2148 5. Interfacing switch and relay to LPC2148 6. Up/Down Counter 7. LCD Interfacing 8. ADC Interfacing 9. Keyboard interfacing 10. Multitasking and Priority inversion in RTOS 11. Study of I2C/SPI protocol

ECE 318: Software Proficiency Program-II

Course Code		SPP-II LAB ECE 318		Evaluation Scheme for Practical			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	4hr/wk	1	Pr. (100)	FEP	100	40
Prepared by		Mr.A. G. Bhosale			Date:-	15/01/2020	
Prerequisites		Logic for writing programs					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
ECE 318	**SSP-II Laboratory** Minimum 10 experiments based on Pyton language programming 1. Compute the GCD of two numbers. 2. Find the square root of a number (Newton's method) 3. Exponentiation (power of a number) 4. Find the maximum of a list of numbers 5. Linear search and Binary search 6. Selection sort, Insertion sort 7. Merge sort 8. First n prime numbers 9. Multiply matrices 10. Programs that take command line arguments (word count) 11. Find the most frequent words in a text read from a file 12. Simulate elliptical orbits in Pygame 13. Simulate bouncing ball in Pygame

ECE 324: Mini Project Lab

Students will carry out small application based projects in laboratory with spent of 2 hr/week with available resources in department.

Course Code		Mini Project ECE 324		Evaluation Scheme for Practical			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
-	-	4hr/wk	1	Pr. (100)	FEP	100	40

Description of Lab	
ECE 324	This lab prepares students to develop thinking process to solve problems of industry, Medical field,Automotive and avionic industry, Social problem, security issues, AI based solutions etc.by applicationof science and engineering in innovative manner. The group of students not more than 3should identify problems, perform requirement analysis. After interactions with course coordinatorand based on comprehensive literature survey/need analysis, the student shall identify the title anddefine the aim and objectives of mini-project. As per requirements the group should develop specificationsof final outcome of the project. The students should think critically and undertake designof the project with skills available with them to meet the requirements and specifications. Thegroup is expected to detail out specifications, methodology, resources required, critical issues involvedin design and implementation and submit the synopsis within first week of the semester.The student is expected to exert on design, development and testing of the proposed work as per theschedule. The working model of the project should be demonstrated for internal submission andoral examination. This LAB will help to develop sensitivity of students towards industry problems, think critically tofind innovative solutions to simplify human life. Completed mini project and documentation in the form of mini project report is to be submitted atthe end of semester. The project should complete in 12 weeks including field trails if any.At the end of project the guide should advise students to protect IP either in the form of Patent orregistration of design or publish paper on work completed or participate in project competitionThe probable areas of the project work (but not only restricted to): Machine automation, biomedicalengineering, prosthesis, accident prevention, efficiency/cost/ time improvements, , smartcity, smart transportation, Automotive Electronics, energy utility, energy harvesting, AI based solutions,cyber security, Biometrics etc.

Program Elective – II

(Vertical - Communication)

ECE 308: Wireless Sensor Networks

Course		**Final Year Engineering**		**Course Code**		**ECE 308**	
Semester VI		**A.Y. :- 2020-2021**		**Evaluation Scheme for Theory**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr. A. K. Rathod& Mr. S. M. Hirikude			Date:-	15/01/2020	
Prerequisites		Knowledge of Computer network, Operating systems and Analog and digital communication concepts like modulation, demodulation. Transmitter and receivers etc.					

Course Outcomes

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

3081.1	**Illustrate**[3]Wireless Sensor Network architectures
3081.2	**Describe**[4] Various Protocols of Wireless Sensor Networks.
3081.3	**Compare**[5]different operating systems supporting wireless sensor networks
3081.4	**Choose**[5] specific WSN for applications in various fields.

Course Contents

Unit No.	Wireless Sensor Networks	No. of Hours
	Section I	
1.	**Unit-I Characteristics Of WSN:**	
	Characteristic requirements for WSN - Challenges for WSNs – WSN vsAdhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.	**07**
2.	**Unit-II Medium Access Control Protocols:**	
	Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.	**07**
3.	**Unit-III Routing And Data Gathering Protocols**	
	Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.	**07**
	Section II	
4.	**Unit-IV Embedded Operating Systems:**	
	Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.	**07**
5.	**Unit-V Data Storage and Manipulation:**	**05**

Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique.

