College Calendar 2021-22

Department of Electronics & Communication Engineering

Syllabus of 3rd Year
V & VI SEMESTER
Department of
Electronics & Communication Engineering

College Calendar 2021-22
Do you know in how many ways the ‘Knowledge’ serves his master? Like mother it protects, like father it teaches and guides, like wife, provides all kinds of happiness after destroying all sorrows, it brings wealth from every corner and spreads the fame in all direction. Like ‘Kalpalatha’ knowledge offers everything to human being whatever he wishes.
COLLEGE CALENDAR
2021-22
(V & VI Semester)
Vision Statement

Pursuing Excellence, Empowering people, Partnering in Community Development

Mission Statement

To develop N.M.A.M. Institute of Technology, Nitte, as Centre of Excellence by imparting Quality Education to generate competent, Skilled and Humane Manpower to face emerging Scientific, Technological, Managerial and Social Challenges with Credibility, Integrity, Ethics and Social Concern.
In Memorium

Late Nitte Mahalinga Adyanthaya
Our Founder

Late Justice K. S. Hegde
1909-1990
SRI N. VINAYA HEGDE
President, Nitte Education Trust
Chancellor, Nitte (Deemed to be University), Mangaluru
## Sl.No. | Name of the Faculty | Designation
--- | --- | ---
1. | Dr. Niranjan N. Chiplunkar | Principal
2. | Mr. Yogeesh Hegde | Registrar
3. | Dr. Shrinivasa Rao B. R. | Vice Principal / Controller of Examinations / Professor
4. | Dr. I. Ramesh Mithanthaya | Vice Principal / Dean (Academics) / Professor
5. | Dr. Sudesh Bekal | Dean (R&D)/Professor
6. | Dr. Rajesh Shetty K. | Dean (Admissions) / Professor
7. | Dr. Subrahmanya Bhat K. | Dean (Student Welfare) / Professor
8. | Dr. Nagesh Prabhu | PG Coordinator/Professor
9. | Dr. Srinath Shetty K. | Resident Engineer/Professor

## HEADS OF DEPARTMENTS

1. **Prof. Shalini K. Sharma**  
   Counseling, Welfare, Training & Placement
2. **Dr. Arun Kumar Bhat**  
   Civil Engg.
3. **Dr. Jyothi Shetty**  
   Computer Science & Engg.
4. **Dr. Karthik Pai B. H.**  
   Information Science & Engg.
5. **Dr. Srinivas Pai P.**  
   Mechanical Engg.
6. **Dr. KV SSSS Sairam**  
   Electronics & Communication Engg.
7. **Dr. Suryanarayana K.**  
   Electrical & Electronics Engg.
8. **Dr. Ujwal P.**  
   Biotechnology Engg.
9. **Dr. Udaya Kumar Shenoy**  
   Computer & Communication Engg.
10. **Dr. Sharada Uday Shenoy**  
    Artificial Intelligence & Machine Learning Engg.
11. **Dr. Muralidhara K.**  
    Robotics & Artificial Intelligence Engg.
12. **Dr. Kumudakshi**  
    Mathematics
13. **Dr. Shobha R. Prabhu**  
    Physics
14. **Dr. Shivaprasad Shetty M.**  
    Chemistry
15. **Mrs. Rashmi D. Hegde**  
    Humanities
16. **Dr. Surendra Shetty**  
    MCA

## INCHARGE OF INSTITUTION’S RESPONSIBILITIES

1. **Dr. Gururaj Upadhyaya**  
   Workshop Supdt.
2. **Dr. Narasimha Bailkeri**  
   1st year Coordinator
3. **Dr. Venkatesh Kamath**  
   Deputy Controller of Examination
4. **Dr. Janardhan Nayak**  
   Co-ordinator, Red Cross Unit
5. **Mr. Srinivas Nekkar**  
   NSS Co-ordinator
6. **Mr. Krishnaraja Joisa**  
   Public Relations Officer
7. **Dr. Jnaneshwar Pai Maroor**  
   Co-ordinator, Alumni
8. Sri. Shekar Poojari  
   Student Welfare Officer
9. Dr. Shivaprasad Shetty M.  
   NCC Officer

**ENTREPRENEURSHIP DEVELOPMENT CELL**

1. Dr. Ramakrishna B.  
   Professor/EDC- Incharge
2. Mrs. Geetha Poojathri  
   Co-ordinator

**DEPARTMENT OF TRAINING & PLACEMENT**

1. Mr. Bharath G. Kumar  
   Lead Placements

**DEPARTMENT OF MATHEMATICS**

1. Dr. Shashirekha B. Rai  
   Professor
2. Dr. P. Shankaran  
   Professor
3. Dr. Kumudakshi  
   Asso. Professor/ HoD
4. Dr. Sharad M. Hegde  
   Asst. Professor Gd III
5. Dr. Vasanth K. R.  
   Asst. Professor Gd III
6. Mrs. Ambika N.  
   Asst. Professor Gd I
7. Mrs. Vinaya Acharya  
   Asst. Professor Gd I
8. Mrs. Anitha D. Bayar  
   Asst. Professor
9. Mrs. Bhavya K.  
   Asst. Professor
10. Ms. Chaithra K.  
    Asst. Professor
11. Mrs. Bhavya. D.  
    Asst. Professor
12. Mrs. Sharmila  
    Asst. Professor
13. Mrs. Anjana Pai K.  
    Asst. Professor
14. Mrs. Soumya  
    Asst. Professor
15. Mrs. Smitha G. V.  
    Asst. Professor

**DEPARTMENT OF PHYSICS**

1. Dr. K. B. Vijaya Kumar  
   Professor
2. Dr. Sathyajith K. T.  
   Asso. Professor
3. Dr. Manjunath K. B.  
   Asso. Professor
4. Dr. Shobha R. Prabhu  
   Asso. Professor / HoD
5. Dr. Nagaraja B. S.  
   Asst. Professor Gd III
6. Dr. Raghavendra Bairy  
   Asst. Professor Gd III
7. Dr. Shyam Prasad K.  
   Asst. Professor Gd III

**DEPARTMENT OF CHEMISTRY**

1. Dr. Janardhana Nayak  
   Professor
2. Dr. Ramesh Bhat  
   Asso. Professor
3. Dr. Shivaprasad Shetty M.  
   Asst. Professor Gd III/HoD
4. Dr. Aarti S. Bhat  
   Asst. Professor Gd III
5. Dr. Subrahmanya Ishwar Bhat  
   Asst. Professor Gd III
6. Mr. Sarvajith M. S.  
   Asst. Professor
DEPARTMENT OF HUMANITIES
1. Dr. Ramakrishna B.  Professor
2. Mrs. Rashmi D. Hegde  Asso. Professor/HoD
3. Dr. Vishwanatha  Asso. Professor
4. Dr. Jnaneshwar Pai Maroor  Asst. Professor Gd III
5. Dr. Joy Elvine Martis  Asst. Professor Gd III
6. Mrs. Shyla D. Mendonca  Asst. Professor Gd II
7. Ms. Sonia Lobo  Asst. Professor Gd I
8. Mr. Srinivas Nekkar  Asst. Professor
9. Mrs. Sudeeksha S. Pai  Asst. Professor

OFFICE SECTION HEADS
1. Mr. Keshava Mugeraya  Sr. Supdt., Academic Section/ Purchase In-Charge
2. Mrs. Suneetha R. Shetty  Sr. Supdt., Administrative Section
3. Mr. Suresh Achar  Sr. Supdt., Stores
4. Mrs. Jayashree  Sr. Programmer
5. Mrs. Shailaja V. Shetty  Supdt., Accounts Section
6. Sri. Sudhakar K.  Incharge Librarian

SECURITY DEPARTMENT
1. Mr. Hirianna Suvarna S.  Security Supervisor

SPORTS DEPARTMENT
1. Sri. Shyam Sundar M.  P.E.D
2. Sri. Ganesh Poojary  P.E.D
3. Ms. Sowjanya M.  P.E.I
4. Mr. Ravi Prakash C. Anpur  Basket Ball Coach

HOSTEL WARDENS
1. Dr. Veena Devi S.V  Chief Warden, NET Ladies Hostels, Nitte
2. Dr. Vishwananatha  Chief Warden, NET Gents Hostels, Nitte

HOSTEL SUPERINTENDENT / MANAGER
1. Mr. John D'Souza  Sr. Manager, Gents Main Hostel
2. Mr. Francis D'Souza  Hostel Manager, Gents Main Hostel
3. Mr. Rajesh Ballal  Supervisor, Gents PG Hostel
4. Mrs. Gayathri Kamath  Supdt. Ladies PG Hostel
5. Mrs. Chethana Sharma  Supdt. Ladies Main Hostel
6. Mrs. Hema S. Hegde  Supdt., Hostel Office
REGULATIONS
2021-22
(Applicable for admission batch 2018-19 onwards)

COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE PROGRAMMES
CONTENTS

REGULATIONS

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7. WITHDRAWAL FROM THE PROGRAMME
8. EVALUATION SYSTEM
9. EVALUATION OF PERFORMANCE
10. COMMUNICATION OF GRADES
11. VERTICAL PROGRESSION
12. AWARD OF CLASS
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14. AWARD OF DEGREE
15. GRADUATION REQUIREMENTS AND CONVOCATION
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17. CONDUCT AND DISCIPLINE
18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE
19. LISTS OF MAJOR SCHOLARSHIPS
1. INTRODUCTION

1.1 The general regulations are common to all B.E. (Credit System) Degree Programmes conducted at the NMAMIT, Nitte Campus and shall be called "NMAMIT Regulations".

1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting Instructions of course, conduct of the examination and evaluation and certification of student’s performance and all amendments related to the said Degree programme(s).

1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the BE Degree program (of VTU) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. This set of Regulations, may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time, and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.

1.4 In order to guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.

1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of NMAMIT courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

1.6 The course shall be called Bachelor of Engineering course abbreviated as B.E. (Subject of specialization) – Credit System.

1.7 DURATION OF THE COURSE
(a) The course shall extend over a period of total duration of 4 years.
(b) Each year shall have the following schedule with 5 ½ days a week.
   Suggested Break down of Academic Year into Semesters
1. No. of Semesters / Year Three; Two being Main semesters (odd, even) and one being a supplementary semester; after 2 main semesters.  
(Note: Supplementary semester is primarily to assist weak and/ or failed students through make up courses. However, Autonomous Colleges may use this semester to arrange Add-On courses for other students and/ or for deputing them for practical training elsewhere.)

2. Semester Duration
Main semester (odd, even) each 19 Weeks; Supplementary Semester 8 Weeks

3. Academic Activities
Main Semester

<table>
<thead>
<tr>
<th>Weeks:</th>
<th>Registration of Courses &amp; Course Work (16.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Examination Preparation and Examination (3.0)</td>
</tr>
<tr>
<td></td>
<td>Total (19)</td>
</tr>
<tr>
<td></td>
<td>Supplementary Semester</td>
</tr>
<tr>
<td></td>
<td>Registration of Courses &amp; Course Work (5.0)</td>
</tr>
<tr>
<td></td>
<td>Examination Preparation and Examination (3.0)</td>
</tr>
<tr>
<td></td>
<td>Total (8)</td>
</tr>
<tr>
<td></td>
<td>Declaration of results: 2 weeks from the date of last examination</td>
</tr>
<tr>
<td></td>
<td>Inter- Semester Recess:</td>
</tr>
<tr>
<td></td>
<td>After each Main Semester (2)</td>
</tr>
<tr>
<td></td>
<td>Total Vacation: 10 weeks (for those who do not register for supplementary semester) and 4 weeks (for those who register for supplementary semester)</td>
</tr>
</tbody>
</table>

(Note: In each semester, there will be provision for students for Registration of courses at the beginning, dropping of courses in the middle and withdrawal from courses towards the end, under the advice of faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and also ensure their better monitoring by Faculty Advisors.)

A candidate shall be allowed a maximum duration of eight years from the first semester of admission to become eligible for the award of Bachelor Degree.

The calendar of events in respect of the course shall be fixed by the Senate from time to time, but preferably in line with the academic calendar of the VTU.

2. DEGREE PROGRAMMES
2.1 Undergraduate B.E. Degree Programmes are offered in the following
disciplines by the respective programme hosting departments listed below:

i) Biotechnology Engineering (BT)
ii) Civil Engineering (CV)
iii) Computer Science & Engineering (CS)
iv) Electronics & Communications Engineering (EC)
v) Electrical & Electronics Engineering (EE)
vi) Information Science & Engineering (IS)
vii) Mechanical Engineering (ME)
viii) Artificial Intelligence and Machine Learning Engg. (AM)*
ix) Computer and communication Engineering (CC)*
x) Robotics and Artificial Intelligence Engineering (RA)*

Other teaching departments are –

i) Mathematics (MA)
ii) Physics (PH)
iii) Chemistry (CY)
iv) Humanities, Social Sciences and Management (HU)

2.2 The provisions of these Regulations shall be applicable to any new discipline* that may be introduced from time to time and appended to the above list.

3. REGISTRATION

3.1 Every student after consulting his Faculty Advisor in parent department shall register approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will have to pay a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the college at the end of each semester, like odd, even, supplementary and it forms the basis for determining the student’s performance in that semester.

3.2 Lower and Upper Limits for Course Credits Registered in a Semester

Course Credit Assignment

All courses comprise of specific Lecture/Tutorial/Practical (L-T-P) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

i) One hour Lecture per week is assigned one Credit.

ii) 2-hour Tutorial session per week is assigned 1.0 Credit.
iii) 2-hour Lab. session per week is assigned 1.0 credit. For example, a theory course with L-T-P schedule of 3-2-0 hours will be assigned 4.0 credits.

A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0 credit.

Calculation of Contact Hours / Week – A Typical Example

<table>
<thead>
<tr>
<th>No. of Courses</th>
<th>Credits / Course</th>
<th>Total Credits</th>
<th>Contact Hours per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Lecture Courses</td>
<td>3:0:0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2 Lec. cum Lab Courses</td>
<td>3:0:1</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>2 Lec. cum Tut. Courses</td>
<td>3:1:0</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>1 Lec. Tut. cum Lab Courses</td>
<td>1:1:1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10:2:2</strong></td>
<td><strong>25</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>

A student must register, as advised by Faculty Advisor, between a minimum of 16 credits and up to a Maximum of 28 credits.

3.3 **Mandatory Pre-Registration for higher semester**

In order to facilitate proper planning of the academic activities of the Semester, it is necessary for the students to declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks prior to the last working day of the semester. Registration to a higher semester is allowed only if the student fulfills the following conditions -

i) satisfied all the academic requirements to continue with the programme of studies without termination

ii) cleared all Institute, hostel and library dues and fines, if any, of the previous semester

iii) paid all required advance payments of the Institute and the hostel for the current semester

iv) has not been debarred from registering on any specific grounds by the Institute.

4. **ADD / DROP / AUDIT options**
4.1 **Registration of courses**
Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with subject teacher and under faculty advice. The permissible course load to be either average credits (=22) or to be within the limits of minimum (=16) and maximum (=28) credits.

4.2 **DROP-option**
During a specified period at the middle of a semester student’s performance in CIE is reviewed by the faculty advisor. Following poor performance by a student he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses to be re-registered by these students and taken up for study at a later time.

4.3 **Withdrawal from courses**
During a specific period specified towards the end of the semester, student’s performance in CIE is reviewed by the Faculty advisors. Following poor performance by a student in identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with mention in the Grade card (Grade ‘W’). Such courses to be re-registered by these students and taken up for study at a later time.

4.4 **AUDIT-option**
A student can register for courses for audit only, with a view to supplement his/her knowledge and/or skills. The student’s grades in such course(s) will have to be reflected in the grade card. However, CORE courses shall not be made available for audit. But these shall not be taken into account in determining the student’s academic performance in the semester. "U" grade is awarded to such courses on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses.

5. **COURSE STRUCTURE:**

5.1 Typical Breakdown for the B.E. Degree Curriculum:

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Category</th>
<th>Credit Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Basic Sciences (BSC)</td>
<td>24-30</td>
</tr>
<tr>
<td>2.</td>
<td>Engineering Sciences (ESC)</td>
<td>15-20</td>
</tr>
<tr>
<td>3.</td>
<td>Humanities, Social Sciences and Management</td>
<td>7-10</td>
</tr>
<tr>
<td>4.</td>
<td>Professional Courses (PCC) – core</td>
<td>70-90</td>
</tr>
<tr>
<td>5.</td>
<td>Professional Courses (PEC) – elective</td>
<td>18</td>
</tr>
<tr>
<td>6.</td>
<td>Open Elective Courses (OE)</td>
<td>06</td>
</tr>
<tr>
<td>7.</td>
<td>Project Work (PROJ)</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Seminar on Current Topic</td>
<td>(VI – 2, VII-2, VIII-12)</td>
</tr>
</tbody>
</table>
8. Internship 03
9. Mandatory Learning courses Non-Credit

Note: Student can register between 16 to 28 credits per semester. Total Credits to be earned: 175

5.2 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components ‘a’ to ‘g’, the semester wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies (BOS). The BOS will consider the proposals from the departments and make recommendations to the senate for consideration and approval.

5.3 **The earned Credit Requirement for the B.E. Degree is 175.**

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to student to plan their career.

5.4 **Mandatory Learning Courses**

These are courses that must be completed by the student at appropriate time or at his convenience. The ‘PP’ grade is awarded for a Pass in the course and ‘NP’ grade is awarded for a Fail in the course. In case ‘NP’ grade is awarded, the student has to re-register for the same course wherein he has no alternative options. However, he/she can opt for other courses if he/she has been provided with multiple options.

The ‘PP’ and ‘NP’ grades do not carry grade points and hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However such non-credit mandatory courses are required to be included in the students’ performance record (transcript) with Pass or Fail (PP or NP).

Courses that come under this category are the following.

Moral and Ethical Values, Communication skills, Entrepreneurship Development Programme, Environmental issues, Constitution of India, Proficiency in a Language etc.

Such courses will not carry any credits for the award of degree, but a pass in each of such course during the programme shall be a necessary requirement for the student to qualify for degree award.

5.5 **PROJECT**

i) Project work at 8th semester shall be completed batch wise. The batch shall consist of a maximum of 4 students.

ii) Project viva-voce examination shall be conducted individually.

5.6 **ELECTIVES**

i) A candidate shall take electives in each semester from groups of electives,
commencing from 5th semester.

ii) The minimum number of students to be registered for any Elective offered shall not be less than ten.

iii) A candidate shall opt for his/her choice of electives and register for the same if pre-registration is not done, at the beginning of each of 5th, 6th, 7th and 8th semesters. The candidate is permitted to opt for change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

6. ATTENDANCE REQUIREMENT:

6.1 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops and paper presentation.

6.2 The basis for the calculation of the attendance shall be the period of term prescribed by the College by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course (as per CET/COMED-K or Management allotment).

6.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up the shortage.

6.4 A candidate having shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded ‘N’ grade in these courses. He/she shall have to repeat those course(s). Such students shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or supplementary semester.

6.5 Attendance in CIE and SEE: Attendance at all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

7. WITHDRAWAL FROM THE PROGRAMME

7.1 Temporary Withdrawal

a) A student who has been admitted to a degree programme of the college may be permitted once during the course to withdraw temporarily, for a period of one semester, on the grounds of prolonged illness or grave calamity in the family etc., provided –

i) The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.
ii) The College is satisfied about the genuineness of the case and that even by taking into account the expected period of withdrawal, the student has the possibility to complete the programme requirements (175 credits) within the time limits specified by the university.

iii) The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.

iv) A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the Student's roll list. The fees/charges once paid shall not be refunded.

v) A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

7.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account. Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

(a) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues if any.

(b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts.

(c) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

8. EVALUATION SYSTEM

8.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

8.2 The Letter grades S, A, B, C, D, E, F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

8.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid-semester examinations and one semester end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE) : 50% (50 marks)
Continuous Internal Evaluation (CIE) : 50% (50 marks)
i) Quizzes, Tutorials, Assignments, Seminars, mini projects, tutorials etc. : 10 marks

ii) Mid-semester Examination : 40 marks

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

8.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.

8.5 The course Instructor shall announce in the class and/or display at the Faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

8.6 Passing standards

<table>
<thead>
<tr>
<th>Evaluation Method</th>
<th>Passing Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessional (CIE)</td>
<td>Score: ≥40% (≥20 marks)</td>
</tr>
<tr>
<td>Terminal (SEE)</td>
<td>Score: ≥40% (≥20 marks)</td>
</tr>
</tbody>
</table>

i) Project work evaluation: The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a Department committee constituted for this purpose. Seminar presentation, project report and final oral examination conducted by project evaluation committee at the department level shall form the SEE of the project work.

ii) In the case of other requirements, such as, seminar, industrial internship, field work, comprehensive viva voce, if any, the assessment shall be made as laid down by the Academic council.

iii) **There shall be no re-examination for any course in the credit system.**

However, students
- who have abstained from attending CIE or SEE without valid reasons ('N' grade), or
- who have failed ('F' grade) to meet the minimum passing standards prescribed for CIE and/or SEE, or
- who have been detained for want of attendance, or
- who have withdrawn ('W' grade),
- who have dropped any course
shall be required to re-register for such course(s) and go through CIE and
SEE again and obtain a grade equal to or better than E in each case. While such students should re-register for same course(s) if core, they can re-register for alternative course(s) from among the elective courses, as the case may be. The re-registration shall be possible when the particular course is offered again either in a main (Odd/Even) or a supplementary semester.