6. **Unit-VI Applications Of WSN:**
WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. **07**

Text Books:
1.KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books:
1.K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349 ,2005
2.Philip Levis, " TinyOS Programming",Cambridge University Press, 2009
3.Anna Ha´c, "Wireless Sensor Network Designs", 1st edition, John Wiley & Sons Ltd,2004

ECE 316: Wireless Sensor Network Lab

Course Code		**WSN LAB ECE 316**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr.S.M.Hirikude			Date:-	15/01/2020	
Prerequisites		Knowledge of NS2commands and functions					

List of Experiments to meet the Requirements of the Syllabus	
	WSN Laboratory Minimum 10 experiments based on syllabus. 1. Implementation of Error Detection / Error Correction Techniques

ECE 316	2. Implementation of Stop and Wait Protocol and sliding window 3. Implementation and study of Goback-N and selective repeat protocols 4. Implementation of High Level Data Link Control 5. Study of Socket Programming and Client – Server model 6. Write a socket Program for Echo/Ping/Talk commands. 7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols. 8. Network Topology - Star, Bus, Ring 9. Implementation of distance vector routing algorithm 10. Implementation of Link state routing algorithm 11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS 12. Encryption and decryption.

Program Elective – II

(Vertical -Signal Processing)

ECE 308: Digital Image Processing

Course	Third Year Engineering			Course Code			ECE 308
Semester V	A.Y. :- 2020-2021			Evaluation Scheme for Theory			
Lect.	Tut.	Practical	Credits	Component	Exam	WT	%Pass
3 hr/wk	-	-	3	Theory (100)	FET	20	40
					CAT-I	15	
					CAT-II	15	
					ESE	50	40
Prepared by		Mr.A. G. Bhosale Mr. P. S. Bidkar			Date:-	15/01/2020	
Prerequisites		The prerequisites for this course are matrix operations and fundamentals of digital signal processing.					

Course Outcomes

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

308.1	**Identify**[1] the type and operations that can be performed on a given image.
308.2	**Apply**[3] filters on image to improve its quality.
308.3	**Demonstrate**[3] the use of compression, segmentation and morphological operations on image.
308.4	**Analyze**[4] the effect of image transforms on images.

Course Contents:

Unit No.	Digital Image Processing	No. of

		Hours
	Section I	
1.	**Digital Image Fundamentals** Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Introduction to the Basic Mathematical Tools Used in Digital Image Processing, Color Fundamentals, Color Models, Color Transformations.	**07**
2.	**Intensity Transformations and Filtering** Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, The Basics of Filtering in the Frequency Domain, Image Smoothing using Lowpass Frequency Domain Filters, Image Sharpening using Highpass Filters.	**07**
3.	**Wavelet and Other Image Transforms** Matrix-based Transforms, Basis Functions in the Time-Frequency Plane, Fourier-Related Transforms, Walsh-Hadamard Transforms, Slant Transform, Haar Transform and Wavelet Transforms.	**06**
	Section II	
4.	**Image Compression** Fundamentals, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-length Coding, Symbol-based Coding, Bit-plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding.	**07**
5.	**Morphological Image Processing** Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transform, Some Basic Morphological Algorithms, Morphological Reconstruction, Grayscale Morphology.	**06**
6.	**Image Segmentation** Fundamentals, Point, Line, and Edge Detection, Thresholding, Segmentation by Region Growing and by Region Splitting and Merging, Region Segmentation Using Clustering and Superpixels, Region Segmentation Using Graph Cuts, Segmentation Using Morphological Watersheds.	**07**

Text Books:	1. Rafael C Gonzalez , Richard E. Woods, Digital Image Processing, 4th Edition, Pearson Publication, 2018. 2. Milan sonka , Vaclav Hlavac, Image Processing Analysis and Machine vision, 3rd edition, Thomson Publication, 2007.

Reference Books:	1. S. Jayraman, S Esakkiarajan , Veerakumar, Digital Image Processing, 5th edition, Tata McGraw-Hill, 2015. 2. B. Chanda , D. Datta, Majumder, Digital image processing and Analysis, 2nd edition, PHI, 2011. 3. Rafael C Gonzalez , Richard E. Woods, Digital Image Processing using Matlab, 2nd edition, McGraw Hill Education, 2017. 4. S. Annadurai, R. Shanmugalaxmi, Fundamentals of Digital Image Processing, 1st edition, Pearson Publication, 2007.