8.7  

i) Grade point scale for absolute grading

<table>
<thead>
<tr>
<th>Level</th>
<th>Out Standing</th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
<th>Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>S</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>Grade Points</td>
<td>10</td>
<td>09</td>
<td>08</td>
<td>07</td>
<td>06</td>
<td>04</td>
<td>00</td>
</tr>
<tr>
<td>Score (Marks)</td>
<td>≥ 90</td>
<td>&lt; 90 - ≥80</td>
<td>&lt; 80 - ≥70</td>
<td>&lt; 70 - ≥60</td>
<td>&lt; 60 - ≥50</td>
<td>&lt; 50 - ≥40</td>
<td>&lt; 40</td>
</tr>
<tr>
<td>Range(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ii) The grade points given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in arriving at the credit index of the student for that semester, as it is the sum total of all the credit points earned by the student for all the courses registered in that semester.

8.8  

Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range S-E. Letter grade ‘F’ in any course implies failure of the student in that course and no credits earned.

8.9 The Transitional Grades ‘I’, ‘W’ and ‘X’ would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (S-F) after the student completes the course requirements.

♦ Grade ‘I’: To a student having satisfactory attendance at classes and meeting the passing standard at CIE, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:
  i) Illness or accident, which disabled him/her from attending SEE;
  ii) A calamity in the family at the time of SEE, which required the student to be away from the College;

♦ Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that particular examination for which he or she is absent, failing which they will not be given permission. This is admissible only for students who have more than 45 CIE marks.
- Grade 'W': To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice
- Grade ‘X’: To a student having attendance ≥85% and CIE rating (90%), in a course but SEE performance observed to be poor, which could result in a F grade in the course. *(No ‘F’ grade awarded in this case but student’s performance record maintained separately).*

8.10 **Grade Card:** Each student shall be issued a Grade Card (or Transcript) at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students performance like SGPA and CGPA and the courses taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

8.11 **The Make Up Examination**

The Make Up Examination facility would be available to students who may have missed to attend the SEE of one or more course(s) in a semester for valid reasons and given the ‘I’ grade; Also, students having the ‘X’ grade shall be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be same as the regular SEE for the course(s).

a) In the event of a student in the final semester failing in a Laboratory course and/or in CIE of a course, he/she could be given 'I' grade for the course. In such a case the concerned course instructor would have the possibility to grant the student extra time not exceeding 12 weeks for completing the course, with the concurrence of the Department/College. If no such extra time is sought/granted, the concerned student would have to re-register for the course in a succeeding semester and take steps to fulfill the requirements of the Degree.

b) All the ‘I’ and ‘X’ grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding ‘I’ and ‘X’ grades after the last scheduled make-up examinations shall be automatically converted to ‘F’ grade.

c) All the ‘W’ grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ supplementary semester and fulfill the passing standards for their CIE and (CIE+SEE).
9. **EVALUATION OF PERFORMANCE**

The overall performance of a student will be indicated by two indices: SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

\[
\text{SGPA} = \frac{\sum (\text{course credit}) \times (\text{Grade point})}{\sum (\text{course credits})} \quad (\text{for all courses in that semester})
\]

CGPA is computed as follows:

\[
\text{CGPA} = \frac{\sum (\text{course credits}) \times (\text{Grade points})}{\sum (\text{course credits})} \quad (\text{for all courses excluding those with F grades until that semester})
\]

10. **COMMUNICATION OF GRADES**

The SGPA and CGPA respectively, facilitate the declaration of academic performance of a student at the end of a semester and at the end of successive semesters. Both of them would be normally calculated to the second decimal position, so that the CGPA, in particular, can be made use of in rank ordering the students’ performance at a College. If two students get the same CGPA, the tie could be resolved by considering the number of times a student has obtained higher SGPA; But, if it is still not resolved, the number of times a student has obtained higher grades like S,A,B etc. could be taken into account.

11. **VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)**

11.1 There shall be no restriction for promotion from an odd semester to the next even semester, provided the student has fulfilled the attendance requirement.

11.2 **A Student shall be declared fail if he / she**

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements.

11.3 **(A) Vertical Progression in case of students admitted to First year:**

(a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.

(a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.

(a.2) Students who have earned all the prescribed credits of I year, and having
not more than four F grades in the four semesters of II and III year shall be eligible to move to IV year.

(B) Vertical Progression in case of Diploma students admitted to Second year (lateral entry):
(a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year.
(a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The mandatory non-credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E/B.Tech. Programmes shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.
(b.1) In case, any student fails to satisfy the attendance requirement of the Courses Additional Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree.

(C) Vertical Progression in case of B.Sc students admitted to Second year (Lateral entry):
(a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III year.
(a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The prescribed mandatory non-credit Courses Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B. Sc holders admitted to III semester of B.E/B. Tech Programmes, shall attend the classes during the respective semesters
to complete CIE and attendance requirements and to appear for the University examinations.

(b.1) In case, any student fails to satisfy the attendance requirement of the above said Courses; he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.

The Principal of each college shall make suitable arrangements in the timetable to facilitate the B. Sc students to attend the above mentioned courses to satisfy the CIE and attendance requirements and to appear for the University examinations.

11.4 Termination from the programme
A student shall be required to withdraw (discontinue) from the programme and leave the college on the following grounds.

i) Failure to secure a CGPA = 5.0 on three consecutive occasions.

ii) Failure to earn a credit of 175 (135 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).

iii) Absence from classes for more than six weeks at a time in a semester without leave of absence being granted by competent authorities.

iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

12. AWARD OF CLASS
Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen from the following Table.

<table>
<thead>
<tr>
<th>Grade Point</th>
<th>Percentage of Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.75</td>
<td>50 (second class)</td>
</tr>
<tr>
<td>6.25</td>
<td>55</td>
</tr>
<tr>
<td>6.75</td>
<td>60 (First class)</td>
</tr>
<tr>
<td>7.25</td>
<td>65</td>
</tr>
<tr>
<td>7.75</td>
<td>70 (Distinction)</td>
</tr>
<tr>
<td>8.25</td>
<td>75</td>
</tr>
</tbody>
</table>
13. **APPEAL FOR REVIEW OF GRADES**

a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

14. **AWARD OF DEGREE**

14.1 (1) **B.E. Degree**

a) Students shall be declared to have completed the Programme of B.E./B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (175 credits for regular students registered for 4 year degree programmes & 135 for lateral entry students).

b) For the award of degree, a CGPA≥5.00 at the end of Programme shall be mandatory.

c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.

d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc. graduates.

e) (i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/Autonomous colleges under VTU to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student’s eight semester Grade Card.

(ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(2) **B.E. (Honors) Degree**
VTU, Belagavi has framed the guidelines for applying for the award of Bachelor of Engineering (Honors) degree.

These Regulations are applicable for the following students:

1. Admitted to I semester / I year from the academic year 2018-19 (i.e. USN XXX18XXXXX)
2. Admitted to III semester / II year from the academic year 2019-20 (i.e. USN XXX19XX4XX)
3. These Regulations are uniformly applicable to Affiliated, Autonomous and Constituent Colleges under VTU.

Eligibility criterion

(i) Students have to earn 18 or more additional credits through MOOCs.
(ii) Students shall register for this course from fifth semester onwards.
(iii) Students shall obtain a grade ≥ D in all the courses in first attempt only in all the semesters till 5th.
(iv) Students shall obtain CGPA of 8.5 and above at the end of fourth semester.
(v) For Diploma students, they shall complete Additional Mathematics I and II during 3rd and 4th semesters in first attempt only.

Requirements:

(i) Students shall maintain a grade ≥D in all courses from 5th to 8th semester in ‘first attempt’ only.
(ii) Students not having CGPA greater than or equal to 8.5 at the end of the B.E. programme shall not be eligible for the award of Honors degree, even if they have satisfied the requirement of additional credits.
(iii) Students shall take up additional course work, other than the regular courses prescribed by the University from 5th to 8th semester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %) before closure of eighth semester as per the academic calendar.
(iv) Students shall be permitted to drop the registered course work (s) and select alternative course work (s) in case they cannot give proctored examination.
(v) Students have to take courses from the list of MOOCs approved by the University, which can be from NPTEL / SWAYAM / other platforms.
(vi) Students shall select courses in consultation with their Class Advisor, such that the content / syllabus of them are not similar to that of the core courses, professional electives or open electives, which the students may chose in the program.
(vii) Students shall earn the additional credits for these courses through MOOCs, by only appearing in person to the proctored examinations conducted by NPTEL / SWAYAM / other platform. The method of assessment shall be as per NPTEL online platform.

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(viii) The Credit equivalence shall be as follows - 4 weeks of online course duration – 1 credit, 8 weeks of online course duration – 2 credits and 12 weeks of online course duration – 3 credits.

Registration:

(i) Any student meeting the eligibility criteria and interested to register for Honors degree qualification shall apply to the University through the Principal in the prescribed form along with the prescribed application fees within 15 working days after notification by the University.

(ii) The Registrar shall notify the registration of the student and it will be notified to the student and the student shall pay a one-time, non-refundable registration fees as prescribed by the University to confirm the registration.

Award of Honors Qualification:

(i) Students who successfully complete the MOOCs prescribed by the University and submit their E-certificates to the University through the Principal against the notification issued by the Registrar in time before the closure of eighth semester, as per the academic calendar shall be eligible for B.E. (Honors) degree. If a student does not submit the certificates in time on or before the last date, their request shall not be considered, even if they have earned the requisite number of credits.

(ii) The Honors degree shall be awarded only if the CGPA at the end of the B.E. programme is equal to or greater than 8.5.

(iii) A student who has earned the requisite number of credits and who has submitted the certificates in time and has been accepted by the University will get B.E. degree with Honors suffixed indicating recognition of higher achievement by the student concerned.

(iv) Further students fulfilling all the above requirements shall be entitled to receive their transcripts indicating both the achievement of the student concerned.

(v) The award of the Honors degree shall be recommended by the Academic Senate and approved by the Executive Council of the University.

14.2 (1) Noncompliance of CGPA ≥ 5.00 at the end of the Programme

(a) Students, who have completed all the courses of the Programme but not having a CGPA ≥ 5.00 at the end of the Programme, shall not be eligible for the award of the degree.

(b) In the cases of 14.2 (1) a, students shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Main), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

(c) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is
≥5.00, the students shall become eligible for the award of the degree. If CGPA < 5.00, the students shall follow the procedure laid in 14.2 (1) b

(d) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reap pared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA < 5.00, the students shall follow the procedure laid in 14.2 (1) b

(e) In case, the students earn improved grade/s in some courses and fail in the other reap pared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reap pared course/s in which the students have failed. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA < 5.00, the students shall follow the procedure laid in 14.2 (1) b

(f) In case, the students fail (i.e., earns F grade) in all the reap pared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 14.2 (1) b

(g) Students shall obtain written permission from the Registrar (Evaluation) to reappear in SEE to make up the CGPA equal to or greater than 5.00.

(2) Noncompliance of Mini-project

(a) The mini-project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements. Also, mini-project shall be considered for eligibility to VII semester.

(3) Noncompliance of Internship

(a) All the students of B.E/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation. A University examination shall be conducted during VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfy the internship requirements.

14.3 The maximum duration for a student for complying to the Degree requirements is 16 – semesters from the date of first registration for his first semester (8 years from the date of admission to first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

15 GRADUATION REQUIREMENTS AND CONVOCATION

15.1 A student shall be declared to be eligible for the award of the degree if he/she has

a) Fulfilled “Award of Degree” Requirements

b) No Dues to the College, Departments, Hostels, Library, Central Computer
Centre and any other centres

c) No disciplinary action pending against him/her.

15.2 The award of the degree must be recommended by the Senate

15.3 **Convocation**

Degree will be awarded for the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer ‘Award of Degree’) within the specified date in order to arrange for the award of the degree during convocation.

16 **AWARD OF PRIZES, MEDALS, CLASS & RANKS**

For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the College for such awards. Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class as described in 12.

17 **CONDUCT AND DISCIPLINE**

17.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

17.2 **As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.**

17.3 The following acts of omission/ or commission shall constitute gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

a) Ragging.

b) Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.

c) Willful damage or stealthy removal of any property/belongings of the College/Hostel or of fellow students/citizens.

d) Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.

e) Mutilation or unauthorized possession of Library books.

f) Noisy and unseemly behaviour, disturbing studies of fellow students.

g) Hacking in computer systems (such as entering into other Person’s area without prior permission, manipulation and/or Damage of computer hardware and software or any other Cyber crime etc.).

h) Plagiarism of any nature.
i) Any other act of gross indiscipline as decided by the Senate from time to time.

j) Use of Mobile in the college Academic area.

k) Smoking in College Campus and supari chewing.

l) Unauthorized fund raising and promoting sales.

Commensurate with the gravity of offence the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

17.4 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

17.5 All cases involving punishment other than reprimand shall be reported to the Principal.

17.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

18. **EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE**

18.1 As per VTU guidelines, every student entering 4 year degree programme should earn 100 activity points & every student entering 4 year degree programme through Lateral Entry should earn 75 activity points for the award of the Engineering Degree.

18.2 The Activity Points earned will be reflected on the student’s eighth semester Grade Card.

18.3 The activities can be spread over the years (duration of the programme) any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.

18.4 Activity Points (non-credit) have no effect on SGPA/CGPA point.

18.5 In case students fail to earn the prescribed Activity Points, Eighth semester Grade Card shall be issued only after earning the required Activity Points.

**Note:** Students are required to be inside the examination hall, 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

**********
# LIST OF MAJOR SCHOLARSHIPS

<table>
<thead>
<tr>
<th>Applicable to</th>
<th>Types of scholarship</th>
<th>Method</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For SC/ST Students</strong></td>
<td><strong>Income : Below Rs.2,50,000/-</strong></td>
<td>Online application</td>
<td>SSP</td>
</tr>
<tr>
<td></td>
<td><strong>Income : Above Rs.2,50,000/- to Rs.10,00,000/-</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>For Others</strong></td>
<td><strong>Category I :</strong></td>
<td>Online application</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Category 2A, 3A, 3B,&amp; GM</strong></td>
<td>Online application</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Income Below Rs.1,00,000/-</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><strong>Minority students</strong></td>
<td>Online application</td>
<td>NSP &amp; SSP</td>
</tr>
<tr>
<td></td>
<td><strong>Income Below Rs.2,50,000/-</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parents must have Beedi Id. Card</strong></td>
<td><strong>Beedi Scholarship</strong></td>
<td>Online application</td>
<td>scholarships.gov.in or nsp.gov.in</td>
</tr>
<tr>
<td><strong>1st year Students</strong></td>
<td><strong>Central Sector Scholarship (MHRD)</strong></td>
<td>Online application</td>
<td>scholarships.gov.in or nsp.gov.in</td>
</tr>
<tr>
<td><strong>1st year Students</strong></td>
<td><strong>AICTE-Pragati.etc</strong></td>
<td>Online application</td>
<td><a href="http://www.aicte-india.org">www.aicte-india.org</a></td>
</tr>
</tbody>
</table>

1. Scholarship details will be published in the notice board near College Academic Section. Students must see the notice board and submit the application before due dates.

2. All SC/ST and Category I students who have not paid any fee in CET must apply for Fee concession or Scholarship. Otherwise they must pay the tuition fee and college fee.

3. The students, who are applying for any of the above scholarship through online, must submit the hardcopy with supporting documents (with attestation) to the academic section in time.
B. E. SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING

V & VI SEMESTER

With
Scheme of Teaching
& Examination
# DEPARTMENT: ELECTRONICS & COMMUNICATION ENGINEERING

<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Qualification</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. K. Rajesh Shetty</td>
<td>Ph.D.</td>
<td>Professor/Dean (Admissions &amp; Alumni Affairs)</td>
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<td>Dr. Rekha Bhandarkar</td>
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<td>Ph.D.</td>
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<td>Ph.D.</td>
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<td>12.</td>
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<td>13.</td>
<td>Dr. Roopa B. Hegde</td>
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<td>38.</td>
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<td>41.</td>
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<td>M.Tech.</td>
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DEPARTMENT: ELECTRONICS & COMMUNICATION ENGINEERING

Vision:
Empowering people, Partnering in Community Development by achieving expertise requiring the knowledge of state of the art technology in the field of Electronics and Communication.

Mission:
To impart specialized education in the field of Electronics & Communication that contributes to the socio-economic development of the region and to generate technical manpower with high degree of credibility, integrity and ethical standards by providing vibrant learning environment.

Program Educational Objectives (PEOs):

PEO1: The graduate should have effective foundation in mathematics, science as well as other relevant disciplines and a strong foundation in Electronics and Communication Engineering.

PEO2: The graduate will inculcate effective communication skills, teamwork, lifelong learning and leadership in preparation for a successful career in industry and academia with credibility, integrity and ethics.

PEO3: The graduate will be able to design and develop innovative systems that contribute to socio-economic development.

Program Specific Outcomes (PSOs):

PSO1: Understand the concepts and applications in the field of communication, signal processing, VLSI, embedded systems, power electronics and control systems.
PSO2: Effectively apply the domain knowledge to arrive at optimum solutions to real time applications.

PSO3: Apply acquired skills in project management and execution to Electronics and Communication systems.

Program Outcomes (POs):

Engineering Graduates will be able to:

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

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

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

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

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
### Graduate Attributes:

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<tr>
<th>Sl. No.</th>
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<tr>
<td>B</td>
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<td>C</td>
<td>Design / development of solutions</td>
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<td>D</td>
<td>Conduct investigations of complex problems</td>
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<td>E</td>
<td>Modern tool usage</td>
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<td>F</td>
<td>The engineer and society</td>
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<td>L</td>
<td>Life-long learning</td>
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### DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

#### SCHEME OF TEACHING AND EXAMINATION

**V SEMESTER B.E.**

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- Project based evaluation
- A choice of opting general open elective against program elective once during 5th to 8th semester
### DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

#### SCHEME OF TEACHING AND EXAMINATION

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A choice of opting general open elective against program elective once during 5th to 8th semester
| PROGRAM ELECTIVE COURSES | \hline |
|---------------------------|\hline|
| **ELECTIVE I** | **ELECTIVE II** | |
| **STREAM 1: COMMUNICATION AND NETWORKING** | | |
| 19ECE11 Adhoc & Sensor Networks | 19ECE21 Cognitive Radio | |
| 19ECE12 Modern Radar & Navigational Aids | 19ECE22 Fiber Optics | |
| 19ECE13 Multimedia Communications | 19ECE23 Detection and Estimation | |
| 19ECE14 Optical Communication & Networks | 19ECE24 High Performance Communication Networks | |
| 19ECE15 Spread Communication Spectrum | 19ECE25 RF Circuit Design | |
| 19ECE16 Wireless Communication | 19ECE26 Satellite Communication Systems | |
| **STREAM 2: VLSI/ EMBEDDED SYSTEMS** | | |
| 19ECE31 Automation using Scripting Language | 19ECE41 Advanced Digital Logic Verification | |
| 19ECE32 Automotive Electronics | 19ECE42 Analog and Mixed Mode VLSI Design | |
| 19ECE33 Biomedical Instrumentation | 19ECE43 Digital IC Design using Verilog HDL | |
| 19ECE34 Embedded Linux | 19ECE44 Embedded Systems | |
| 19ECE35 Low Power VLSI | 19ECE45 Internet of Things | |
| 19ECE36 Nanoelectronics | 19ECE46 Introduction to Sensors and Actuators | |
| **STREAM 3: SIGNAL PROCESSING** | | |
| 19ECE51 Artificial Intelligence | 19ECE61 Advanced Signal Processing | |
| 19ECE52 Biomedical Signal Processing | 19ECE62 Fuzzy Logic | |
| 19ECE53 DSP Processors & Architecture | 19ECE63 Linear Algebra for Signal Processing | |
| 19ECE54 Image Processing | 19ECE64 Optical Computing | |
| 19ECE55 Machine Learning and its Applications | 19ECE65 Pattern Recognition | |
| 19ECE56 Wavelets | 19ECE66 Speech Processing | |
| **STREAM 4: IT AND MANAGEMENT** | | |
| 19ECE71 Big Data Analytics | 19ECE81 Computer Architecture | |
| 19ECE72 Computer Operating Systems | 19ECE82 Data Base Management System | |
| 19ECE73 Cryptography | 19ECE83 Finance Management | |
| 19ECE74 Data Structures using C++ | 19ECE84 Object Oriented Programming with C++ | |
| 19ECE75 Object Oriented Programming in Java | 19ECE85 Project Management | |
| 19ECE76 Real Time Operating Systems | 19ECE86 Python Programming | |

ANALOG COMMUNICATION

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Course Learning Objectives:
This course will enable students to
1. Apply statistical parameters on various processes.
2. Understand different Amplitude modulation and demodulation schemes & their applications.
3. Understand different angle modulation and demodulation schemes.
4. Analyze different types of noise in communication system.
5. Analyze different receivers in presence of noise.

UNIT – I

Random Process: Introduction, probability theory, conditional probability, random variables, statistical averages, Random process: stationarity, mean, correlation and covariance functions, power spectral density, Gaussian process.

UNIT – II

Amplitude Modulation: Introduction, Time Domain and Frequency domain description, Generation and Detection of AM, Various types of AM, Generation and Detection of different types of AM (SSB, DSB-SC), VSB(qualitative analysis), Applications of AM.

UNIT – III


UNIT – IV


UNIT – V

Noise in Continuous Wave Modulation Systems: Introduction, receiver model, Noise in DSB-SC receivers, Noise in SSB receivers, Noise in AM receivers, Noise in FM receivers, Threshold Effect, pre-emphasis and de-emphasis in FM.

10 Hours

Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.
Course Outcomes:
At the end of the course the student will be able to

1) Apply the knowledge of probability theory & random process in mathematical analysis of noise behaviour in communication systems.

2) Illustrate the mathematical representation of amplitude modulation schemes; describe the types of Amplitude modulation and demodulation techniques.

3) Illustrate the mathematical representation of Frequency modulation and phase modulation; Describe direct and indirect techniques of FM modulation and demodulation schemes.

4) Analyze the types of noise and its effect on systems; determine the noise parameters in two port communication networks.

5) Determine the receiver performance in presence of noise for continuous wave modulation systems.

Mapping of PO's/ PSO's & CO's:

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<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
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3 – High  2 – Medium  1 - Low

TEXT BOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/117102059/2
COMPUTER NETWORKS

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Course Learning Objectives:

This course will enable the students to

1. Appreciate the use of computer networking in various walks of life, describe the types of networks, network configurations and network topologies. Also Write the OSI and TCP/IP reference models for networking.
2. Explain responsibilities of data link layer, its implementation and associated protocols, algorithms/pseudo codes.
3. Explain the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
4. List types of networking devices, backbone networks and Internet Protocol (IP) addressing.
5. Explain the responsibilities of network, transport and application layers.

UNIT – I


Physical Layer: Basis for Data Communication: Transmission of digital signals: Bit rate, Bit length, Baseband and broadband transmission, Transmission impairment, Data rate limits, Performance, Guided Transmission Media Twisted Pair Coaxial Cable and Fiber Optics. 12 Hours

UNIT – II

Data Link Layer: Framing, Error Control, Flow Control, Error-Detection and correction: Introduction, Error detection using CRC.


UNIT – III


Controlled Access: Reservation, Polling and Token Passing.

Channelization: FDMA, TDMA, CDMA.

Wired LAN: Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet. 10 Hours

UNIT – IV

Connecting LANs, Backbone and Virtual LANs: Connecting devices, Backbone Networks, Virtual LANs.
Network Layer: Need for network layer, Logical addressing, IPv4 addresses, IPv6 addresses, IPv4 and IPv6 datagrams, Transition from IPv4 to IPv6. 10 Hours

UNIT – V

Network Layer: Delivery, Forwarding, Types of Routing protocols, Unicast Routing Protocols, The Transport Layer: Process to process Delivery, User Datagram Protocol (UDP) and TCP.
Application layer: Domain name space, Distribution of name space, Resolution. 10 Hours

Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

Course Outcomes:
At the end of the course the student will be able to
1. Explain the different aspects of computer networks, protocols, discuss network models and guided media.
2. Apply framing techniques for variable size data, Use CRC for error detection using the given generator polynomial of degree 4 or less, Analyse data link layer protocols for unidirectional data transfer.
3. Analyse and Compare multiple access methods, Evaluate throughput for random access method, system capacity in controlled access and channelization methods for the given network scenario. Explain IEEE standards for Ethernet.
4. Identify the network connecting devices, Explain addressing schemes used at the network layer and Configure a block of IPv4 addresses among the given number of organizations and end users.
5. Explain the use of unicast routing protocols, UDP/TCP and DNS for global communication. For the given network topology, Construct minimum spanning tree using Dijkstra’s algorithm.

Mapping of PO's/ PSO's & CO's:

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3 – High  2 – Medium  1 - Low

TEXTBOOK:
REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/106105081/
2. http://nptel.ac.in/courses/106105082/

************

MICROPROCESSOR AND MICROCONTROLLER

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Course Learning Objectives:
This course will enable students to
1. Apply the fundamentals of memory, central processing unit for an embedded systems design.
2. Identify the architecture of Microcontroller and Microprocessor.
3. Develop application using 8051 Interrupts, Timers/Counters and IO port.
4. Understand MSP430 architecture.
5. Understand ARM processor architecture.

UNIT – I

Introduction to 8051 Microcontroller: Architecture, Memory organization, addressing modes, Basic instructions format, Instruction set - Data transfer group, Arithmetic group, logical group, control transfer group, 8051 Assembly Language programs.

UNIT – II

8051 Peripheral Modules: Programming 8051 I/O port, I/O interfacing examples (LED, Switch and Seven segment LED), Timers/Counters in Mode1 & Mode2, Timer Programming examples, Serial Communication in Mode 0, Example programs on serial communication and External Interrupts.

UNIT – III

MSP430 Microcontroller: Introduction, Architecture, Memory, CPU, Clock generators, Interrupts, Parallel Ports, Communication peripherals- SPI & I2C
UNIT – IV

**Introduction to ARM processor:** ARM architecture, Pipeline, programming model, memory organization, concept of stack, processor modes, addressing mode. 

10 Hours

UNIT - V

**ARM Instruction Execution:** Data processing, Data transfer, Data path timing, Branch instruction, ALU functions, Adder design, Barrel shifter, Multiplier design.

10 Hours

**Scheme of SEE Question Paper**
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

**Course Outcomes:**
At the end of the course the student will be able to
1. Describe the architecture and write the assembly language program with relevant instruction set for 8051 microcontroller.
2. Develop applications using IO Ports, Timers, Serial communication and Interrupts of 8051 microcontroller.
3. Describe the architecture of MSP430 microcontroller.
4. Describe the architecture of ARM processor and instruction formats.
5. Analyze the working of instruction execution in ARM processor.

**Mapping of PO’s/ PSO’s & CO’s:**

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3 – High

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1 - Low

**TEXTBOOKS:**
REFERENCE BOOKS:

NPTEL/MOOC Links:
1. http://nptel.ac.in/courses/106108100/
2. http://nptel.ac.in/courses/108107029/

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VLSI DESIGN

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Course Learning Objectives:
This course will enable students to
1. Know MOS transistor theory and CMOS technologies
2. Analyze inverter circuits.
3. Design Combinational, sequential and dynamic logic circuits.
4. Know the working of Semiconductors Memory circuits.
5. Know the concepts of CMOS testing.

UNIT – I

Introduction: A Brief History, MOS Transistors, CMOS Logic (T1: 1.1 to 1.4.8)

MOS Transistor Theory: Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects (T1:2.1-2.4), DC Transfer Characteristics of inverter (T1:2.5.1-2.5.3).

10 Hours

UNIT – II

Fabrication: VLSI Design Flow (T2:1.5), Introduction, CMOS Technologies (T1:3.1-3.2), CMOS Fabrication and Layout (T1:1.5), Layout Design Rules (T1:3.3). Power distribution network (T1:13.3).

MOSFET Scaling: Small-Geometry Effects, MOSFET Capacitances (T2: 3.5 - 3.6).

10 Hours

UNIT – III

Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths (T1: 4.1 to 4.5).

Combinational Circuit Design: Introduction, Circuit families (T1: 9.1 to 9.2.3).

12 Hours

UNIT – IV

Sequential Circuit Design: Introduction, Circuit Design for Latches and Flip-Flops (T1:10.1, 10.3.1 to 10.3.4).

UNIT – V

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM) and Static Random Access Memory (SRAM) (T2: 10.1 to 10.3).

Testing and Verification: Introduction, Logic Verification Principles, Manufacturing Test Principles, Design for testability (T1: 15.1, 15.3, 15.5 15.6.1 to 15.6.3).

10 Hours

Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

Course Outcomes:
At the end of the course the student will be able to
1. Construct inverter and basic logic gates using MOSFETs, analyse MOSFET V-I characteristics and inverter DC characteristics.
2. Explain CMOS fabrication flow, power distribution in a chip through network of conductors, and MOSFET scaling.
3. Design combinational CMOS circuit, stick and layout diagrams with the knowledge of physical design aspects for logic gates, estimate the delay through cascade and optimize using Logical Effort Technique.
4. Design sequential and dynamic logic circuits, generate and distribute clock.
5. Explain the structure and READ/WRITE operations in SRAM and DRAM memory elements along with timing considerations, the need for testing and testability issues in VLSI Design.

Mapping of PO’s/PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:
REFERENCE BOOKS:

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OPERATIONS RESEARCH

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Course Learning Objectives:
Upon Completing this course, the students will be able to
2. Understand to formulate a Linear Programming Problem.
4. Understand the concept of duality.
5. Solve balanced and unbalanced Transportation Problem.
6. Formulate Assignment Problem.
7. Estimate the project completion time using CPM.

UNIT – I

Introduction, Linear Programming: Introduction, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study, Models used in OR.
Introduction to Linear Programming Problem (LPP): Generalized LPP- Formulation of problems as LPP. Solutions to LPP by graphical method (Two Variables).
Simplex Method - 1: Introduction to simplex method, Setting up the simplex method, Algebra of the simplex method. 15 Hours

UNIT – II

Simplex Method - 2: The simplex method in tabular form, Slack, Surplus and Artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP.
Duality Theory - Concept of Duality, Writing Dual of given LPP, Solutions to LPP by Dual Simplex Method.
Transportation Problem: Formulation of Transportation Problem (TP), Solution, Initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in TP by Modified Distribution (MODI) method. Unbalanced TP. Maximization TP. Degeneracy in TP, Applications of TP. 16 Hours
UNIT – III


Network Model -Critical Path Method: Introduction, Construction of networks, Fulkerson’s rule for numbering the nodes, Critical path method to find the expected completion time of a project.

8 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. List the applications, phases and models in Operations research; Formulate Linear Programming models for the optimum utilization of productive resources in service and manufacturing systems.
2. Apply graphical method to find optimum solution for a given two variable Linear Programming Problem.
3. Determine the optimum solution and Compute Maxima or Minima for a given Linear Programming Problem using Simplex method, Big M method and Two phase simplex method; Discuss the concept of duality in Simplex problems; Formulate and Solve dual Simplex problem for a given Linear Programming Problem.
4. Formulate balanced and unbalanced transportation problem; Compute initial basic feasible solution for a given transportation problem using North-West Corner rule and Vogel’s Approximation method and optimal solution using Modified Distribution method; Explain degeneracy in transportation problem and List the applications.
5. Formulate assignment model and Obtain optimal solution using Hungarian method; Explain Travelling Salesman Problem. Model an optimal replacement policy for individual and group replacement problems for a given real time scenario.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low
TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. https://nptel.ac.in/courses/110/106/110106062/
2. https://nptel.ac.in/courses/110/106/110106059/

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BASIC COMMUNICATION LAB

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Course Learning Objectives:
This course will enable students to:
1. Design and study the characteristics of narrow and wide –band pass and band elimination filters.
2. Design different types of attenuators – T, π and lattice.
3. Study Amplitude Modulation and demodulation.
4. Understand the generation and detection of DSB-SC and SSB signals.
5. Design a Frequency Modulator using IC 8038 to frequency modulate the given message signal.
6. Study the design and application of pre-emphasis and de-emphasis circuits.
7. Design circuits for various pulse modulation schemes – PAM, PWM and PPM.
8. Study the working of Transistor mixer circuit, PCM and TDM.

List of Experiments:
1. (a) Wide Band active Band pass filter.
   (b) Narrow Band active Band pass filter.
2. (a) Wide Band active Band elimination filter.
   (b) Narrow Band active Band elimination filter.
3. Design and testing of: T, π and lattice Attenuators.
4. Amplitude modulation and demodulation.
5. DSB-SC and SSB-SC generation and detection.
6. Frequency modulation using IC 8038.
7. Design and testing of Pre-emphasis and De-emphasis circuits.
8. PAM (modulation and demodulation).
9. Pulse modulation techniques.
   (a) PWM (Pulse Width Modulation).
   (b) PPM (Pulse Position Modulation).
10. Transistor mixer – up/down conversions.
12. Time Division Multiplexing scheme.

**Course Outcomes:**

Upon successful completion of this lab, students will be able to:

1. Set up the experiments to illustrate the concepts of Analog Communication using suitable circuits.
2. Simulate the concepts of the Analog Communication using appropriate simulation tools.

**Mapping of PO’s/ PSO’s & CO’s:**

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3 – High
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**MICROPROCESSOR / MICROCONTROLLER APPLICATIONS LAB**

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*This course is a project based learning subject associated, which will be evaluated based on project work carried out during semester (50 marks) and the CIE for the lab (50 marks).

**Course Learning Objectives:**

1. Learn assembly language programming skill for 8051 microcontroller.
2. Use different types and operands, function calls to achieve an efficient programming logic.
3. Design real time project using 8051 microcontroller.

**LIST OF EXPERIMENTS**

1. Introduction to Integrated Development Environment (IDE) of 8051 Microcontroller.
2. Assembly level programming: Data transfer, Arithmetic, logical and program flow control instruction usage.
3. Application programs on data processing and development of computational algorithms.
4. Real time hardware interfacing experiment with 8051 Microcontroller: LED, 7 Segment LED, Switch, and Stepper Motor.
5. Project work on selected Microprocessor or Microcontroller.

Course Outcomes:
At the end of the course the student will be able to
1. Develop assembly language program for 8051 microcontroller.
2. Design and implement real time project using 8051 Microcontroller.

Mapping of PO’s/ PSO’s & CO’s:

<table>
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<tr>
<th>PO</th>
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3 – High
2 – Medium
1 - Low

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EMPLOYABILITY SKILL DEVELOPMENT

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Total Hours 12
Credits 0

UNIT – I
Quantitative- Numbers (Odd, even, H.C.F & L.C.M, Square roots & cube roots, Average, Percentage)
Analytical/logical- Numerical logic (next number in series, odd man out)
Verbal- Vocabulary (root words, prefix, suffix)

UNIT – II
Quantitative-Ratios & Proportions, Partnership
Analytical/logical- Coded language
Verbal- Vocabulary (synonyms)

UNIT - III
Quantitative- Time & work
Analytical/logical- Syllogism
Verbal- Vocabulary (antonyms)

UNIT – IV
Quantitative- Pipes & Cistern
Analytical/logical- Direction (N-E-W-S)
Verbal- One word substitution

UNIT - V
Quantitative- Speed
Analytical/ Logical- Seating arrangement
Verbal- Idiom/phrases

UNIT - VI
Quantitative- Problems on trains
Analytical /logical- Blood relations
Verbal- Sentence completion

UNIT - VII
Quantitative- Problems on boats & streams
Analytical/logical- Blood relations
Verbal- Active & Passive voice

UNIT - VIII
Quantitative- Allegation & Mixtures
Analytical/logical- Statement & Conclusion
Verbal- Direct & indirect speech

REFERENCE BOOKS:

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ANTENNA AND MICROWAVE SYSTEMS

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Course Learning Objectives:
Upon Completing this course, the students will be able to
1. Learn the application of Smith chart to solve impedance matching problems in transmission lines and study the micro-strip lines.
2. Study different microwave devices in terms of their S matrices, microwave oscillators and devices.
3. Possess the basic concepts of radiation of electromagnetic energy from a radiator.
4. Analyze the radiation pattern in terms of power, radiation intensity or electric field and basic antenna types.
5. Describe the construction and design features of commercial antennas.

UNIT – I

58
Impedance matching transformers: Introduction, General condition for impedance matching, Quarter wave impedance transformer, Smith chart as an admittance chart.

Stub matching, Single stub matching on a line, Double stub matching networks, Problems.

Micro Strip lines: Characteristic impedance, Losses and quality factor Q of micro strip lines, Parallel strip lines: Distributed parameters, Characteristic impedance, Attenuation losses.

UNIT – II

Microwave devices: S – Parameters, S-matrices of a multiport network. E-plane Tee, H-plane Tee and Hybrid Tee, Directional Couplers.

Microwave Signal Generators: High frequency limitations of conventional microwave devices, Reflex Klystrons oscillators: Velocity modulation, Power output and efficiency and electronic admittance.

Microwave solid state devices: Gunn diode, Transferred electron devices (TED), Modes of operations.

Microwave transistors and circuits, MESFET.

UNIT – III

Antenna Basics: Basic antenna parameters, Patterns, beam area, Radiation Intensity, Beam efficiency, Directivity and Gain, Antenna aperture, Effective height.

Point Sources: Introduction, Point sources, Power patterns, Power theorem and applications, Radiation intensity, Examples of Power patterns, Field patterns, Phase patterns.

Antenna Arrays: Array of two isotropic point sources with various cases, Pattern multiplication, Linear array of n- isotropic sources of equal amplitude and spacing.

UNIT – IV

Null Directions: Null directions of arrays, Broad side case, End-fire case and general case with equal currents of any phase.

Electric Dipole and Thin Linear Antennas: Short electric dipole, field expressions of short dipole, Radiation resistance, thin linear antenna, Field Pattern for various lengths.

Loop Antenna: Small loop, Loop antenna (general case), Far – field Patterns of circular Loop Antennas and Uniform Current, Radiation resistance of loops.

UNIT – V


Antenna Types: Slot antenna, Babinet’s principle and Complementary antenna, Horn antenna, The rectangular Horn antenna, Reflector antenna - Paraboloidal reflector, Broad band frequency independent antenna, Basics, Rumsey’s principle, Log- periodic antennas.
Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

Course Outcomes:
At the end of the course the student will be able to understand:
1. Discuss the condition for impedance matching in transmission lines using passive networks; Solve impedance mismatch problems using Smith chart with single/double stub line components; Calculate physical parameters for the given micro-strip lines.
2. Determine the S-matrix for the microwave junctions using the properties of S-parameters to reach the targeted S-coefficients for the junctions; Describe the mechanism of operation of vacuum tube based and semiconductor oscillators and Determine the parameters of the oscillators to examine their applications in microwave frequency band.
3. Determine the antenna radiation pattern parameters using vector calculus methods and Categorize the antenna as point source, antenna arrays.
4. Analyse the antenna radiation pattern using basic null direction and Determine the pattern parameters-HPBW, BWFN of dipole and loop antenna.
5. Summarize the features, construction, principle of operation & expressions that help in designing the antenna types for narrow band and broad band frequency independent operations.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:
NPTEL/ MOOC Link:
1. https://nptel.ac.in/courses/108/103/108103141/
2. https://nptel.ac.in/courses/108/101/108101112/
3. https://nptel.ac.in/courses/108/101/108101092/
Course Learning Objectives:

This course will enable students to

1. Study the basic Nyquist’s sampling theorem, generation of samples, Pulse
   amplitude modulation and Time division multiplexing.
2. Understand the techniques used in geometric interpretation of signals, designing
   a correlation receiver and matched filter receiver, maximum likelihood estimation
   and different types of Waveform Coding Techniques- PCM, DPCM, DM.
3. Understand the difficulties in base-band shaping for data transmission, ISI and
   Correlative coding techniques.
4. Study the design of Coherent and Non-coherent digital modulation techniques,
   Coherent Quadrature modulation techniques.
5. Understand the Spread Spectrum technique, Pseudo Noise sequences, Direct
   Sequence spread spectrum, Frequency Hop spread spectrum.

UNIT – I

Introduction: Sources and signals, Basic signal processing operations in digital
communication, Channels for digital communication.

Sampling Process: Sampling theorem, Generation and Reconstruction of a message
signal from its samples, Quadrature sampling of Band Pass signal, Effect of Aliasing,
Practical aspects of sampling and signal recovery: Natural and Flat top samples, Pulse
Amplitude Modulation and TDM.  

UNIT – II

Detection and estimation: Gram-Schmidt Orthogonalization procedure, Geometric
interpretation of signals, Response of bank correlators to noisy input, Detection of known
signals with unknown phase in noise, Probability of Error, Maximum Likelihood Detection,
Correlation receiver, Matched Filter: Matched filter receiver, Maximization of SNR at the
output of Matched filter and Properties of matched filter. Estimation: concept and criteria,
Maximum likelihood estimation of phase.

Waveform Coding Techniques: PCM, Channel noise and error probability, Quantization
noise and SNR, Robust quantization, DPCM and Delta Modulation.  

UNIT – III

Base-band shaping for data transmission: Discrete PAM signal, Waveform formats,
Power spectra of discrete PAM signals, Inter Symbol Interference, Nyquist’s criterion for
distortion less base-band binary transmission, Correlative coding techniques, Eye pattern,
Base-band M-ary PAM systems.  

UNIT – IV

Digital modulation techniques: Digital Modulation formats, Coherent Binary
Modulation techniques, Coherent Quadrature Modulation techniques, Non-Coherent Binary
Modulation techniques, Comparison of binary and Quaternary modulation techniques, M-ary modulation techniques: M-ary PSK, M-ary QAM.

12 Hours

UNIT - V

Spread spectrum modulation: Pseudo noise sequences, notion of spread spectrum, Direct Sequence spread coherent Binary PSK, Signal space dimensionality and processing gain, Probability of Error, Anti Jam Characteristics, Frequency Hopped spread spectrum, Applications.

8 Hours

Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

Course Outcomes:
At the end of the course the student will be able to understand:
1. Apply the concepts of sampling and reconstruction to baseband and bandpass signals.
2. Apply signal space representation in the analysis of digital communication systems and Analyze quantization and apply it to PCM, DPCM and DM.
3. Realize line codes and their power spectral densities; describe the principle of ISI and analyze the methods for minimizing ISI.
4. Analyze the digital modulation techniques and determine the error performance for the digital modulation techniques.
5. Demonstrate the understanding and functioning of Spread Spectrum systems and evaluate their performance using processing gain and jamming margin.

Mapping of PO's/ PSO's & CO's:

<table>
<thead>
<tr>
<th>PO1</th>
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3 – High
2 – Medium
1 - Low

TEXTBOOKS:

REFERENCE BOOKS:
NPTEL/MOOC Links:
1. https://onlinecourses.nptel.ac.in/noc17_ec12
2. https://nptel.ac.in/courses/117105077/2
3. https://nptel.ac.in/courses/117105077/20
4. https://nptel.ac.in/courses/117105077/21
5. https://nptel.ac.in/courses/117105077/38

**INFORMATION THEORY AND CODING**

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### Course Learning Objectives:
This course will enable students to

1. Understand how information is measured in terms of probability.
2. Understand the basics of information theory to analyze entropy, information rate, source extensions and Markoff sources.
3. Illustrate the properties of codes, to identify the instantaneous codes, devise source codes using various coding techniques and to determine its efficiency.
4. Identifying communication channels based on their channel diagram and to calculate entropy, mutual information and channel capacity.
5. Illustrate the concepts of Shannon’s Channel Capacity theorem, Shannon-Hartley Law and Shannon’s Limit.
6. Describe a linear block code in matrix form, understand binary cyclic code and to design an encoder and syndrome calculation circuit for linear block codes and binary cyclic codes.
7. Illustrate error detection and correction capabilities of linear block codes, cyclic codes and implement them using feedback shift registers.
8. Understand the working of encoders and decoders for convolutional codes.