ECE 316: Digital Image Processing Lab

Course Code		**DIP LAB ECE 316**		**Evaluation Scheme for Practical**			
Lect.	**Tut.**	**Practical**	**Credits**	**Component**	**Exam**	**WT**	**%Pass**
-	-	2 hr/wk	1	Pr. (100)	FEP	POE	40
					50	50	40
Prepared by		Mr.A. G. Bhosale Mr. P. S. Bidkar			Date:-	15/01/2020	
Prerequisites		Knowledge of MATLAB commands and functions					

List of Experiments

List of Experiments to meet the Requirements of the Syllabus	
	DIP Laboratory Minimum 10 experiments based on syllabus. 1. Read and Display Images 2. Gray Level Transformations 3. Piecewise Linear Transformations

ECE 316	4. Histogram Processing 5. Image Filtering in spatial domain 6. Image Filtering in frequency domain 7. Morphological Image Processing 8. Edge Detection 9. Segmentation using Thresholding 10. Image Compression using DCT

Program Elective – II

(Vertical -Embedded Electronics)

ECE 308: PLC &Industrial Automation

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	WT	Pass
3	-	2	1	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

308.1	Describe[2] the need of automation
308.2	Identify[2] different components of automated systems
308.3	Prepare[3] PLC ladder diagrams for applications
308.4	Demonstrate[3] interfacing of analog and digital devices to PLC
308.5	Model[5] simple SACADA applications on simulator.
308.6	Summarize[2] distributed control system and SCADA system

Unit I

Introduction: Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus&profibus **06**

Unit II

PLC registers, PLC timer function, PLC counter function, PLC simple arithmetic and logical functions, PLC ladder logic diagram, Advanced PLC functions like SKIP, MASTERCONTROL RELAY, JUMP with non-return, jump with return, Sequencer function **06**

Unit III

Introduction to DCS, concept of DCS, hierarchy of DCS, function of each level of DCS,Introduction to supervisory Control and Data Acquisition system (SCADA), SCADA Architecture,Interfacing SCADA with PLC 08

Unit IV

Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation **06**

Unit V

SCADA Applications in industries: Implementation of SCADA Systems, Petroleum Refining, Nuclear Power Generation, Conventional Electric Power Generation, Petroleum Wellhead Pump Control, Water Purification System, Crane Control, SCADA systems in chemical plants. **06**

Unit VI

Application of SCADA in Power system automation: Introduction, Factors affecting system planning, Present planning techniques in power system, Planning models, Future trends in power system planning, systems approach, Substation and distribution system automation (DAS) **08**

Overview of Industrial automation using robots: Basic construction and configuration of robot, Pick and place robot, Welding robot.

Text Books:	1. John R Hackworth, "Programmable Logic Controllers" Pearson education New Delhi. 2. John W Webb, Ronald A Reis, "Programmable Logic Controllers: Principles and applications", 5th edition, PHI Learning, New Delhi. 3. William Bolton, "Programmable Logic Controllers", 6th Edition, Newnes press, 2015.

Reference Books:	1. Gary Dunning, "Introduction to Programmable Logic Controllers", Delmar Thomson Learning. 2. A.K Gupta, S.K Arora, "Industrial Automation and Robotics", 2nd Edition, University Science press. 3. Gregory K. McMillan, "Process/Industrial Instruments And Controls Handbook", 5th Edition, TMH.

ECE 316: Industrial Automation Lab

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
-	-	2	1	Practical	FEP	50	40

Prerequisite: Basic knowledge of electronics

Contents

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 8-10 experiments. -

1. Introduction to PLC, PLC programming software, ladder diagram for basic gates.
2. Develop ladder logic to realize D flipflop, RS flipflop.
3. Use PLC for control of switch, relays & lamp.
4. Check the delay timer operation on PLC
5. Check the UP/DOWN COUNTER operation on PLC
6. Measure temperature of given liquid using RTD or thermocouple and PLC
7. To develop simple project in SCADA simulator
8. Develop a SCADA simulation for tank level control
9. Develop a SCADA simulation for flow control of the given system.