### UNIT – I

**Information Theory:** Introduction, Measure of information, Average information content (entropy) of symbols in long independent sequences, Information rate, Properties of entropy, Extension of discrete memory less (zero-memory) sources, Average information content (entropy) of symbols in long dependent sequences, Markoff statistical model for information source, Entropy and information rate of Markoff sources. **10 Hours**

### UNIT – II

**Source Coding:** Properties of codes- Block codes, Non-singular codes, Uniquely decodable codes. Instantaneous codes and Optimal codes, Prefix of a code, Test for instantaneous property, Construction of Instantaneous code, Decision tree, Kraft’s inequality, Source coding theorem (Shannon’s Noiseless coding theorem), Shannon’s encoding algorithm, Shannon Fano Algorithm, Huffman minimum redundancy code (binary, ternary and quaternary), Code efficiency and redundancy, Extended Huffman Coding, Arithmetic Codes, Lempel – Ziv Algorithm. **10 Hours**
UNIT – III

Channels and Mutual Information: Introduction, Discrete communication channels, Representation of a channel, Probability relations- Apriori, Posteriori entropy, Equivocation, Mutual information, Properties, Rate of information transmission over a discrete channel, Capacity of a discrete memoryless channel, Shannon’s theorem on channel capacity (Shannon’s second theorem), Special channels- Symmetric, Binary symmetric, Binary erasure, Noiseless, Deterministic and cascaded channels, Estimation of channel capacity by Muroga’s method, Continuous channels, Shannon-Hartley theorem and its implications, Shannon’s limit, Rate Distortion Theory. 10 Hours

UNIT – IV

Linear Block Codes: Introduction to Fields and Vector Spaces, Types of errors, Examples, Methods of controlling errors, Types of codes, Linear Block Codes- Matrix description, Encoding circuit, Syndrome and error detection, Syndrome circuit, Hamming weight, Hamming distance, Minimum distance of a block code error detection and correction capabilities of a linear block code, Single error-correcting Hamming codes, Table lookup decoding using standard array, General decoder for a linear block code. Binary cyclic codes: Algebraic structures of cyclic codes, Encoding using (n-k) bit shift register, Syndrome calculation. 12 Hours

UNIT – V

Other Block Codes: BCH codes, RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes, Burst and Random error correcting codes. Convolution codes: Encoders, Time domain approach, Transform domain approach, State diagram, Code tree, Trellis, Sequential search and Viterbi algorithm, Principle of Turbo coding. 10 Hours

Scheme of SEE Question Paper
There will be 10 questions of 20 marks each in the question paper divided into 5 units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting one full question from each unit.

Course Outcomes:
At the end of the course the student will be able to
1 Calculate the entropy of Zero memory; Analyse Markov sources and Apply the properties of Entropy for a given source statistics.
2 For the given source message, Determine the codewords and Calculate coding efficiency using Shannon, Shannon-Fano, Huffman and Arithmetic coding algorithm for memoryless sources given the source statistics and LZ algorithm for sources with memory.
3 Determine and Analyse the channel entropies, mutual information and the channel capacities for Discrete Memoryless Channels for the given channel diagram or channel matrix and to Discuss Shannon Hartley Law and Shannon’s limit.
4 For the given (n, k) Linear Block Codes and Binary Cyclic Codes Determine the codewords, syndrome, error detecting & correcting capability of the code and the corrected received vector; Design a single error correcting Linear Block Code for the given message length.
5 Evaluate the codewords for a given (n, k, m) convolution encoder and Use Sequential search and Viterbi algorithm to decode the information from the given received vector and Discuss BCH, RS, Golay, Shortened cyclic, Burst error correcting, Burst and Random error correcting codes and Turbo codes.
Mapping of PO's/ PSO's & CO's:

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TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/117101053/

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ADVANCED COMMUNICATION LAB

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Course Learning Objectives:
This course will enable students to:
1. Study the sampling theorem to generate flat top samples and to reconstruct the original signal using kit.
2. Understand various binary digital modulation and demodulation schemes such as ASK, FSK, PSK using kits.
3. Measure transmission line parameters such as free space wavelength, guide wavelength and VSWR using microwave test bench with Reflex Klystron as source.
4. Study optical fiber line and to measure various losses and numerical aperture.
5. Carry out measurement of resonant characteristics of microstrip ring Resonator and determine isolation and coupling coefficient of microstrip line based on directional coupler.
6. Design and conduct an experiment to determine parameters of antenna for Dipole and Yagi antenna.
LIST OF EXPERIMENTS:
1) Verification of sampling theorem using flat top samples.
2) Binary ASK generation and detection.
3) Binary FSK generation and detection.
4) Binary PSK generation and detection.
5) DPSK modulation and demodulation.
6) QPSK modulation and demodulation.
7) Measurement of guide wavelength ($\lambda_g$), frequency and VSWR using Microwave test bench with Reflex Klystron as source.
8) Study of optical fibers: measurement of losses in the analog link and numerical aperture.
9) Determination of coupling coefficient and isolation characteristics of Microstrip line Directional coupler.
10) Measurement of antenna parameters for dipole and Yagi antenna.
11) a) Measurement of resonant characteristics of Microstrip ring resonator.
    b) Measurement of power division & isolation characteristics of Microstrip 3dB power divider.

Course Outcomes:
Upon successful completion of this lab, student will be able to:
1. Set up experiments to demonstrate the concepts of Digital Communication and Microwave Communication schemes using suitable circuits.
2. Simulate the concepts of digital communication and microwave communication schemes using appropriate Simulation tools.

Mapping of PO’s/PSO’s & CO’s:

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<th>PO1</th>
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3 – High  2 – Medium  1 - Low

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VLSI LAB

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Course Learning Objectives:
This course will enable the students to
1. Develop Verilog codes for digital CMOS circuits, adder and counters.
2. Develop Verilog testbench and perform simulation using available EDA tool.
3. Synthesize the Verilog code using the available technological library, given the constraints.
4. Design CMOS schematic circuits, perform AC & DC analysis of an Inverter, MOS amplifiers and DAC.
5. Draw layout, perform DRC and simulation of Inverter, MOS amplifiers and DAC.
PART – A: ASIC DIGITAL DESIGN
Write Verilog code for the following and Perform simulation for functional verification using testbench.
Observe the waveform. Synthesize the code using available technological library, given the constraints*.

1. Inverter – Gate level Verilog Model.
2. 4-bit Parallel Adder.
3. Synchronous counters for given MOD-N, with reset control.
5. Demonstration of ASIC Design flow from RTL to GDS II.
*An appropriate constraint should be given

PART - B: ANALOG DESIGN
1. Design an Inverter for the given specifications*.
   a. Draw the schematic circuit and perform the following
      i) DC Analysis
      ii) Transient Analysis
   b. Draw the Layout, perform DRC and perform simulation.
2. For the following circuits, draw the schematic circuit and perform DC Analysis, AC Analysis and Transient Analysis. Also draw the Layout, perform DRC and perform simulation.
   a) Common source amplifier. b) Common Drain amplifier
3. For a single stage differential amplifier, draw the schematic circuit and perform DC Analysis, AC Analysis and Transient Analysis.
4. Design a 4 bit R-2R based DAC using given op-amp in the library**. Draw the schematic and perform simulation.
   * Appropriate specification should be given.
   ** Applicable Library should be added & information should be given to the designer.

Course Outcomes:
After studying this lab course, the student will be able to:
1) Develop Verilog code and testbench for a 4-bit parallel adder, 4-bit synchronous and asynchronous counters and perform simulation using available EDA tool.
2) Design and perform schematic simulation of CMOS Inverter, Common source amplifier, common drain amplifier and differential amplifier, for the given specifications and layout simulation of CMOS Inverter, Common source amplifier and common drain amplifier using available EDA tool.
Mapping of PO’s/ PSO’s & CO’s:

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EMPLOYABILITY SKILL DEVELOPMENT

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UNIT - I
Quantitative- Permutations & Combinations
Analytical/logical- Cause & Effect statements
Verbal- Sentence corrections (Pronoun errors & misplaced modifiers)

UNIT - II
Quantitative- Area, volume & surface areas
Analytical/logical- Scenario based questions
Verbal- Sentence correction (Parallel construction & Parallel Comparison)

UNIT - III
Quantitative- Profit & loss
Analytical / logical- Figure series & mathematical puzzles
Verbal- Sentence correction (Tense usage)

UNIT – IV
Quantitative- Simple and compound interest
Analytical/logical- Statement & assumption
Verbal- Sentence correction (Subject-verb agreement)

UNIT - V
Quantitative- Logarithms
Analytical/logical- Reasoning analogies
Verbal- Verbal analogies

UNIT - VI
Quantitative- Stocks & Shares
Data interpretation- Tables, bar charts
Verbal- Reading comprehension (simple passage)

UNIT – VII
Quantitative- Discounts (True discounts, bankers’ discount)
Data interpretation- Line graphs & Pie charts
Verbal- Reading comprehension (Difficult passage)

UNIT - VIII

Quantitative- Clocks & Calendars
Data sufficiency
Verbal- Inferences from passages

REFERENCE BOOKS:

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MINI PROJECT

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Student will carry out a project using the knowledge gathered from the courses successfully completed to arrive at some useful conclusions using any of the methods listed below:

i) Designing and testing a circuit for a new concept.
ii) Conceptual development of a new idea in the field of electronics.
iii) Literature survey of any topic of importance in electronics.

Course Outcomes:

After completion of this Project Phase the student will be able to

1. Source, comprehend and Analyze technical literature and other credible sources of information to formulate an engineering problem.
2. Form a team with clearly defined roles for each member.
3. Identify the societal, health or environmental need that is addressed through the solution to the identified engineering problem.
4. Create a project proposal document detailing the problem, its objective, methodology and expected outcomes.
Mapping of PO's/PSO's & CO's:

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ELECTIVES

ADHOC AND SENSOR NETWORKS

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Course Learning Objectives:
This course will enable the students to
1. Establish the concept of forming a network with sensor nodes with radio frequency (RF) link.
2. Analyze the architecture, performance of the wireless and adhoc networks with protocols of Physical, MAC and network layer.
3. Describe the time synchronization and localizations of the adhoc and wireless sensor networks.
4. Observe the characteristics of various layers of wireless sensor networks using simulation tools.
5. Construct a layout of wireless/body sensor networks with the help of development platforms.

UNIT – I

Introduction to sensors:
Sensor basics, Sensor types, Characteristics, Applications 4 Hours

Introduction to Wireless Sensor Networks (WSN):
Factors influencing the WSN design, hardware constraints, Power consumption, Communication, Simplified energy model 4 Hours

WSN Architecture, Hardware components, Physical layer, Radio Frequency(RF), UWB, Modulation, Path loss.
Transceiver tasks and characteristics, Physical layer transceiver design
Medium access control layer: Energy consumption.
Network layer functionalities. 4 Hours
Protocol stack, embedded operating systems, Tiny OS, Contiki OS. 3 Hours
UNIT - II

MAC Protocols:
Fundamentals, Classes of MAC protocols, MAC protocols for WSN, Low duty cycle protocols, Wake up radio concepts, Contention and Schedule based protocols, IEEE 802.15.4 MAC protocol.

Time synchronization:
Properties, Light weight time synchronization protocols (LTS) 8 Hours

Localisation and Positioning:
Procedures, Possible approaches, Combining hierarchical topologies, and power control. Pilot based power control, Adhoc Network design algorithm (ANDA), Energy efficiency unicast routing protocol. 8 Hours

UNIT – III

Wireless Body Area Networks,
Network topologies, Scenarios, WPAN technology, Inertial energy scavenging technique, Wireless sensor network development platforms. 8 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain the fundamental knowledge in Wireless sensor node; Determine the performance parameters of modules of Sensor node.
2. Explain physical, media access control & network layer parameters of wireless sensor network architecture; Determine the path loss for the given Wireless Sensor network scenario.
3. Discuss the concepts of Medium access control protocols; Associate time-synchronisation schemes in the protocols with the conventional MAC protocol concepts.
4. Apply basic techniques of localisation and positioning to control power of the wireless sensor network.
5. Create Wireless Body sensor network basics in terms of different network topology scenarios, involving the present IEEE standard and the energy scavenging techniques to generate power for the voltage sources of the sensor nodes using the inertial technique.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low
TEXTBOOKS:

REFERENCE BOOKS:

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MODERN RADAR AND NAVIGATIONAL AIDS

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Course Learning Objectives:
This course will enable students to
1. Work with different radar range equations and calculate the effect of various external / internal factors on radar accuracies.
2. Learn border view of radar subsystems, Radar measurement and Navigation.
3. Apply the knowledge to obtain signal levels in simple direction finders for Navigational instruments.
4. Study radar measurement processes, evaluate Doppler shifts and blind speeds.
5. Learn the elements of electronic navigation and integrate with emerging technologies.

UNIT – I

Elementary Modern radar: Radar overview, Radar range equation, Radar search and detection, Radar Cross section, Transmitted power, Pulse Repetition frequency and Radar Clutter. 15 Hours

UNIT – II

MTI & Pulse Doppler Radar: Introduction to MTI & Pulse Doppler Radar, Delay line cancellers, MTD, CW & FMCW Radar.
Influencing factors: Propagation effects, Target reflectivity, Target fluctuations, Detection criteria, Detection theory, Signal processing, Pulse compression.
Radar Measurements: Parameter Measurements, Doppler phenomenology, Doppler processing. 16 Hours

UNIT – III

Aids to approach and Landing: ILS, MLS, DME & TECAN. 8 Hours
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Analyze Radar range equations and Estimate radar range, transmitted power, Pulse repetition frequency, cross section, clutter for different target and Integrate for developing Radar range equation.
2. Evaluate the performance of different radar systems for stationary and moving targets and Design different receiver systems for specific radar applications.
3. Apply the propagation effects on radar signal to estimate target reflectivity, fluctuations and Deduce appropriate detection criteria, signal processing and pulse compression schemes.
4. Use parametric measurements to Develop Doppler phenomenology and Doppler processing.
5. Classify different methods of navigation radio detection and VOR techniques, Compare the performance with other hyperbolic systems. Extend the concepts of navigation systems to Evaluate the performance of advances Instrument landing systems.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

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Course Learning Objectives:
The course presents basics of Multimedia Communication that aims to
1. Introduce basics of Multimedia Communication.
2. Introduce the students with knowledge of Audio Video Compression and Multimedia information Networks.
3. Introduce Multimedia transport and management protocols.
4. Introduce the multimedia information representation techniques.
5. Introduce the networks significance in multimedia.

UNIT – I
Multimedia Communications: Introduction, Multimedia information representation, Multimedia networks, Multimedia applications, Media types, Communication modes, Network types, Multipoint conferencing, Network QoS application QoS. 15 Hours

UNIT – II
Audio and Video Compression: Introduction, Audio compression, DPCM, ADPCM, APC, LPC, Video compression, Video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4. Multimedia Information Networks: Introduction, Network performance parameters, Throughput, Networking delay, Delay variance, Error rate, Quality of service. QoS perspectives, QoS Processing, Multimedia transmission, Requirements, transmission over WANs, Multimedia Transmission over LANs, ATM Networks, Wireless LANs. 16 Hours

UNIT – III
Multimedia transport and management protocols
Multimedia transport: RTP and RTCP
Multimedia management protocols: H.323, SIP, SDP, SAP. 8 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
**Course Outcomes:**
A student who successfully fulfils the course requirements will have demonstrated:

1. Discuss the importance of multimedia networks and information representation techniques namely text, image, audio and video for efficient transfer of information.
2. Analyse the interpersonal, interactive and entertainment applications of multimedia communication networks. Determine the QoS parameters associated with a constant bit rate channel of communication network.
3. Demonstrate the audio codec systems DPCM, ADPCM, LPC and video codec systems H.261, H.263, MPEG-1, MPEG-2, and MPEG-4 using SIMULINK tool.
4. Calculate the multimedia network performance parameters throughput, network delay, delay variance, error rate and predict the multimedia transmission over LAN, WAN and MAN.
5. Examine the capabilities of multimedia transport protocols RTP and RTCP and multimedia management protocols H323, SIP, SDP, SAP for the best Voice over IP service.

**Mapping of PO’s/ PSO’s & CO’s:**

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| 3 – High |
| 2 – Medium |
| 1 - Low |

**TEXTBOOKS:**


**REFERENCE BOOK:**


**NPTEL/MOOC Link:**

1. [http://nptel.ac.in/courses/117105083/](http://nptel.ac.in/courses/117105083/)
**OPTICAL COMMUNICATION & NETWORKS**

<table>
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**Course Learning Objectives:**

This Course will enable students to

1. Appreciate the use of Optical Communication and Networks in various walks of life, describe the types of networks, and network Services and Applications.
2. Explain responsibilities of Optical Transmitters, Optical receiver its implementation and its function.
3. Explain the various techniques used in fiber coupler and connectors.
4. List types of optical networks and its significance in optical domain.
5. Explain the operation of WDM concept and its applications.

**UNIT – I**

**Overview of Optical Fiber Communication:** Introduction, Historical development, General system, Advantages, Disadvantages and applications of optical fiber communication, Optical fiber waveguides, Ray theory, Cylindrical, Single mode fiber, Cutoff wave length, Mode filed diameter. Optical Fibers: Fiber materials, Photonic crystal, Fiber optic cables specialty fibers.

Introduction, Attenuation, Absorption, Scattering losses, Bending loss, Dispersion, Intra model dispersion, Inter model dispersion. 12 Hours

**UNIT – II**

**Optical Sources and Detectors:** Introduction, LED’s, LASER diodes, Photo detectors, Photo detector noise, Response time, Double hetero junction structure, Photo diodes, Comparison of photo detectors. 6 Hours

**Fiber Couplers and Connectors:** Introduction, Fiber alignment and joint loss, Single mode fiber joints, Fiber splices, Fiber connectors and fiber couplers. 6 Hours

**Optical Receiver:** Introduction, Optical Receiver Operation, Receiver sensitivity, Quantum limit, Eye diagrams, Coherent detection, Burst mode receiver, Operation, and Analog receivers. 6 Hours

**UNIT – III**

**Optical Amplifiers and Networks:** Optical amplifiers, Basic applications and types, Semiconductor optical amplifiers, EDFA.

**Optical Networks:** Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

**WDM Concepts and Components:** WDM concepts, Overview of WDM operation principles, WDM standards. 9 Hours

**Scheme of SEE Question Paper**

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course the student will be able to
1. Explain the propagation of optical signals for single mode and multimode in different fiber structures.
2. Estimate the fiber losses and quantum efficiency due to attenuation factor, dispersion and total carrier recombination life time.
3. Explain the concept of fiber couplers, connectors and fiber alignment mechanism.
4. Discuss the concepts of optical receiver characteristics to estimate the receiver sensitivity, quantum limit.
5. Explain the concept of SONET/SDH and WDM network models for wavelength connectivity and multiplexing techniques.

Mapping of PO’s/PSO’s & CO’s:

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TEXTBOOK:

REFERENCE BOOKS:

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SPREAD SPECTRUM COMMUNICATION

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Course Learning Objectives:

This course will enable the students to
1. Get a notion about spread spectrum communication system and how it is used for secure communication.
2. Understand the concept of synchronization.
3. Understand the multiple access technique used in spread spectrum communication system.

UNIT – I

Introduction to Spread Spectrum Systems: Two communication problems, Direct sequence spread spectrum, BPSK, QPSK, MSK direct sequence spread spectrum, Frequency –Hop spread spectrum, Hybrid direct sequence/ frequency –Hop spread spectrum, Complex envelope representation of Spread – spectrum systems.

Binary Shift Register sequences for Spread – spectrum Systems: Introduction, Definitions, Mathematical background and sequence generator fundamentals, Maximal length sequences, Gold Codes, Non linear code generators. 16 Hours

UNIT – II

Code tracking Loops: Introduction, Optimum tracking of Wide band signals, Base band Delay lock tracking loop, Non-coherent Delay lock tracking loop, Tau-Dither non-coherent tracking loop, Double Dither non coherent tracking loop, Non coherent Delay lock tracking loop with arbitrary data and spreading modulation, Code tracking loops for frequency – Hop systems.

Initial synchronization of the receiver spreading code: Introduction, Problem definition and the optimum synchronizer, Serial search synchronization techniques, Generalized analysis of average synchronization time, Synchronization using a matched filter, Synchronization by estimating the received spreading code, Tracking loop pull in. 17 Hours

UNIT – III

Code Division Multiple Access: Introduction, Cellular radio concept, Fundamentals of cellular radio system, Co-channel interference protection prediction, and cellular concept revisited, CDMA digital cellular systems, Detection of spread spectrum signal. 6 Hours

Scheme of SEE Question Paper

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:

At the end of the course the student will be able to
1. Generate various types of spreading codes like PN sequence and Gold sequence using appropriate polynomials.
2. Demonstrate the understanding and functioning of different types of spread spectrum systems and evaluate the system using the parameters – processing gain and jamming margin.
3. Realize the need of synchronization and also how to achieve synchronization and maintain synchronization by using code tracking loops.
4. Analyze and evaluate the techniques of initial synchronization in spread spectrum systems.
5. Realize the fundamental concepts of CDMA and Determine the radio channel capacity of CDMA system.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOK:

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WIRELESS COMMUNICATION

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Course Learning Objectives:
This course will enable the students to
1. Have an idea about the cellular design fundamentals and realize the wireless propagation models.
2. Understand the concept of fading channels and need of diversity.
3. Appreciate the bandwidth efficient techniques like CDMA and OFDM.

UNIT – I

Cellular Concept Fundamentals & Radio Wave Propagation
Introduction, Frequency reuse, Cellular geometry, Channel assignment strategies, Handoff strategies, Interference and System capacity, Trunking and GOS, Improving coverage and capacity of cellular systems.
Introduction to Radio wave propagation, Free space propagation model, Relating power to electric field, Basic propagation mechanism – Reflection, Diffraction and Scattering (Suitable models to be covered), Practical link budget design using path loss models, Outdoor and Indoor propagation.

UNIT – II

Fading & Diversity Techniques
Fading, Factors influencing small scale fading, Small scale multipath propagation, Impulse response model of multipath propagation, Small scale multipath measurements, Parameters of mobile multipath channels, Types of small scale fading.

UNIT – III

Broadband Techniques
CDMA: Features of CDMA, DS CDMA, FH CDMA, Radio channel capacity of DS CDMA and FH CDMA.
OFDM: Principle of OFDM, OFDM transceivers, Cyclic Extension, Channel Estimation, Peak to average power ratio, Intercarrier Interference, Adaptive Modulation and Capacity.

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course the student will be able to

1. Demonstrate the understanding of the cellular concept and apply it to evaluate the system capacity with Quality of Service as well as to improve the capacity.
2. Apply the Radio Propagation Models based on the fundamental attributes of propagation and Determine the path loss and percentage coverage area.
3. Interpret and Apply the concept of fading; determine the impulse response of the channel as well as the parameters of mobile multipath channels and classify the fading channels.
4. Apply the diversity techniques and switching & combining methods to combat fading in wireless channels.
5. Explain the concepts of Multi user and Multi carrier systems with respect to Broadband communication systems.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/117104099/2
2. http://nptel.ac.in/courses/117104099/5
3. http://nptel.ac.in/courses/117104099/10

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COGNITIVE RADIO

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**Course Learning Objectives:**
This course will enable the students to
1. Understand the principle of software defined radio.
2. Appreciate the concept of cognitive radio.
3. Explain the next generation wireless networks.

**UNIT – I**

**Introduction To Software Defined Radio & Architecture:** Essential functions of the software radio, Basic SDR, Hardware architecture, Computational Definitions and potential benefits, Software radio architecture evolution, Technology tradeoffs and architecture implications. Processing resources, Software architecture, Top level component interfaces, Interface topologies among plug and play modules. **15 Hours**

**UNIT – II**


**UNIT – III**

**Next Generation Wireless Networks:** The XG Network architecture, Spectrum sensing, Spectrum management, Spectrum mobility, Spectrum sharing, Upper layer issues, Cross – layer design. **9 Hours**

**Scheme of SEE Question Paper**
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course the student will be able to
1. Discuss software radio on hardware & Software radio architecture, potential benefits, trade-offs and architecture implications of Software Defined Radio.
2. Explain Processing resources, top level component interfaces, interface topologies among plug and play modules of Software Defined Radio.
3. Discuss Making radio self-aware, cognitive techniques for position& environment awareness, optimization of radio resources, Artificial Intelligence Techniques in cognitive radio.
5. Discuss the concepts of Wireless Networks and Apply them on The XG Network architecture, spectrum sensing, management, mobility, sharing, upper and cross layer issues in Next Generation Wireless Networks.

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TEXTBOOKS:

REFERENCE BOOKS:
FIBER OPTICS

Course Code: 19ECE22
CIE Marks: 50
Teaching Hours/Week (L:T:P): 3:0:0
SEE Marks: 50
Total Hours: 39
Credits: 03

Course Learning Objectives:
This course will enable students to:
1. Compete the different light propagation mechanisms with fundamentals.
2. Justify the impact of LED and LASER services and their applications.
3. Formulate the different scenarios of fiber optics measurement through industry and medical applications.
4. Elaborate the fiber optics connectivity modes by means of physical components.
5. Minimize the different fiber optic losses by improving the transmission characteristics.

UNIT – I

Optical Fibers and Their Properties: Principles of light propagation through a fiber, Different types of fibers and their properties, Transmission characteristics of optical fiber, Absorption losses, Scattering losses, Dispersion, Optical fiber measurement, Optical sources, Optical detectors – LED-LD-PIN and APD.
Laser Fundamentals: Fundamental characteristics of Lasers, Three level and four level lasers, Laser modes, Resonator configuration, Q-switching and mode locking, Cavity dumping, Types of lasers -Gas lasers, Solid lasers and liquid lasers and semiconductor lasers (Basic working principle only).
15 Hours

UNIT – II

16 Hours

UNIT – III

Laser In Holography and Medical Application: Holography – basic principle; Methods; Holographic interferometry and applications, Holography for non-destructive testing, Medical applications of lasers; Laser and tissue interaction, Laser instruments for surgery, Removal of tumours, Brain surgery, Plastic surgery.
8 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course student will be able to
1. Estimate the fiber losses and quantum efficiency due to attenuation factor, dispersion, photodetector noise and response time.
2. Apply the laser fundamentals concept to construct the different laser levels, resonator, Q switching and mode locking and applications.
3. Determine the industrial application for optical fibers to choose the measurement of pressure, voltage, current and liquid level in fiber optic gyroscope – polarization maintaining fibers.
4. Identify the different laser measurement techniques using the distance, velocity, acceleration and material processing concepts.
5. Discuss the laser applications in holography and interferometry, removal of tumors and brain surgery.

Mapping of PO’s/PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

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DETECTION AND ESTIMATION

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Course Learning Objectives:
This course will enable students to:

1. Understand the basics of binary hypothesis testing leading to signal detection theory with Neyman-Pearson approaches.
2. Understand the basics of binary hypothesis testing leading to signal detection theory with Bayesian approaches.
3. Understand the fundamentals of single parameter estimation theory with deterministic and Bayesian philosophies.
4. Understand the fundamentals of multi-parameter estimation theory with deterministic and Bayesian philosophies.
5. Develop a simple application by using Kalman or Wiener filters.

UNIT – I


UNIT – II


UNIT – III

Bayesian Estimation: Introduction, Maximum a Posteriori (MAP) and minimum mean square error (MMSE) estimation. Signal waveform estimation: Wiener filtering. Kalman filters. 08 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to

1. Apply hypotheses test for random signals to compute likelihood between them.
2. Develop test and metrics for detection of signals in presence of Gaussian and non-Gaussian noises.
3. Develop representation and bounds of estimation for random signals using estimators.
4. Design estimators for noisy signals.
5. Design of Kalman filters or Wiener filters for signal deconvolution or noise suppression.
Mapping of PO’s/ PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low

TEXTBOOKS:

REFERENCE BOOK:

NPTEL/ MOOC Link:
1. https://nptel.ac.in/courses/117103018/

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HIGH PERFORMANCE COMMUNICATION NETWORKS

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Course Learning Objectives:
This course will enable the students to
1. Build the connectivity between different types of communication networks.
2. Maximizing the high performance estimation through physical and logical layer connectivities.
3. Compiling the different network control management techniques, various services and applications etc.,
4. Importance between optical connectivity and wireless connectivity through network evaluation criterion approach.
5. Evaluating the different networks qualitative analysis by enhancing through intelligent networks and Derived demand for network services.
UNIT – I


Internet and TCP/IP Networks: IPV4 Reliable multicast ,Multicast IP, Mobile IP, TCP and UDP, Applications, FTP,SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched Networks. 14 Hours

UNIT – II

ATM And Wireless Network: ATM: Main features of ATM, Addressing, signalling and Routing, ATM header structure, ATM AAL, Internetworking with ATM


Network controls: Control of networks, Objectives and methods of control, Circuit switched networks, Datagram Networks, Network economics, Derived demand for network services, ISPs, Subscriber demand model. 18 Hours

UNIT – III

Optical Networks: Optical Links, WDM systems, Optical cross connects, Optical LANs, Optical paths and Networks. SONET, DWDM, Optical Network Survivability, Physical Layer Implementation Techniques. 7 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to

1. Utilize different network model architectures, pure ATM, Open data layer, internet and calculate the network latency using Traffic Characterization.
2. Explain the use of multicasting routing protocols, TCP/IP and circuit switching performance.
3. Discuss the concepts of ATM and wireless networks , internetworking, channel access, Home RF and Bluetooth and applications.
4. Make use of network control to design subscriber demand model for Internet Service Provider (ISP).
5. Build the optical network connectivity using SONET, WDM and survivability integration techniques using, fiber demand distribution, fiber protection ratio, fiber demand bundling techniques.
Mapping of PO’s/PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low

TEXTBOOKS:

REFERENCE BOOK:

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RF CIRCUIT DESIGN

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Course Learning Objectives:
This course will enable the students to
1. To study the radio frequency and medium wave concepts and the circuit representations of RF and MW networks.
2. To learn the application of Smith chart in lumped and distributed element circuit applications.
3. To design the matching networks.
4. To learn the design of small signal and large signal RF/MW Amplifiers considering the gain.
5. To design an RF/MW oscillator considering the stability.
6. To design an RF/MW frequency converters, rectifiers, detectors, mixers etc.

UNIT – 1

Wave Propagation in Networks: Introduction to RF/MW concepts and applications; RF electronic concepts Fundamental concepts in wave propagation, Circuit representation of two port RF/MW networks.

Passive Circuit Design: Smith Chart, Applications of smith chart in distributed and lumped element circuit applications, Design of matching networks. 16 Hours
UNIT – II

Basic considerations in Active networks: Stability consideration in active networks, Gain considerations in Amplifiers.
Active Networks: Linear and Nonlinear Design: RF/MW Amplifiers small signal design, Large signal design, RF/MW oscillator design. 16 Hours

UNIT – III

RF/MW frequency converters, Rectifier and detector design, Mixer design, RF/MW control circuit design. 7 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
After studying this subject student will be able to understand:
1. Discuss the concept of RF/Microwave electronics from the component to wave nature level and Determine the circuit parameters for a two port RF/MW junction.
2. Determine the transmission line parameters using Smith chart; Determine the frequency response of a passive circuit using analytical methods /procedure.
3. Examine the stability and gain of an active device using stability criterion/transistor design procedures.
4. Design a small/large signal amplifier and Oscillator to operate at RF band using the transistor design procedures.
5. Summarize the design procedures, performance and parameters of detector, mixer & control circuits that operate in RF band.

Mapping of PO's/ PSO's & CO's:

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3 – High  2 – Medium  1 - Low

TEXTBOOK:

REFERENCE BOOK:

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SATELLITE COMMUNICATION SYSTEMS

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Course Learning Objectives:

This course will enable the students to
1. Learn general laws governing Satellite orbits & its parameters also discuss overall design of satellites.
2. Learn the propagation impairments of the Electromagnetic wave and consider losses for link power calculations and implementation of various controls.
3. Learn applications of Satellite and different communication systems used for access.

UNIT – I

Over view of Satellite Systems: Introduction, Frequency allocation, Communication Satellites, INTELSAT.

Orbits: Introduction, Kepler’s laws, Definitions, Satellite period and orbits, Orbital element, Apogee and Perigee heights, Orbit perturbations, Inclined orbits, Calendars, Universal time, Sidereal time, Orbital plane, Local mean time and LEO, MEO, GEO and MOLNIYA and Sun Synchronous orbits.


Propagation Impairments: Introduction, Atmospheric loss, Ionospheric effects, Rain attenuation, Other impairments.

Space link: Introduction, EIRP, Transmission losses, Link power budget, System noise, CNR, Uplink, Down link, Effects of rain, Combined CNR **16 Hours**

UNIT – II

Space Segment: Introduction, Power supply units, Attitude control, Station keeping, Thermal control, TT&C, Transponders, Antenna subsystem.

Earth Segment: Introduction, Receive only home TV system, Out-door unit, Indoor unit, MATV, CATV, Tx.–Rx. Earth station.

Interference: Introduction, Types of Interference between satellite circuits, Remedies

Satellite access: Single access, Pre-assigned FDMA, DAMA, SCPC (spade system), TDMA, Pre-assigned TDMA, Demand assigned TDMA. CDMA. **15 Hours**

UNIT – III

DBS: Introduction, Orbital spacing, Power rating and number of transponders, Frequency and polarization, Transponder capacity, Bit rates for digital TV.
Other Satellite services: Satellite mobile; VSAT, VSAT, LANDSAT, RADARSAT, GPS, Space Station, Indian Satellites, IRS, INSAT, Space missions, CHANDRAYAN and MOM Orbiter

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Analyze different satellite orbits for various applications, Identify services provided by communication satellites at GEO orbit and Apply necessary corrections to the satellite to keep the satellite in GEO orbit.
2. Compute satellite link power budget and carrier to noise ratio for both uplink and down link signals and Estimate transmission losses and losses due to propagation impairments.
3. Device different satellite subsystems for operational requirements and Distinguish between different satellite receiver systems.
4. Deduce combined of multiple satellite access system using different multiplexing and multiple access techniques and Evaluate the multiple access system for providing different satellite services.
5. Apply satellite communication concepts to DBS system and Extend the same to other satellites services and Indian space missions to Compare the performances.

Mapping of PO's/ PSO's & CO's:

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3 – High  2 – Medium  1 – Low

TEXTBOOKS:

REFERENCE BOOKS:
AUTOMATION USING SCRIPTING LANGUAGES

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Course Learning Objectives:
This course will enable students to
1. Get Introduced to various verification techniques.
2. Write a script to automate a tool.

UNIT – I
PERL:
History and Concepts of PERL, Scalar Data, Arrays and List Data, Control structures, Hashes, Basics I/O, Regular Expressions, Functions
Automatic code generation, Report Filtering, Netlist patching, Test Vector Generation, Controlling Tools. 15 Hours

UNIT – II
Tool Command Language:
An Overview of TCL and Tk, TCL Language syntax, Variables, Expressions, Lists, Control flow, Procedures, Errors and exceptions, String manipulation, Accessing files 15 Hours

UNIT – III
Verification:
Introduction to Verification, Verification Process-Specification Design Decomposition, Functional Test Strategies, Transformation Test Strategies, Coverage 9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the students will be able to
1. Illustrate the role of server side scripting using PERL Programming.
2. Apply the concepts of PERL scripting for test vector generation and VHDL testbench.
3. Analyze the salient features of TCL over PERL and write programs using fundamental concepts.
4. Discuss the knowledge of TCL and TK to show TCL/TK structures and substitution rules.
5. Make use of orthogonal verification principle within a design flow for RTL verification.

Mapping of PO's/ PSO's & CO's:

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TEXTBOOKS:

REFERENCE BOOKS:

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AUTOMOTIVE ELECTRONICS

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Course Learning Objectives:

After studying this Course, the student should be able to:
1. Understand the overall Electrical and Electronic architecture of a vehicle.
2. Understand the working of sensors and actuators used in Automotive applications.
3. Understand the use of different communication protocols used in Automotive systems.
4. Know about the AUTOSAR in the open-source platform for Automotive development.
5. Know about the Automotive Control Systems.

UNIT – I


UNIT – II


UNIT - III


Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Describe the function and operation of automotive Electrical and Electronic subsystems.
2. Discuss the principle and operation of sensors and actuators used in automotive applications.
3. Analyse the use of CAN, LIN, MOST and Flexray protocols in automotive applications.
4. Explain the architecture & Methodology of AUTOSAR.
5. Describe Automotive data processing and memory systems.

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3 – High  2 – Medium  1 - Low
TEXTBOOKS:

REFERENCE BOOKS:

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BIOMEDICAL INSTRUMENTATION

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Course Learning Objectives:
After studying this Course, the student should be able to:
1. With widespread use and requirements of medical instruments, this course gives knowledge of the principle of operation and design of biomedical instruments.
2. It attempts to render a broad and modern account of biomedical instruments.
3. It gives the introductory idea about human physiology system which is very important.
4. Demonstrate a basic understanding of disease, medical conditions or physiological conditions.
5. Explain the functional components of various instruments.
6. Demonstrate a critical appreciation of various biomedical instruments.
7. Explore new developments for better management or assessment of conditions.

UNIT – I

Fundamentals of medical instrumentation: Anatomy and Physiology, Physiological Systems of the body, Sources of Biomedical Signals, Basic medical instrumentation system, Intelligent medical instrumentation system, General constraints in design of medical instrumentation system.

Bioelectric signals and electrodes: Origin of Bioelectric Signals, Recording Electrodes, Ag-AgCl Electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes for EMG, Electrical conductivity of Electrode Jellies and Creams, Microelectrodes. 15 Hours
UNIT – II

Physiological transducers and recording systems: Classification of transducers, Pressure Transducers, Transducers for body temperature measurement, Pulse sensors, Respiration sensors, Preamplifiers, Signal processing techniques, Recording system.

Biomedical recorders: ECG, VCG, PCG, EEG, EMG, Other biomedical recorders.  
15 Hours

UNIT - III

9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Discuss the block diagram of basic medical instrumentation system and intelligent instrumentation system and describe the constraints of medical instrumentation system.
2. Describe the electrodes used for the measurement of ECG, EEG and EMG.
3. Discuss the characteristics and principle of pressure transducers, body temperature transducers, pulse transducers and respiration transducers.
4. Describe the biomedical recording systems for ECG, EMG, EEG, PCG and other biomedical recorders.
5. Illustrate the principle and working of X-ray machine, Computed Tomography, MRI scanning system, Cardiac imaging system and ultrasonic imaging system.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:
REFERENCE BOOKS:

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EMBEDDED LINUX

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**NOTE:**
1. CIE Evaluation: MSE-1 + MSE-2 + Mini project : 15Marks + 15 Marks +20 Marks 
2. No. of Hours allotted for Lab: 11 Hours

Course Learning Objectives :
1. Working of basic Linux operating system and usage of basic Linux commands are introduced.
2. Able to understand basic Linux character driver modules and use of its development tools.
3. Covers the basic design framework of an embedded system.

UNIT – I

Overview of Unix/Linux: Introduction to Linux, Unix Commands, Understanding of some basic commands such as echo, pwd, ls, who, date, passwd, cal, cat, grep, cp, rm, chmod, date and combining commands using pipes and redirection. Shell Programming using Loops, Conditional statements and Command line arguments.

UNIT – II


UNIT – III


Project based Lab:
Class 1 to 4
1. Introduction to Raspberry Pi and ARM development board
2. Python Programming
3. Interfacing IO devices
4. Feature finalization of project work

**Class 5 to 11**
Project work

**Scheme of SEE Question Paper**
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

**Course Outcomes:**
At the end of the course the student will be able to
1. Illustrate Linux operating system and identify the usage of Unix commands.
2. Develop and write shell scripts using relevant unix commands.
3. Identify the building blocks of Linux device drivers. Use basic device drivers to work with hardware.
4. Demonstrate applications to use device drivers using system calls.
5. Design a frame work for the embedded system on generic or Linux platform.

**Mapping of PO’s/ PSO’s & CO’s:**

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3 – High  2 – Medium  1 - Low

**TEXTBOOKS:**
1. M. G. Venkateshmurthy “Introduction to Unix and Shell Programming” , Pearson Education.

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### LOW POWER VLSI

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#### Course Learning Objectives:

This course will enable the students to

1. Get a clear understanding of the physics and different sources of power dissipation in CMOS circuits.
2. Be able to appreciate the need for low power design.
3. Gain knowledge about the different power analysis techniques.
4. Get a firm understanding on the different low power techniques used in circuit level and logic level.
5. Gain knowledge on the different special low power approaches in clock distribution.
6. Get a firm understanding on the different low power techniques used in circuit level and logic level.

#### UNIT – I

**Introduction:** Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Basic Principles of Low Power Design.

**Physics of power dissipation in CMOS devices** – The MIS structure, Long channel MOSFET, Submicron MOSFET, Gate induced drain leakage.

**Power dissipation in CMOS** – Short circuit dissipation, Dynamic dissipation, Load capacitance.  

10 Hours

#### UNIT – II

**Simulation Power analysis:** SPICE circuit simulation, Gate Level Logic Simulation-Architecture Level Analysis, Data Correlation Analysis in DSP Systems, Monte Carlo simulation.

**Probabilistic Power Analysis:** Random Logic Signals, Probability and Frequency, Probabilistic Power Analysis Techniques, Signal Entropy.

**Low Power Design at Circuit Level:** Transistor and Gate Sizing- Sizing an Inverter chain, Transistor and Gate sizing for Dynamic Power Reduction, Transistor Sizing for Leakage Power Reduction. Network Restructuring and Reorganization, Special Latches and Flip flops  

15 Hours

#### UNIT – III

**Low Power Design at Logic level:** Gate reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre-Computation Logic.

**Low power Clock Distribution:** Power dissipation in clock distribution, Single driver Vs distributed buffers, Zero skew Vs tolerable skew.

**Special Techniques:** Power reduction in clock networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

14 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain the need for low power design in VLSI chips, sources of power dissipation in CMOS circuits and analyse the basic and emerging low power design approaches.
2. Explain the physics of power dissipation in CMOS devices; Explain the simulation based power analysis techniques to determine the power dissipation in VLSI circuits.
3. Determine the power dissipation in VLSI circuits using probabilistic power analysis techniques.
4. Explain power reduction techniques at the circuit level and logic level for VLSI circuits.
5. Explain the approaches of low power design in clock distribution, architectural and system levels.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low

TEXTBOOK:

REFERENCE BOOKS:

NPTEL/MOOC Link:
1. https://nptel.ac.in/courses/106105034/
2. https://nptel.ac.in/courses/106105161/58

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NANOELECTRONICS

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Course Learning Objectives:
This course will enable students to:
1. Explain semiconductor device physics and materials technology to enable the Nanoelectronics.
2. Know fundamentals of CMOS technology in sub nanometer regime.
3. Know transistors with new structure and nano materials.
4. Know materials characterization techniques.

UNIT – I

Overview, Nano devices, Nano materials, Nano characterization, Technology node, Basic CMOS Process flow. MOS Scaling theory, Issues in scaling MOS transistors: Short channel effects. MOS capacitor, Gate oxide thickness scaling, SiO2 vs High-k gate dielectrics and Integration issues of high-k, CV and IV techniques.

12 Hours

UNIT – II

Metal gate transistor, Transport in Nano MOSFET, Silicon on Insulator, Ultrathin body SOI - double gate transistors, FinFET and Surround gate FET. Metal source/drain junctions: Properties of schottkey junctions on Silicon, Germanium and compound semiconductors. Germanium Nano MOSFETs: Advantages of Germanium over Silicon, PMOS versus NMOS. Compound semiconductors: material properties, MESFETs, Compound semiconductors, Hetero structure MOSFETs.

15 Hours

UNIT – III


12 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
**Course Outcomes:**

At the end of the course the student will be able to

1. Explain technology node of CMOS technology and illustrate the application of scaling theory to MOS transistors in sub nanometer regime.
2. Describe MOS capacitor with oxide and high-K gate dielectrics and analyse the integration issues.
3. Discuss the properties of materials and device, develop various nanostructures for transistors.
4. Explain and select the synthesis and characterization techniques of nanomaterial.
5. Describe some emerging nanoelectronic materials analyse them for nanoelectronics applications.

**Mapping of PO’s/ PSO’s & CO’s:**

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- 3 – High
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**TEXTBOOKS:**


**REFERENCE BOOKS:**


**NPTEL Link:**

https://nptel.ac.in/courses/117108047

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ADVANCED DIGITAL LOGIC VERIFICATION

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**Teaching Hours/Week (L:T:P)** 3:0:0
**Total Hours** 39

**Course Learning Objectives:**
This course will enable the students to
1. Understand the significance of testing and verification.
2. Understand the different verification methodologies.
3. Understand basic of System Verilog.
4. Understand the concept of randomization in system Verilog.
5. Gain knowledge about UVM.

**UNIT – I**

**Verification Concepts:** Concepts of verification, Importance of verification, Stimulus v/s Verification, Functional verification, Verification challenges, Typical verification flow, Functional verification approaches, Direct testing, Coverage: Code and Functional coverage, coverage plan, Types of code coverage. 8 Hours

**Language Constructs System Verilog constructs:** Data types: Two-state data, Strings, arrays: Queues, Dynamic and associative arrays, Structs, Enumerated types. Program blocks, Module, Interfaces, Clocking blocks, Modports. 7 Hours

**UNIT – II**

**Classes & Randomization SV Classes:** Language evolution, Oop terminology, Classes and objects, Class Variables and Methods, Class Instantiation, Inheritance, Polymorphism and encapsulation, Class members: Types. Randomization: Directed Vs Random testing. Randomization: Constraint Driven Randomization. 8 Hours

**Assertions & Coverage Assertions:** Introduction to Assertion based verification, Immediate and concurrent assertions. Functional coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling. 7 Hours

**UNIT – III**

**Building Testbench:** Layered test bench architecture, Introduction to Universal Verification Methodology, Overview of UVM Base Classes and simulation phases in UVM and UVM macros. Unified messaging in UVM, UVM environment structure, Connecting DUT- Virtual Interface, UVM tb-top memory model. 9 Hours

**Scheme of SEE Question Paper**
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from **Unit - I & Unit – II** and 1 full question from **Unit – III**.
Course Outcomes:
At the end of the course the student will be able to
1. Explain the concept of verification process and model the typical verification flow; compare the white, black and grey box verification approach used in verification environment.
2. Develop the system verilog code by choosing suitable language constructs.
3. Explain the classes and object and describe the concept of inheritance, polymorphism, encapsulation and randomization.
4. Explain the concept of assertion based verification and describe the concept of cover group, cover point, binning and event sampling.
5. Explain UVM methodology; Construct UVM test bench architecture and identify the simulation phases and bases classes used in UVM.

Mapping of PO's/ PSO's & CO's:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOK:

NPTEL/ MOOC Link:
1. http://www.nptel.ac.in/courses/106103016/#
ANALOG AND MIXED MODE VLSI DESIGN

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<td>Credits</td>
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Course Learning Objectives:

This course will enable the students to

1. Learn different types of MOS device models, single stage amplifiers, current mirrors & differential amplifiers.
2. Understand Op-Amp design, fundamentals and architecture of different data converters.
3. Understand the design of capacitors, resistors, MOSFET Switch, Delay and Adder elements etc. in sub-micron CMOS technology.

UNIT – I

Review of MOS device physics, MOS device models.

Single stage amplifiers: Basic concepts, Common source, Source follower, Common gate stage, Cascode stage amplifiers.

Current mirrors (basics), Differential amplifiers: Single-ended and differential operation, Basic differential pair (qualitative analysis only), Common mode response.

Op-Amp design: General considerations, One-stage Op-Amp, Two Stage Op-Amp.

14 Hours

UNIT – II


Data Converter Architectures: DAC Architectures: Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, ADC Architectures: Flash, 2-step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.

17 Hours

UNIT – III

Sub-Micron CMOS circuit design: Process flow, Capacitors and resistors, MOSFET Switch, Delay and Adder elements.

8 Hours

Scheme of SEE Question Paper

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course the student will be able to
1. Explain the working of Single-Stage MOS Amplifier topologies; Identify MOS amplifier topology and compute its gain and impedance parameters.
2. Explain the working of Current Mirrors, One and two-stage Op-Amps; Compute the value of output current for a given current mirror circuit; Demonstrate the use of Current mirror circuit for a given specification.
3. Compute the performance parameters for a given DAC; Select between Resistor String, R-2R, Current Steering, Charge Scaling, Cyclic, Pipeline DAC architectures for the given application & specification.
4. Compute the performance parameters for a given ADC; Select between Flash, 2-Step Flash, Pipeline, Dual Slope, Single Slope and SAR ADC for the given application & specification.
5. Discuss the process flow for construction of transistors, Resistors and Capacitors in sub-micron technology; Describe the operation of CMOS Delay and Adder elements.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High     2 – Medium     1 – Low

TEXTBOOKS:

REFERENCE BOOK:

NPTEL/ MOOC Link:
1. Analog Circuits: http://www.nptel.ac.in/courses/117101106/ [NPTEL]
2. VLSI Circuits: http://nptel.ac.in/courses/117106092/ [NPTEL]

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DIGITAL IC DESIGN USING VERILOG HDL

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NOTE:
1. CIE Evaluation: MSE-1 + MSE-2 + Verilog programming Lab : 15Marks + 15 Marks +20 Marks
2. No. of Hours allotted for Lab: 11 Hours
3. Tool to be used: Xilinx

Course Learning Objectives:

This course will enable students to
1. Understand the basics of design methodologies involved in digital system design.
2. Develop Verilog code in behavioral modeling for digital circuits.
3. Verification of Combinational and Sequential circuits using Testbench.
4. Describe a design at Register transfer level for Algorithmic state machines.

UNIT – I

Design Methodology: Design flow (T1_10.1), Design Optimization (T1_10.2), Design for Test (T1_10.3), Synthesizable HDL Models of Sequential Circuits (T2_5.6), Design Procedure (T2_5.8), HDL for Registers and Counters (T2_6.6).

Verilog for Synthesis: Data Types and Operations (T1_C.1), Combinational Functions (T1_C.2), Sequential Circuits (T1_C.3), Memories (T1_C.4), Programming examples in behavioral modeling.

12 Hours

UNIT – II

Verification: Verification of Combinational Circuits (T1_2.4), Verification of Sequential Circuits (T1_4.4.2), Verilog Testbench for Combinational and Sequential Circuits (T1)

10 Hours

UNIT – III

Register Transfer Level: Introduction, Register Transfer Level notation, Register Transfer Level in HDL, Algorithmic State Machines (ASMs), Design Example (T2_8.1-8.5)

6 Hours

Scheme of SEE Question Paper

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain the design methodology of modern digital systems.
2. Implement a Verilog code in behavioral modeling for a given a state diagram/digital circuit.
3. Develop Verilog Testbenches to verify combinational logic circuits.
4. Develop Verilog Testbenches to verify sequential logic circuits.
5. Explain the fundamentals of representing a digital system at the Register Transfer Level for Algorithmic State Machines.

Mapping of PO’s/ PSO’s & CO’s:

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1 – High       2 – Medium      3 - Low

TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/MOOC Link:
1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee05/

VERILOG PROGRAMMING LAB

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<td>Implementation of Sequential Circuits using FPGA</td>
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<td>7-9</td>
<td>Verification of Combinational and Sequential circuits using Testbench</td>
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EMBEDDED SYSTEMS

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Course Learning Objectives:
This course will enable students to:
1. Understand the technological aspects of embedded systems and recognize design challenges in embedded system design processes.
2. Illustrate the domain and application specific aspects of embedded systems and understand different computational models.
3. Acquire knowledge about different entities of Embedded System Development Environment

UNIT – I

Introduction to embedded systems, Embedded system versus general computing systems, Classification of embedded systems, Major application areas of embedded systems, Purpose of embedded systems, Embedded system design challenges, Common design metrics and optimizing them. Survey of different embedded system design technologies, Trade-offs, Custom single purpose processors, Design of custom single purpose processors, General purpose processors, General-purpose processor design, Core of the embedded system, Memory, Sensors and actuators, Communication interface and other system components.

16 Hours

UNIT – II

Embedded systems- Application and domain specific, Fundamental issues in hardware software co-design, Computational models in embedded design, Introduction to Unified Modelling Language (UML), Embedded firmware design approaches, Embedded firmware development languages, Programming in embedded C.

15 Hours

UNIT – III

The Integrated Development Environment (IDE), Types of files generated on cross compilation, Disassembler/ decompiler, Simulators, Emulators and debugging, Target hardware debugging, Boundary scan.

08 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course the student will be able to
1. List and explain the basic concepts and applications of embedded system,
   Discuss the design metrics, design challenges and design technologies of
   embedded system, Design custom single purpose processor.
2. Discuss the memory, sensors and actuators, communication interface and
   system components.
3. Discuss the fundamental issues in hardware software co-design and interpret the
   computational models.
4. Discuss the embedded firmware design approaches and development
   languages.
5. Discuss the Integrated Development Environments for embedded firmware.

Mapping of PO's/ PSO's & CO's:

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3 – High  2 – Medium  1 - Low

TEXTBOOKS:
   Hardware/Software Approach”, John Wiley & Sons

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/108102045/
2. http://nptel.ac.in/courses/108105057/
3. http://nptel.ac.in/courses/106105159/

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INTERNET OF THINGS

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NOTE:
1. CIE Evaluation:MSE-1 + MSE-2 + IoTLab : 15Marks + 15 Marks +20 Marks
2. No. of Hours allotted for Lab: 11 Hours
3. Tool to be used: Energia
Course Learning Objectives:
This course will enable students to:
1. Understand the basic concepts of IoT and its architecture.
2. Understand the cloud and fog computing in IoT.
3. Understand the design of IoT system.

UNIT – I

Introduction to the Internet of Things: Internet of Things Concepts (T1_1.2), IoT Framework (T1_1.4), Information and Communication Technology Infrastructure (T1_1.5), Standards (T2_2.1).

5 Hours

Enabling Technologies for the Internet of Things: IP Based IoT (T2_2.2.2), Physical/Link Layer (T2_2.2.2), Network Layer (T2_2.2.3), Transport Layer (T2_2.2.4), Application layer (T2_2.2.5).

6 Hours

UNIT – II

Interoperability and Discoverability: The Verticals: Cloud-Based Solutions (T2_3.2), Messaging Queues and Publish/Subscribe Communications (T2_3.5) Service and Resource Discovery (T2_4.1), Local and Large-Scale Service Discovery (T2_4.2), Scalable and Self-Configuring Architecture for Service Discovery in the IoT (T2_4.3).

5 Hours

Cloud and Fog Computing in the Internet of Things: IoT System Requirements (T1_4.2), Cloud Computing in IoT (T1_4.3), Big Data Processing Pattern (T2_6.2), Big Stream (T2_6.2), Big Stream and Security (T2_6.3), Fog Computing in IoT (T1_4.4), The Role of IoT Hub (T2_6.6).

6 Hours

UNIT – III

A Tutorial Introduction to IoT Design and Prototyping with Examples: Hardware for IoT (T2_7.1), Main Features of IoT Hardware Development Platforms (T1_6.2), Software for IoT (T2_7.2), Design and Prototyping of IoT Applications (T1_6.3), Projects on IoT Applications (T1_6.4).

6 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain IoT; Describe the IoT framework, Information and Communication Technology Infrastructure and Standards.
2. Describe IP based IoT and explain the enabling technologies of IoT.
3. Explain the interoperability and discoverability of IoT systems.
4. Describe the Cloud and Fog computing techniques in IoT.
5. Design and develop prototype of an IoT system.
Mapping of PO's/PSO's & CO's:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOK:

NPTEL/ MOOC Link:
1. https://nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/108/108/108108098/

IoT Lab

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<tr>
<td>1.</td>
<td>Introduction to IoT Lab</td>
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<td>2.</td>
<td>Browsing HTML pages using HTTP Server and Controlling GPIO and Reading Sensor Connected to the interfacing Hardware Kit</td>
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<td>3.</td>
<td>Creation of own Web Server and Web page</td>
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<td>4.</td>
<td>Working with ThingSpeak Cloud Server for IoT</td>
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<td>Application of Message Queue Telemetry Transport(MQTT) in IoT</td>
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<td>Working with Eclipse Cloud Server using MQTT Dash</td>
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*************
INTRODUCTION TO SENSORS AND ACTUATORS

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NOTE:
1. CIE Evaluation: MSE-1 + MSE-2 + Mini project: 15 Marks + 15 Marks + 20 Marks
2. No. of Hours allotted for Lab: 11 Hours

Course Learning Objectives:
This Course will enable students to
1. Provide an introduction to Mechatronics system Design.
2. Provide an introduction to sensors and actuator technology.
3. Discuss the basic principles of Signal Processing needed for sensors.

UNIT – I


UNIT – II

Actuators: Introduction, Solenoids and Relays, DC Motors, Stepper Motors, Hydraulics, Pneumatics

UNIT – III

Signal Conditioning: Amplification, Filtering, Protection, Linearization, error compensation

LIST OF EXPERIMENTS:
1. To study the characteristics of IR sensor and Ultrasonic Sensor.
2. To determine the value of unknown resistance using Wheatstone bridge.
3. To study the characteristics of temperature sensor.
4. To study the characteristics of K-type Thermocouple.
5. To determine the direction control of stepper motor.

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

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**Course Outcomes:**
A student who successfully fulfills the course requirements will be able to:

1. Explain the performance parameters of sensors.
2. Describe the principle of operation and characteristics of proximity sensors, switches, potentiometers, LVDT, optical encoders, strain gages, load cells, thermocouples, and accelerometers and design simple application circuits using the same.
3. Discuss the construction and working of stepper motor, DC motor, Solenoid and Relay. Determine the specification of motor required for a given application.
4. Discuss the components of hydraulic and pneumatic systems.
5. Describe the need for Signal conditioning and Design the basic Signal Conditioning circuits.

**Mapping of PO’s/PSO’s & CO’s:**

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3 – High  2 – Medium  1 - Low

**TEXTBOOKS:**

**REFERENCE BOOKS:**

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**ARTIFICIAL INTELLIGENCE**

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_Syllabus of V & VI Semester B.E. / Electronics & Communication Engg._
Course Learning Objectives:
The course presents basics of Artificial Intelligence that aims to
1. Introduce AI, propositional calculus, graph theory and Heuristic approach.
2. Arm the students with the basics of issues involved with knowledge presentation and history of AI representational systems.
3. Introduce Role of knowledge in language understanding.

UNIT - I
Introduction to Artificial Intelligence (AI): The History of Artificial Intelligence and the State of the Art. Components of AI.
Heuristic Search Techniques: Hill Climbing, Best First Search-A* SEARCH, AO* Search, Problem Reduction and Constraint Satisfaction. 15 Hours

UNIT - II
Natural Language Processing (NLP): Applications of NLP, Examples of NLP Systems, Chomsky Hierarchy of Grammars, Transformational Grammar, Case Grammars (FILLMORE’s) & Context Free Grammar (CFG).
Parsing Process: Introduction to Parsing-Top-Down and Bottom-Up Process. Types of Parsing-Deterministic Parsing and Non-Deterministic Parsing. 15 Hours

UNIT – III
Game Playing: MiniMax Search and Alpha- Beta (α-β) Pruning.
Learning: Rote Learning, Learning by Taking Advise, Learning in Problem Solving, Neural Net Learning-Single Layer Network, Multilayer Network, Feed Forward and Back Propagation
Neural Network (3 Hrs-SS) 9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
A student who successfully fulfills the course requirements will have demonstrated:
1. Apply AI production rules to solve the state space problems namely Water Jug Problem, Missionaries and Carnivals Problem, Chess Problem, 8-Puzzle Problem and Cryptarithmetic Problem.
2. Analyze AI problem using Hill Climbing and Heuristic Search algorithms for best path finding and decision making functions.
3. Apply Knowledge Based System (KBS) representation technique in solving problems to support human decision making.
4. Determine Natural Language Processing (NLP) in understanding human language using NLP grammars and parsing techniques.
5. Apply Alpha–Beta search and artificial neural network feed forward and back propagation neural network learning for AI applications.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. nptel.ac.in/courses/106105077/
2. nptel.ac.in/courses/106106126/

************
BIOMEDICAL SIGNAL PROCESSING

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**Course Learning Objectives (CLOs):**
This course will enable the students to
1. Understand the general characteristics of medical data.
2. Identify different techniques to record ECG.
3. Analyze digital & integer filters in biomedical applications.
4. Learn application of adaptive filters in biomedical signal processing.
5. Learn importance of signal averaging in signal processing.
6. Understand different data reduction techniques.
7. Analyze an ECG signal using different techniques.

**UNIT – I**

**Overview of Biomedical Signals:** Sources and nature of biomedical signals, Types of biomedical signals: Deterministic, Stochastic, Fractal and chaotic. Characteristics of medical data, Objectives of biomedical signal analysis. Introduction to ECG, EEG, EMG, PCG and their signal characteristics.

**Artifacts in Biomedical Signals:** Baseline wander, Power-line noise and High frequency noise sources.

**Digital and Integer Filters:** Digital filters pole-zero plot, Integer filters: Basic design concept, Low-pass, High-pass, Band-pass and Band-reject integer filters. 14 Hours

**UNIT – II**

**Adaptive Filters and Signal Averaging:** Principal noise canceller model, 60-Hz adaptive canceling using a sine wave model, Applications of adaptive filtering, Basics of signal averaging.

**Data Reduction Techniques:** Overview of data reduction techniques, Turning point algorithm, Huffman coding.

**Characterization of Nonstationary Signals:** Mean, Variance, Measures of activity, Higher-order statistics.

**Advanced Biomedical Signal Analysis techniques:** Power spectrum estimation, Discrete Cosine Transform (DCT) and Short-time Fourier Transform (STFT), Discrete Wavelet Transform (DWT). 14 Hours

**UNIT – III**

**ECG QRS Detection:** Differentiation techniques, Template matching techniques, Pan-Tompkins QRS detection algorithm.

**Computer-Aided Biomedical Signal Interpretation:** Overview of computer-aided diagnosis, ECG interpretation, Computer-assisted classification, Portable arrhythmia monitor.

**Instructions to access the biomedical data:** Demo to open source database PhysioNet, Acquisition of signal from database, Simulation of signals using MATLAB. 11 Hours
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes (COs):
At the end of the course the student will be able to
1. Discuss the sources, objectives and characteristics of biomedical signals and describe the artefacts affecting the physiological signals.
2. Design and implement digital and integer filters using Lynn Transfer function for biomedical applications.
3. Apply LMS algorithm for adaptive filtering and calculate SNR using signal averaging technique in biomedical signal analysis.
4. Apply Huffman and turning point algorithm for efficient data reduction and Analyze DCT, STFT and DWT for biomedical signal analysis.
5. Apply the differentiation, template-matching technique, Pan-Tomkin’s algorithm and use computer aided techniques for biomedical signal feature extraction and classification.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/MOOC Link:
1. http://onlinecourses.nptel.ac.in/noc18_ec02/preview

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DSP PROCESSORS AND ARCHITECTURE

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Course Learning Objectives:
This course will enable students to
1. Learn to represent real-time signals in digital format and understand transform-domain representations of the signals.
2. Understand the architectural features for the programmable DSP device.
3. Study the linear systems approach to signal processing problems using high-level programming language.
4. Demonstrate the linear filters on real-time DSP chips.
5. Present the applications of linear filters and their real-time implementation challenges.

UNIT – I


Architectures for Programmable Digital Signal-Processors: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing. 15 Hours

UNIT – II


Implementation of Basic DSP Algorithms: Introduction, the Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). 15 Hours

UNIT – III


Interfacing Memory and Parallel I/O Peripherals to DSP Devices: Introduction, Memory Space Organization, Memory interface. Introduction to TMS320C6748 Processor (Architecture). 9 Hours

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Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course student will be able to
1. Apply the knowledge of digital signal processing algorithms for developing representation of signals.
2. Identify the basic architectural features of fixed point digital signal processors that are useful for programming.
3. Identify and list the relevant features and instruction set for programming TMS320C54XX processor.
4. Develop algorithms and plan the implementation of FIR and IIR filters in TMS320C54xx processors.
5. Develop and plan the implementation of DFT and FFT algorithms in TMS320C54XX processor along with interfacing memory and peripherals.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

REFERENCE BOOKS:

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**IMAGE PROCESSING**

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**Course Learning Objectives:**

This course will enable the students to

1. Recall the mathematical & signal principles, forming the basis for methods for image processing.
2. Understand image representation, enhancement, filtering, restoration, analysis & reconstruction.
3. Know the processing techniques including various image transformations, image reconstruction, segmentation & recognition.
4. Design & conduct imaging experiments using MATLAB.
5. Convert image from RGB to gray, black & white, remove blurring effects, noise reduction, edge detection, compression and segmentation.

**UNIT – I**

**Definition of Digital Image Processing:** Origins and examples of DIP, Fundamental steps in DIP, Elements of visual perception, A simple image formation model, Concepts of sampling & quantization, Representation of digital images, Spatial and Gray level resolution, Zooming & Shrinking of digital images, Basic relationships between pixels. Understanding of Satellite image & Concept of False Color Composite.

**Image Enhancement in Spatial domain:** Concept & Importance of Histogram Some basic gray level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening filters.

**Image Enhancement in Frequency domain:** Introduction to Fourier Transform & Frequency Domain Basics of filtering in frequency domain, Designing the filter in for smoothening and sharpening the images.

15 Hours

**UNIT – II**

**Image Restoration:** A model of image degradation & Restoration process, Noise models, Restoration in the presence of Noise only-spatial filtering, Periodic noise reduction by frequency domain filtering, Inverse filtering, Minimum Mean Square (Wiener) filtering.

**Color Fundamentals:** Color models, Pseudocolor Image processing, Basics of Full color image processing, Color transformations, Smoothing & Sharpening, Noise in color images, Color image compression.

**Image Compression:** Fundamentals, Image compression models, Some basic compression methods: Huffman coding, Arithmetic coding, Run length coding, JPEG, MPEG.

15 Hours
UNIT – III

Morphological Image Processing: Introduction, Dilation & Erosion, Opening & Closing operations, Some basic morphological algorithms.
Image Segmentation: Fundamentals, Point, Line & edge detection, Thresholding, Region-based segmentation.

9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Apply the image fundamentals and mathematical transforms: zooming (nearest neighbor, bilinear and bilateral) and shrinking necessary for improving resolution of image.
2. Apply spatial & frequency domain techniques to enhance the image.
3. Explain the image restoration technique in presence & absence of noise and explain noise models: Gaussian, Raleigh, exponential, impulse, gamma and impulse.
4. Explain the color models (RGB, CMYK, HSI and YCbCr), pseudocolor image processing, image compression and video compression techniques.
5. Apply morphological operations and segmentation techniques for detection region of interest.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOK:

REFERENCE BOOK:

NPTEL/MOOC Link:
1. https://nptel.ac.in/courses/117105135/
2. https://nptel.ac.in/courses/117105079/#

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**MACHINE LEARNING AND ITS APPLICATIONS**

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**Course Learning Objectives:**
This course will enable students to:
2. Critical understanding of basic statistical significance tests.
3. Practice machine learning algorithms for solving healthcare and biomedical problems.
4. Identify potential applications of machine learning in practice and execution of machine learning tools such as WEKA.

**UNIT – I**

**Introduction to Machine Perception:** Feature Extraction, Bio Markers, Feature Selection, Learning and Adaptation-Supervised, Unsupervised and Reinforcement Learning.

**Statistical Pattern Recognition:** Standard Deviation, Variance, Covariance, Eigenvector and Eigenvectors, Dimensionality Reduction, Principal Component Analysis, Independent Component Analysis.  
15 Hours

**UNIT – II**

**Statistical Significance Test:** Multivariate Data Analysis, Methods in Analysis of Two-Class Problem and Multi-Class Problem.

**Classification System:** Class Labeling, Training and Testing a Classifier, $k$-fold Cross Validation, Confusion Matrices, Statistical Data Interpretation and Visual Tools, Performance Measure Techniques.  
15 Hours

**UNIT – III**

**Classifiers:** Decision Tree, $k$-Nearest Neighbor ($k$-NN) classifier and Support Vector Machine (SVM) classifier, Advances in Machine-Learning systems, Introduction to WEKA.  
9 Hours

**Scheme of SEE Question Paper**
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course student will be able to:
1. Identify the characteristics of pattern recognition that make it useful to real-world problems.
3. Formulate two class and multiclass problems and analyse multivariate data to real-world problems.
4. Identify and utilize performance metrics for machine learning algorithms.
5. Identify pattern classifiers and propose solutions for machine learning problems.

Mapping of PO's/ PSO's & CO's:

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TEXTBOOKS:

REFERENCE BOOK:

NPTEL/MOOC Link:
1. https://nptel.ac.in/courses/117105135/

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WAVELETS

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Course Learning Objectives:
Upon Completing this course, the students will be able to
1. Understand Continuous and Discrete Wavelet Transform
2. Explain Orthogonal Wavelet Decomposition
3. Explain Orthonormal Wavelets and their relationships to filter banks
4. Understand Orthonormal basis generating wavelets
5. Construct simple Wavelets
6. Explain applications of Wavelet Transforms

UNIT - I

Continuous Wavelet Transform: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.
Introduction to Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction. Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional liner vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. Example MRA. (i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

15 Hours

UNIT – II

MRA, Orthonormal Wavelets and Their Relationship to Filter Banks: Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal.
Examples of Wavelets: Examples of orthogonal basis generating wavelets, (i) Daubechies D4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

15 Hours

UNIT – III

Construction of Simple Wavelets: Construction of simple wavelets like Harr and DB1.
Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections. Embedded tree image coding, compression with JPEG audio compression, Audio masking and Wavelet based audio coding.

9 Hours
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain and Apply the concept of Continuous and Discrete Wavelet Transforms.
2. Apply the concepts of approximating Vectors in Nested Subspaces of Finite-Dimensional Linear Vector Space and Infinite –Dimensional Vector Space. Use Haar Wavelet decomposition for digital filter implementation.
3. Apply Wavelet basis two scale relation, basis for the detail subspaces and direct sum decomposition in MRA. Explain digital filtering interpretation with decomposition filters and reconstructing the signal.
4. Explain Orthonormal basis generating wavelets. Analyse orthonormal MRAs for discrete time signals.
5. Apply wavelet transforms to signal and image compression.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. https://nptel.ac.in/courses/117/101/117101123/
2. https://nptel.ac.in/courses/108/101/108101093/

*******
ADVANCED SIGNAL PROCESSING

Course Code | 19ECE61 | CIE Marks | 50
Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50
Total Hours | 39 | Credits | 03

Course Learning Objectives:
This course will enable the students to
1. Homomorphic signals and systems are discussed with cepstral analysis.
2. Different types of adaptive filters with its application are elaborated.
3. Introduces multirate digital signal processing along with different forms of filter bank applications.

UNIT – I

Homomorphism signal processing: Homomorphic system, Complex Cepstrum, Properties of complex cepstrum, Complex cepstrum of exponential signals, Real Cepstrum, Implementation of cepstrum using DFT, Hilbert transform relations in cepstral analysis.
Homomorphic systems: Convolution and Deconvolution, Examples of Homomorphic signal processing, Communication signal processing and speech processing. 16 Hours

UNIT – II

Multi-rate Signal Processing: Multi-rate Systems, Decimation and Interpolation (integer and fractional), Decimation Filters, Interpolation File 15 Hours

UNIT – III

Interpolated FIR filters for decimation and interpolation filters. Uniform DFT filter banks, QMF banks Perfect Reconstruction, Poly Phase Filter structure, Poly Phase Filter structure for Decimation and Interpolation, Filter Banks, Half band and Multiband filters, PR systems. 8 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.
Course Outcomes:
At the end of the course student will be able to

1. Apply the concepts of DSP to find the DFT for a signal of length 8 or less; Design digital IIR filters using Butterworth/ Chebyshev approximation and digital FIR filter using windows for the given frequency specifications; Determine the cepstrum for the given first or second order system.

2. Discuss the properties of the Complex Cepstrum. Explain and Use the concept of homomorphic signal processing to Design a system for real time applications namely communication signal processing and speech processing.

3. Discuss Weiner Filter, Steepest Descent, LMS, Direct Least Square and RLS algorithms; Design first and/ or second order filters using Weiner Hopf equations and Steepest Descent Algorithm for the given signal conditions.

4. Discuss and Build systems for Adaptive filters in Noise canceller, Echo canceller, Side lobe canceller, Adaptive line enhancer. Apply the principle of decimation and interpolation to obtain the rate transformed signals for the given decimation/ interpolation factor.

5. Analyse uniform DFT filter banks, QMF banks perfect reconstruction, Poly Phase filter structure for Decimation and Interpolation, Half band and Multiband filters.

Mapping of PO's/ PSO's & CO's:

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TEXTBOOKS:
4. DSP Handbook.

REFERENCE BOOKS:

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FUZZY LOGIC

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Course Learning Objectives:
The course presents basics of Fuzzy Logic that aims to:
1. Introduce concept of Fuzzy logic, Classical and Fuzzy relations, Member functions and Fuzzy arithmetic.
2. Arm the students with the basics of Fuzzy rule based system.
3. Introduce Fuzzy classification.

UNIT – I

Introduction: Brief history of fuzzy theory and applications.
Classical sets: Operations on Classical Sets, Properties of classical sets, Mapping of classical sets to functions.
Classical and fuzzy relations: Cartesian Product, Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. From classical relations to fuzzy relations.
Composition of Fuzzy Relations.
Tolerance and Equivalence Relations: Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations.

UNIT – II

Fuzzy Arithmetic: Fuzzy Numbers and Decomposition Theorem, Addition and Subtraction of Fuzzy Numbers, Multiplication and Division of Fuzzy Numbers, Fuzzy Equations, Fuzzy Ranking.
Classical logic and fuzzy logic: Classical predicate logic-tautologies, Contradictions, Equivalence, Logical proofs, Deductive Inferences, Fuzzy logic, Fuzzy tautologies, contradictions, Equivalence and logical proofs, Other forms of the implication operation.
Fuzzifiers and Defuzzifiers: Fuzzifiers- different types, Defuzzifiers- different types, comparison of defuzzifiers.

UNIT – III

Fuzzy classification: Classification by equivalence relations-crisp relations, Fuzzy relations cluster analysis, Cluster validity, c-Means clustering-hard c-Means (HCM), Fuzzy c-Means (FCM), classification metric, Hardening the fuzzy c-Partition, Similarity relations from clustering.
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
A student who successfully fulfills the course requirements will be able to
1. Analyse classical sets and fuzzy sets based on membership function, characteristic function and basic operations.
2. Illustrate the properties of classical relation and fuzzy relation; determine the relation matrices for the given relationship between two sets; determine projections and cylindrical extensions and composition for the given fuzzy sets.
3. Explain Fuzzy numbers and decomposition theorem; Evaluate fuzzy numbers by performing addition, subtraction, multiplication and division on given fuzzy sets.
4. Discuss on Fuzzy inference rules based on Modus Ponens, Modus Tollens and Hypothetical Syllogism; Evaluate the fuzzy linguistic terms based on the hedges; Explain Fuzzifiers and Defuzzifiers.
5. Explain clustering based on equivalence relations, C-means clustering, Hard C-means and Fuzzy C-means; Illustrate the construction of fuzzy relation based on fuzzy partition matrix.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/108104049/16

***********
# LINEAR ALGEBRA FOR SIGNAL PROCESSING

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**Course Learning Objectives:**

Upon Completing this course, the students will be able to

1. Understand the concept of linear equations.
2. Explain vector spaces.
3. Define linear transformation.
4. Understand the concept of orthogonality.
5. Determine Eigenvalues and Eigenvectors for a given data.
6. Explain how linear algebra can be applied in real time applications.

**UNIT - I**

**Linear Equations:** Introduction. Systems of Linear Equations, Matrices and Elementary Row Operations, Solution Sets of Linear Systems.

**Vector Spaces:** Subspaces, Null Spaces, Column Spaces, Basis, Dimension, Rank.

**Linear Transformations:** Linear Transformations, Representation of Transformations by Matrices, Null Space and Range space of Linear Transformation. Basis and dimension calculation of Null Spaces and Range Spaces of Linear Transformation.

15 Hours

**UNIT – II**


**Eigenvalues and Eigenvectors:** Eigenvalues and Eigenvectors, The Characteristic Equation, Diagonalization, Four Fundamental Subspaces associated with Linear Transformation.

Singular Value Decomposition (SVD).

15 Hours

**UNIT – III**

**Applications in Signal Processing:** Least Square Problems, Least Square Estimation, Curve Fitting, QR Factorisation, Fourier Series and Projection, Data Compression using Orthonormal Transformations like DFT, DCT and SVD.

9 Hours

**Scheme of SEE Question Paper**

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from **Unit - I & Unit – II** and 1 full question from **Unit – III**.
Course Outcomes:

At the end of the course the student will be able to:

1. Solve a given set of Linear equations, Determine the rank, Null Spaces, Column Spaces for a given \( m \times n \) matrix.
2. Illustrate the representation of linear transformations using matrices; Calculate basis and dimension of null spaces and range spaces of linear transformation.
4. Determine Eigenvalues and Eigenvectors for a given matrix; Explain four fundamental subspaces associated with linear transformation. Apply Singular Value Decomposition (SVD) for a given \( m \times n \) matrix.
5. Analyse the applications of Linear Algebra towards Least Square Estimation, Curve Fitting, QR Factorization, Fourier Series and Projection, Data Compression using DFT, DCT and SVD

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. https://www.coursera.org/programs/nmam-institute-of-technology-on-coursera-e9clx?collectionId=&productId=ARf5_jvZEeeYEBLbuVGJ2g&productType=course&showMiniModal=true
2. https://nptel.ac.in/courses/111/108/111108066/
OPTICAL COMPUTING

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Course Learning Objectives:
This course will enable the students to
1. Understand the concept of optical processing.
2. Understand the concept of optical arithmetic.
3. Know about the optical devices.
4. Understand the concept of shadow casting and symbolic substitution.

UNIT – I

Linear Optical Processing: Introduction, Photographic film, Spatial filtering using binary filters, Holography, Inverse filtering, De-blurring
Optical Arithmetic: Introduction, Half-tone processing, Non-linear optical processing, Arithmetic operation

16 Hours

UNIT – II

Recognition using analog optical systems: Introduction, Matched filter, Joint transform correlation, Phase only filter, AM recognition filters, Generalized correlation filter, Mellin transform based correlation
Devices: Non-linear devices, Integrated objects, Threshold devices

13 Hours

UNIT – III

Shadow casting and symbolic substitution: Shadow casting system and design algorithm, POSC logic operation, POSC multiprocessor, Parallel ALU using POSC, Sequential ALU using POSC, Symbolic substitution

10 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Illustrate the optical properties of a photographic film and discuss the various spatial filtering operations that can be realized using a linear optical processor. Discuss holography as a means of synthesizing complex filters. Explain inverse and Weiner filters.
2. Illustrate the computing applications of coherent optical processors in the areas of spatial filtering, non linear operations and arithmetic.
3. Illustrate the working of Character Recognition filters such as Matched filter, Joint Fourier Transform filter, Phase-only filter and Amplitude Modulated Phase-only
filter. Use the properties of Mellin transforms and establish the interrelationship between Mellin and Fourier Transform.

4. Illustrate the working of devices that are used to realize digital optical computing schemes.

5. Illustrate Shadow casting setup and POSC Design Algorithm. Design a parallel and sequential ALU. Implement the optical symbolic substitution schemes.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

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PATTERN RECOGNITION

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Course Learning Objectives:
This course will enable the students to
1. Make use of Probability & Statics and Image Processing to understand the basic concepts of Pattern Recognition.
2. Learn various parameters used in Pattern Recognition by choosing appropriate decision making technique.
3. Perform clustering and apply linear regression concepts for Pattern Recognition.
4. Apply the knowledge of linear models for classification on various pattern recognition studies.

UNIT – I

Introduction: Pattern recognition systems, the design cycle, learning and adaptation.
Mathematical preliminaries: Probability of events, Random variables, joint distributions and densities, Moments of random variables, estimation of parameters from samples, minimum risk estimators.
Bayesian Decision Theory: Introduction, Continuous features, Minimum error rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features.
Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Bayesian estimation: Gaussian case  

UNIT – II

Non Parametric techniques: Introduction, density estimation, parzen Windows, k-Nearest neighbor estimation, Fuzzy classification
Linear discriminant functions: Introduction, linear discriminant functions and decision surfaces, generalized linear discriminant functions, Gradient descent procedures;
Clustering: Introduction, Hierarchical clustering, partitional clustering.
Dimensionality reduction: Principal component analysis, Fisher discriminant analysis.  

UNIT - III

Introduction to Artificial Neural Networks: Biological Neuron – Artificial Neural Model - Types of activation functions, Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. Learning: Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem. L1, L2  

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes: 
At the end of the course the student will be able to
1) Estimate mean and variance of a probability density function from given samples of size not more than 20 using parameter estimation methods; The method of moments, maximum likelihood method, unbiased estimator.
2) Apply Bayes theorem for classification of continuous and discrete features with minimum error.
3) Apply window based technique to determine the probability density function of given samples of size not more than 6 using rectangular/triangular/Gaussian windows and K-NN, Fuzzy methods for classification of samples of size not more than 10. Determine the coefficients discriminant function in the next iteration given the coefficients of current iteration.
4) Apply clustering methods; single-linkage/complete-linkage/Average-linkage/k-means/Ward’s method/Forgy’s method for pattern classification and PCA, Fisher discriminant analysis for dimensionality reduction of features.
5) Make use of single layer and two-layer feed forward neural networks and Gradient descent algorithm to implement truth table with binary inputs not more than three.

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TEXTBOOKS:

REFERENCE BOOKS:

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SPEECH PROCESSING

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Course Learning Objectives:
This course will enable students to
1. Obtain knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Describe signal processing techniques for real-time processing of speech signals.
3. Discover practical aspects of speech processing and relate experimental methodology into practice.

UNIT – I


Time-domain methods for speech processing: Time dependent processing of speech, Short time energy and average magnitude, Short-time average zero crossing rates. 16 Hours
UNIT – II

**Analysis and Synthesis:** Brief Applications of temporal processing of speech signals in synthesis, Enhancement, Hearing applications and clear speech.

**Frequency domain methods for speech processing:** Introduction, Definitions and properties: Fourier transforms interpretation and linear filter interpretation, Sampling rates in time and frequency.

15 Hours

UNIT – III

**Filter bank summation and overlap add methods:** Short-time synthesis of speech, Sinusoidal and harmonic plus noise method of analysis/synthesis.

**Homomorphic speech processing:** Introduction, Homomorphic system for convolution, Complex cepstrum of speech, Homomorphic vocoder.

8 Hours

**Scheme of SEE Question Paper**
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

**Course Outcomes:**
At the end of the course the student will be able to

1. Identify and model basic characteristics of human speech production and hearing mechanisms.
2. Develop time domain methods to design applications involving short time analysis of speech signals.
3. Develop algorithms for analysis and synthesis of digital speech signals in time and frequency domains.
5. Create a plan to develop end to end subsystems using homomorphic signal processing for speech signals.

**Mapping of PO’s/ PSO’s & CO’s:**

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**TEXTBOOK:**
REFERENCE BOOKS:

NPTEL/MOOC Link:
1. http://nptel.ac.in/courses/117105145/
2. http://nptel.ac.in/courses/126104006/23

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BIG DATA ANALYTICS

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Course Learning Objectives:
This Course will enable students to
1. Understanding of the statistical procedures most often used by practicing engineers.
2. Understand Forecasting methods and apply for business applications.
3. Learn tips and tricks for Big Data use cases and solutions.
4. Able to apply fundamental algorithmic ideas to process data.
5. Learn to apply hypotheses and data into actionable predictions.
6. Constructing a real world application with data storage and retrieval.

UNIT – I

Introduction to Big Data Analytics: Definition, Overview and Big data in Industry.
Overview of Data Analytics Lifecycle: Phases of typical analytics lifecycle-discovery, Data preparation, Model planning, Model building.
Introduction to R programming: Using R programming for Initial Analysis of the Data, Basic visualization using R. **16 Hours**

UNIT – II

Advanced Analytics and Statistical Modeling for Big Data - Theory and Methods: Core methods used by data scientist, Candidate selection using Naïve Bayesian Classifier, Categorization using K-means clustering algorithm and association rules, Predictive modelling using decision trees, Linear and logistic regression and time series analysis and text analysis. **13 Hours**

UNIT – III

Advanced Analytics and Statistical Modeling for Big Data – Technology and Tools: Analytic tools for unstructured data, MapReduce and the Hadoop ecosystem. In-database analytics with SQL extensions and other advanced SQL techniques and MADlib functions for in-database analytics. **10 Hours**
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student should be able to
1. Explain the phases of data analytics.
2. Use R programming to Discuss the data analysis phase.
3. Explain the classifiers used for data selection by data scientist; Apply Baye’s theorem to solve problems on Classifiers.
4. Describe the predictive statistical models available for data analytics.
5. Explain the basics of database techniques to identify and classify the types of data.

Mapping of PO’s/PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. https://onlinecourses.nptel.ac.in/noc16_mg06

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**COMPUTER OPERATING SYSTEMS**

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**Course Learning Objectives:**

This course will enable students to

1. Define and Describe operating systems, Resource allocation, Operating System structure, Operating System operations and services.
2. Explain Process concept, Operations on processes, Inter process communication, Multi-threaded Programming and Process management.
3. Explain memory management concepts as applicable to kernel and programs in an Operating System.
4. Define and Describe Virtual memory, Paging policies and Scheduling of processes in an Operating System.

**UNIT – I**

**Introduction And Overview Of Operating Systems**: Introduction to Operating system, Goals of an O.S, Operation of an O.S, Functions performed by an OS, Computational structures and OS responsibilities, O.S and the computer system, Efficiency and user convenience, Classes of operating systems, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, Distributed operating systems.

**Structure of the Operating Systems**: Structure of an Operating system,, Configuring and installing of the Kernel, Operating system with monolithic structure, Layered design, Virtual machine operating systems, Kernel based operating systems, and Microkernel based operating systems.

**UNIT – II**

**Process Management**: Concept of Processes and Programs, Programmer view of processes, OS view of processes, Interacting processes, Threads, Processes in UNIX, Threads in Solaris.

**Memory Management**: Managing the memory hierarchy, Memory allocation preliminaries, Memory allocation to process, Reuse of memory, Contiguous and noncontiguous allocation to programs, Paging, Segmentation, Segmentation with paging, Kernel memory allocation.

**UNIT – III**

**Virtual Memory**: Virtual memory basics, Demand paging, Address translation and page fault generation, Address translation in multi programming systems, Operation of a virtual memory handler, Page replacement policies, Shared pages, UNIX virtual memory.

**Scheduling**: Scheduling preliminaries, Non- Preemptive scheduling algorithms-FCFS,SRN,HRN, Preemptive scheduling algorithms-RR,LCN,STG, Scheduling in Practice- Long-term scheduling, Medium and short term scheduling.

9 Hours
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the students will be able to
1. Describe Computational structure, operations and services of Operating System.
2. Explain fundamental classes and structures of Operating System.
3. Describe how processes and threads are used in operating system context.
4. Illustrate how memory is managed in operating system and compare memory management techniques.
5. Describe Virtual memory, paging policies, Scheduling of processes in an Operating System and apply the concepts of page replacement policies and scheduling to achieve effective resource utilization.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

REFERENCE BOOK:

************
# CRYPTOGRAPHY

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**Course Learning Objective:**

The course presents the basics of Cryptography that aims to:

1. Introduce OSI model, different types of encryption and decryption techniques.
2. Introduce basic mathematical functions required to solve most of the Cryptographic algorithms.
3. Arm the students with ability to select appropriate cryptographic algorithm based on the requirement.
4. Introduce various Private and Public key cryptographic algorithms.
5. Introduce basics of Digital Signature, Hash and MAC algorithms.

## UNIT – I

**Overview:** Services, Mechanisms and attacks, OSI security architecture, Model for network security.

**Introduction to finite fields:** Groups, Rings and Fields, modular arithmetic, Euclid algorithm, Finite fields of the form $\text{GF}(p)$, polynomial arithmetic, Finite fields of the form $\text{GF}(2^n)$.

**Introduction to number theory:** Prime numbers, Fermat's and Euler's theorem, Chinese Remainder Theorem, Discrete logarithm.

**Classical encryption techniques:** Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography.

16 Hours

## UNIT – II

**Block ciphers and DES:** Fiestel ciphers, Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems, IDEA, Double DES, Triple DES, Blow–Fish, RC4, RC5.

**Public Key Cryptography and RSA:** Principles of Public Key Cryptosystems, RSA algorithm, Problems, Knapsack problem, ElGamal cryptosystem.

**Other public key cryptosystems and key management:** Key management, Diffie Hellman key exchange, Man in the middle attack, Elliptic curve arithmetic, Elliptic curve cryptography, Problems. Analog of Diffie-Hellman on ECC, Analog of ElGamal on ECC.

16 Hours

## UNIT – III

**Message authentication and hash functions:** Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of Hash functions, and MAC, SHA-1 and MD5.

**Digital signature and authentication protocol:** Digital signature and authentication protocol, Digital signature standard.

Introduction to quantum cryptography, Introduction to Block chain technology. 7 Hours
Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Explain the security mechanism and attacks on a Network; Describe the OSI architecture for Network Security; Perform encryption and decryption using Symmetrical cipher models.
2. Explain the properties of Group, Rings and Fields; Apply the mathematical techniques Euclid algorithm, CRT and Fermat Theorem to solve the problems of finite field (GF (p)).
3. Explain the modes of operation of Block Ciphers, RC4 and Blow-Fish; Describe the working of Data Encryption Standard (DES); Determine the cipher using S-DES (8-Bit data).
4. Explain the working of Public key ciphers; perform the encryption and decryption using Public key ciphers.
5. Explain the message authentication and Hash function; describe digital authentication protocol and standards.

Mapping of PO's/ PSO's & CO's:

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3 – High 2 – Medium 1 - Low

TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
1. http://nptel.ac.in/courses/106105031/
2. http://nptel.ac.in/courses/106103015/
DATA STRUCTURES USING C++

<table>
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Course Learning Objectives:
This Course will enable students to
1. Outline the concepts of data structures, types and overview of data structures.
2. Make use of linear data structures like stack, queue and their applications.
3. Make use of nonlinear data structures like binary tree and their usage.

UNIT – I

Arrays And Matrices: Arrays, Matrices, Special matrices sparse matrices.
15 Hours

UNIT – II

Stacks: The abstract data types, Derived classes and inheritance, Formula-based Representation, Linked representation, Applications.
Queues: The abstract data types, Derived classes and inheritance, Formula-based representation, Linked representation, Applications.
Skip Lists and Hashing: Dictionaries, Linear representation, Skip list representation, Hash table representation.
15 Hours

UNIT – III

Binary And Other Trees: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT and class extensions.
Search Trees: Binary search trees, B-trees, Applications.
9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
After studying this Course, the student should be able to:
1. Describe the concepts of Data Representation, Functions and Dynamic memory allocation in data structures.
2. Describe the concepts of Linear Lists, Arrays and Matrices in data structures.
3. Explain the data types, inheritance classes and representation of stacks & queues.
4. Explain the concepts of data redundancy and data integrity using skip listing & hashing.
5. Explain the concepts of finding the solution by Tree search algorithm.
## Mapping of PO’s/ PSO’s & CO’s:

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3 – High  
2 – Medium  
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**TEXTBOOK:**


**REFERENCE BOOKS:**


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## OBJECT ORIENTED PROGRAMMING IN JAVA

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**Course Learning Objectives:**

The course presents basic Object Oriented Programming in Java programming that aims to

1. Introduce Java Operators, Arrays and Data Structures.
2. Arm the students with the basic object oriented programming concepts.
3. Introduce different techniques like Inheritance, Multithreaded Programming and HTML.

**UNIT – I**

**Introduction to Java:** Java history. Connection between Java and Internet, JVM – The heart of Java, Java’s Magic Bytecode, Servlets: Java on the Server Side and Java Buzzwords, Overview of Java: Two Paradigms, Three OOP Principles – Encapsulation, Inheritance, Polymorphism, Lexical issues.  

3 Hours


7 Hours

**Methods and Classes:** Overloading Methods, Argument Passing, Returning Objects, Recursion, Access Specifiers, Static member, Final variable, String Class.  

4 Hours
UNIT – II

Inheritance: Inheritance basics, superclass, Multilevel Inheritance, Method Overriding, Final and abstract keyword, Basics of Packages and Interfaces.  

Exception Handling: Exception Types, Try and catch, Multiple catch Clauses, Nested try Statements, Throw, Java’s Built-in Exceptions. 

Multithreaded programming: Main Thread, Creating threads, Extending the thread class, Thread priority, Synchronization, Stopping and blocking a thread, Basics of Enumerations. 

Java Servlets: Benefits, A simple Java Servlet, Anatomy of a Java Servlet, Reading data from a client, Reading HTTP Request Headers, Sending data to a client and writing the HTTP Response Header, Working with Cookies, Tracking Sessions.

UNIT – III

Java Server Pages (JSP), JavaScript & HTML: Basics of JSP Tags, Attributes, URLs, Links, Applet, The APPLET Element, Naming Applets JAR Archives, The OBJECT Element and Passing Parameters to Applets. Introduction to JavaScript(JS), HTML DOM, JS Data Type, Loops in JS, functions in JS, Embedding JS in HTML.

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
A student who successfully fulfills the course requirements will have demonstrated:
1. Explain the various data types and variables of Java Programming.
2. Explain the various principles of the object oriented programming; Develop simple Object oriented programs using the concept of Methods & Classes.
3. Apply the concept of Inheritance, Exception handling, multithreaded programming to write a program using JAVA.
4. Develop simple HTML codes using Java servlets.
5. Explain the front-end development of webpage using applets and Java Server page.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOKS:

REFERENCE BOOKS:

NPTEL/ MOOC Link:

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REAL-TIME OPERATING SYSTEMS

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Course Learning Objectives:

This course will enable the students to
1. Understand the difference between a Real Time System and General computing system and calculate performability and program runtime in a Real Time System.
2. Be familiar with various task scheduling methods and their intended usage.
3. Learn various multiple access protocols used in Real Time Communication.
4. Know the services offered issues involved in Real Time Operating Systems.
5. Analyze and design the architecture of a Real Time Systems.

UNIT – I


Task Assignment & Scheduling: Classical Uniprocessor scheduling algorithms: Rate Monotonic and Earliest Deadline First; Multiprocessor scheduling: Utilization-Balancing Algorithm, Next-Fit Algorithm, Bin-Packing Assignment.  16 Hours

UNIT – II

Real Time Communication: Network topologies, Network architecture issues; Protocols: Contention-based protocol (VTCSMA only) and Token-based protocols: Timed Token Protocol.

Real Time Operating Systems (RTOS): OS Services, Real Time & Embedded System OS, RTOS Task scheduling models, OS security issues.  16 Hours
UNIT – III

RTOS Tools with case studies: Use of MUCOS/OS-II, Use of Vx Works, Case studies of Automatic Chocolate Vending machines, Coding for sending application layer byte streams on a TCP/IP network. (Excluding programming). 7 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Describe the structure, types and issues in the real time systems, illustrate the performability of a given real-time system and estimate source code run time.
2. Illustrate RM and EDF uniprocessor scheduling algorithm and Utilization-Balancing, Next-Fit and Bin-Packing Assignment multiprocessor scheduling algorithms.
3. Describe the network architectural issues and VT-CSMA, Timed token and Token ring real time protocols for real-time communication.
4. Explain RTOS services, Kernel services, Scheduling algorithms and OS security issues.
5. Describe the features of MUCOS and Vx-Works along with ACVM and Sending application layer bytes on a TCP/IP protocol.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High  2 – Medium  1 - Low

TEXTBOOKS:

REFERENCE BOOK:
NPTEL/ MOOC Link:
1. http://nptel.ac.in/downloads/106105086/

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Course Learning Objectives:
Upon Completing this course, the students will be able to
1. Outline the basic structure and operation of a digital computer.
2. Learn about arithmetic unit and perform fixed point and floating point addition, subtraction, multiplication and division in binary 2’s complement number system.
3. Appreciate the fine grain details of basic processing unit in terms of control unit, arithmetic and logical unit, memory unit and I/O unit.
4. Remember and comprehend the hierarchical memory system including cache memories and virtual memory.
5. Tell how different ways of communication with I/O devices and standard I/O interfaces.

UNIT – I

Basic Computer Organization: Basic structure of computer and its components, Memory Location and Addresses, Memory operations, Instructions and instruction sequencing, Comparison of RISC and CISC architectures.

Arithmetic Operations: Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer division, Floating-point numbers and operations on numbers in IEEE format.

UNIT – II

Memory Systems: Memory system: Basic concepts, Semiconductor RAM memories, Read only memories, Speed, Size and cost, Cache memories – Mapping functions, FIFO and LRU replacement policies, Performance considerations, Virtual memories, Secondary storage.

Pipelining: Introduction to pipelining, Instruction level pipelining (ILP), Pipeline hazard- Structural, Data, and control hazards.
UNIT – III

Input/ Output Organization: Input / Output organization: Accessing I/O Devices, Interrupts – interrupt hardware, Enabling and disabling interrupts, Exceptions, Handling multiple devices, Controlling device requests, Buses, Direct memory access, Interface circuits (parallel, Serial), Standard I/O Interfaces – PCI bus, SCSI bus, USB (Basics only) 09 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Describe the organization of computer, its component parts, structural design and connectivity.
2. Carry out the multiplication & division operations performed on numbers in IEEE format.
3. Comprehend the basic structure of processors, and modern trends in processor technology.
4. Explain the structure of memory systems in cache memories and virtual memory.
5. Explain the design of basic and standard I/O interfaces.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:
DATA BASE MANAGEMENT SYSTEM

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Course Learning Objectives:

This course will enable students to

1. Describe databases and database management systems.
2. Understand database structures and their working principles.
4. Learn how to relate tables together in a database.
5. Recognize structured query language (SQL) statements and write queries using SQL.
6. Construct the stages of database project design-query processing and optimizing database, concurrency control using locking techniques.
7. Understand the issues associated with Transaction Processing and Recovery.

UNIT – I

Introduction: DBMS Administrators, Designers, Users, Developers & maintenance users of DBMS.


Relational data model & Relational algebra: Queries in relational algebra. 16 Hours

UNIT – II

SQL- A Relational Database language, Different clauses & example queries.

Database Design: I, II, III Normal forms, BCNF, Join dependencies, IV & V Normal forms. 14 Hours
UNIT – III

Query processing & Optimization, Transactions, Recovery & Concurrency control. Security & Integrity constraints. 9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course student will be able to
1. Explain the working principle of a database structure.
2. Construct a simple database model using Entity- Relationship Modeling.
3. Develop the queries using SQL to retrieve data from database.
4. Describe the stages of database project design considering the normal forms of database design.
5. Explain the issues associated with Query Processing & Optimization related to data retrieval from database.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

NPTEL/ MOOC Link:
1. https://onlinecourses.nptel.ac.in/noc15_cs14

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FINANCE MANAGEMENT

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Course Learning Objectives:
This Course will enable students to
1. Develop basic financial management knowledge essential to make a managerial career in professional life.
2. Impart some of the crucial and basic skills required to work in the area of budgeting, investment and financial decision making.
3. Enable in making a right decisions on selection of projects for investment.
4. Understand the basics of finance and financial markets, project evaluation and selection.

UNIT – I

Financial Management: Concepts and Meaning – Introduction to Finance; Objectives of Financial Management; Profit Maximization; EVA; Changing Role of Financial Managers.

Time Value of Money: Techniques and Applications of Compounding and Discounting. 13 Hours

UNIT – II

Cost of Capital: Sources of various Types of Capital; Cost of Debenture Capital; Cost of Preferential Capital; Cost of Term Loans; Cost of Equity Capital.


Inventory Management: Techniques of Inventory Management and Control – EOQ, ABC Analysis, Just-in-Time (JIT) System. 13 Hours

UNIT – III

Capital Budgeting (Investment Evaluation Techniques): Payback Period Method; Present Worth Method; Annual Worth Method; Future Worth Method; Estimation of IRR.

BreakEven Analysis: Estimation of Break-Even Point and Values. 13 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course the student will be able to
1. Describe the basic financial management skills required for a professional.
2. Explain techniques and applications of compounding and discounting and calculate compounded/discounted amount for the given proposal.
3. Evaluate the given investment option by capital budgeting techniques.
4. Describe the basics of cost of capital and working capital. Determine the cost of capital for the given investment option.
5. Describe the basics of inventory management and calculate the economic order quantity and reorder point for the given conditions. Calculate breakeven point for the given manufacturing setup.
Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOKS:

REFERENCE BOOKS:

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OBJECT ORIENTED PROGRAMMING WITH C++

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Course Learning Objectives:
The course presents basic Object Oriented Programming using C++ programming that aims to:
1. Arm the students with the basic object oriented programming concepts.
2. Introduce different techniques like Inheritance, Polymorphism, Virtual Functions and Constructors.
3. Arm the students with the necessary constructs of OOP C++ programming.
4. Introduce concepts like template classes and STL libraries.

UNIT – I

Principles of OOP: OOP paradigm, Procedural Vs. Object Oriented Programming, Benefits and applications of OOP.
C++ Features: Program structure, Namespace, Identifiers, Variables, Constants, Enum, Operators, Typecasting, Control structures.
C++ Functions: Call and Return by reference, Inline functions, Overloading of functions, Default arguments.
Objects and classes: Basics of object and class in C++, Private and public members, Static data and function members, Constructors and their types, Destructors, Operator overloading, Type conversion, Friend functions. **16 Hours**

UNIT – II

Inheritance: Concept of Inheritance, Types of inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid, Protected members, Overriding, Virtual base class.

Polymorphism: Pointers in C++. Pointes and Objects, This pointer, Virtual and pure virtual functions, Implementing polymorphism.

I/O and File management: Concept of streams, cin and cout objects, C++ stream classes, Unformatted and formatted I/O, Manipulators, File stream, C++ File stream classes, File management functions, File modes, Binary and random files. **16 Hours**

UNIT – III

Templates, Exceptions and STL: What is template? function templates and class templates, Introduction to exception, Try-catch-throw, Multiple catch, Catch all, Rethrowing exception, Implementing user defined exceptions, Overview and use of Standard Template. **7 Hours**

Scheme of SEE Question Paper

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:

A student who successfully fulfills the course requirements will be able to

1. Explain the basic principles and features of object-oriented programming using C++ and hence analyse the given program.
2. Illustrate the concepts of functions, classes and objects using object-oriented programming with C++.
3. Illustrate the concepts of inheritance and polymorphism to write a program using C++.
4. Illustrate I/O and File management techniques using the concepts of stream classes in C++.
5. Apply the concepts of exception handling and templates to write a program using C++.

Mapping of PO’s/ PSO’s & CO’s:

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TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
2. https://www.coursera.org/learn/c-plus-plus-a

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PROJECT MANAGEMENT

<table>
<thead>
<tr>
<th>Course Code</th>
<th>19ECE85</th>
<th>CIE Marks</th>
<th>SEE Marks</th>
<th>Credits</th>
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Course Learning Objectives:
This course will enable students to
1. Understand key concepts of project management and project lifecycle.
2. Practice the key stages of managing projects.
3. Develop increased awareness of available resources to further develop project management skills.
4. Understand how to apply new knowledge to their own projects and set realistic goals for moving forwards.

UNIT – I

Introduction: Characteristics of project, Neat types and forms. Systems approach: Concepts project as a system, design algorithm.
Project organization: Formal and informal organization, Forms of organization of structures, Project organization, Matrix organization, Pure project organization, Selection of structures. 15 Hours

UNIT – II

Work definition: Planning, work break down, Responsibility integration with organizational structure detailed project plan.
Project scheduling: Activities, Events Gantt charts network scheduling pert, CPM resource constraints.
Project costing: Estimation and budgeting, Project cost, account systems cost, Schedules, Forecasting, Financial evaluation of a project, Social costs. 15 Hours
UNIT – III

Project control and management: Phases types, Variance analysis problems, Role of project manager, Team work and leadership.
Project termination: Varieties of project termination processes, Final report.
Computers in project management: Monitoring information, System software packages, Utility and limitations.

9 Hours

Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Course Outcomes:
At the end of the course student will be able to:
1. Explain project management and its concepts.
2. Describe project organizations and its structure.
3. Describe effective project execution and control techniques that result in successful projects.
4. Demonstrate a strong working knowledge of ethics and professional responsibility.
5. Describe effective organizational leadership and change skills for managing projects and project teams.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High

2 – Medium

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TEXTBOOK:

REFERENCE BOOKS:

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## PYTHON PROGRAMMING

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### Course Learning Objectives:
Upon Completing this course, the students will be able to
1. Demonstrate basic understanding of python programming language.
2. Illustrate and relate the advanced python concepts with reference to OOP concepts.
3. Build python programs for real world applications.

### UNIT – I

**Introduction:** Getting Started with Python Programming, Running Code in the Interactive Shell, Input, Processing and Output, Editing, Saving and Running a Script, Behind the Scenes: How Python Works.

**Data Types and Expressions:** Data Types, String Literals, Escape Sequences, String Concatenation, Variables and the Assignment Statement, Program Comments and Docstrings, Numeric Data Types and Character Sets, Arithmetic Expressions.


14 Hours

### UNIT – II

**Strings and Text Files:** The Structure of Strings, The Subscript Operator, Slicing for Substrings, Strings and Number Systems conversion from one form to another, Text files (reading and writing text/numbers from/to a file).

**Lists and Dictionaries:** Lists literals and basic operators, Search, Replace, Insert element from List, Tuples, Defining simple functions, Dictionary literals, adding/accessing/removing keys, Traversing dictionaries.

**Design with Functions:** Functions as Abstraction Mechanisms, Functions Eliminate Redundancy, Functions Hide Complexity, Design with Recursive Functions.

14 Hours

### UNIT – III

**Design with Classes:** Getting Inside Objects and Classes, Structuring Classes with Inheritance and Polymorphism, operator overloading (eq, str, etc); abstract classes; exception handling, try block.

**Introduction GUI and CGI:** creating simple GUI; buttons, labels, entry fields, dialogs and fonts, Multithreading: Threads and Processes, Basics of CGI interface and its applications.

11 Hours

### Scheme of SEE Question Paper
There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from **Unit - I & Unit – II** and 1 full question from **Unit – III**.
Course Outcomes:
At the end of the course the student will be able to
1. Explain the fundamentals of python programming. Explain and use the data types and expressions to write python programs using PyCharm.
2. Use the concepts of loops: for, if, else if and while loops for implementation of logical and mathematical expressions using PyCharm.
3. Explain strings, conversion of strings to numbers, lists, tuples and dictionaries for writing python programs using PyCharm.
4. Apply the concepts of functions using PyCharm.
5. Determine the attributes and behaviour of classes required by a python program; Design a Graphical User Interface using Tkinter.

Mapping of PO’s/ PSO’s & CO’s:

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3 – High 2 – Medium 1 - Low

TEXTBOOK:

REFERENCE BOOKS:

NPTEL/ MOOC Link:
2. https://www.coursera.org/learn/python

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