College Calendar 2021-22

Department of

Computer Science &

Engineering

Syllabus

of

2nd Year

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.

(An Autonomous Institution affiliated to VTU, Belgavi)

NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India

ISO 9001:2015 Certified, Accredited by NAAC with “A” Grade

COLLEGE CALENDAR

2021-22

(III & IV 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

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 Poojarthi               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
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

PORTS 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. Vishwanatha  
   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
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REGULATIONS

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14. AWARD OF DEGREE
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17. CONDUCT AND DISCIPLINE
18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE
19. LISTS OF MAJOR SCHOLARSHIPS
REGULATIONS COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE PROGRAMMES OF NMAM INSTITUTE OF TECHNOLOGY, NITTE

Karkala, Udupi Dist., Karnataka

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 $5 \frac{1}{2}$ days a week.

Suggested Break down of Academic Year into Semesters

<table>
<thead>
<tr>
<th>1. No. of Semesters / Year Three; Two being Main semesters (odd, even) and one being a supplementary semester; after 2 main semesters.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(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.)</td>
</tr>
</tbody>
</table>

| 2. Semester Duration | Main semester (odd, even) each 19 Weeks; Supplementary Semester 8 Weeks |
| 3. Academic Activities | Main Semester |
| (Weeks): | Registration of Courses & Course Work (16.0) |
| | Examination Preparation and Examination (3.0) |
| | Total (19) |
| | Supplementary Semester |
| | Registration of Courses & Course Work (5.0) |
| | Examination Preparation and Examination (3.0) |
| | Total (8) |
| | Declaration of results: 2 weeks from the date of last examination |
| | Inter- Semester Recess: After each Main Semester (2) |
| | Total Vacation: 10 weeks (for those who do not register for supplementary semester) and 4 weeks (for those who register for supplementary semester) |

(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>
<tr>
<td>8.</td>
<td>Internship</td>
<td>03</td>
</tr>
<tr>
<td>9.</td>
<td>Mandatory Learning courses</td>
<td>Non-Credit</td>
</tr>
</tbody>
</table>

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>
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</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.

1. 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;

2. 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.

3. 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.

4. 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).

5. **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.**

6. **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).

1. 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.

2. 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.

3. 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.

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

CGPA is computed as follows:

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

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>
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</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>

Percentage = (GPA - 0.75) x 10

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.
(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 reappeared 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 reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared 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 reappeared 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 students entering 4 year degree programme should earn 100 activity points & every students 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>
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<tbody>
<tr>
<td>For SC/ST Students</td>
<td>Income : Below Rs.2,50,000/-</td>
<td>Online app.</td>
<td>SSP</td>
</tr>
<tr>
<td></td>
<td>Income : Above Rs.2,50,000/- to Rs.10,00,000/-</td>
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<td></td>
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<tr>
<td>For Others</td>
<td>Category I :</td>
<td>Online app.</td>
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<td></td>
<td>Category 2A, 3A, 3B, &amp; GM</td>
<td>Online app.</td>
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</tr>
<tr>
<td></td>
<td>Income Below Rs.1,00,000/-</td>
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</tr>
<tr>
<td></td>
<td>Minority students</td>
<td>Online app.</td>
<td>NSP &amp; SSP</td>
</tr>
<tr>
<td></td>
<td>Income Below Rs.2,50,000/-</td>
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<tr>
<td>Parents must have Beedi Id. Card</td>
<td>Beedi Scholarship</td>
<td>Online app.</td>
<td>scholarships.gov.in or nsp.gov.in</td>
</tr>
<tr>
<td>1st year Students</td>
<td>Central Sector Scholarship (MHRD)</td>
<td>Online app.</td>
<td>scholarships.gov.in or nsp.gov.in</td>
</tr>
<tr>
<td>1st year Students</td>
<td>AICTE-Pragati.etc</td>
<td>Online app.</td>
<td><a href="http://www.aicte-india.org">www.aicte-india.org</a></td>
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</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

COMPUTER SCIENCE & ENGINEERING

III & IV SEMESTER

With

Scheme of Teaching
& Examination

AY 2021-22
### DEPARTMENT: COMPUTER SCIENCE & ENGINEERING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Faculty Name</th>
<th>Qualification</th>
<th>Designation</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. Niranjan N. Chiplunkar</td>
<td>Ph.D</td>
<td>Professor &amp; Principal</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Jyothi Shetty</td>
<td>Ph.D</td>
<td>Professor &amp; Head</td>
</tr>
<tr>
<td>3.</td>
<td>Dr. D. K. Sreekantha</td>
<td>Ph.D</td>
<td>Professor</td>
</tr>
<tr>
<td>4.</td>
<td>Dr. Sarika Hegde</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
</tr>
<tr>
<td>5.</td>
<td>Dr. Venugopala P.S.</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
</tr>
<tr>
<td>6.</td>
<td>Dr. Roshan Fernandes</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
</tr>
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<td>7.</td>
<td>Dr. Sudeepa K.B</td>
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</tr>
<tr>
<td>8.</td>
<td>Dr. Aravinda C V</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
</tr>
<tr>
<td>9.</td>
<td>Dr. Vikram Raju R</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
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<td>10.</td>
<td>Dr. Radhakrishna</td>
<td>Ph.D</td>
<td>Asso. Prof</td>
</tr>
<tr>
<td>11.</td>
<td>Mr. Raju K</td>
<td>M.Tech, (Ph.D)</td>
<td>Asso. Prof</td>
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<tr>
<td>12.</td>
<td>Mr. Pradeep Kanchan</td>
<td>M.Tech. (Ph.D)</td>
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<tr>
<td>13.</td>
<td>Mr. Vijaya Murari T.</td>
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<tr>
<td>15.</td>
<td>Dr. Anisha P Rodrigues</td>
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<tr>
<td>16.</td>
<td>Mr. Ganesh Pai</td>
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<tr>
<td>20.</td>
<td>Mr. Sampath Kini</td>
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<td>Mrs. Asmita Poojary</td>
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<td>Mrs. Aishwarya D. Shetty</td>
<td>M.Tech.</td>
<td>Asst. Prof Gd I</td>
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</table>
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION:
To be a center of excellence in Computer science & Engineering education and research, empower the lives of individuals to fulfill their academic excellence, professional passions, and partnership for community development.

MISSION:
- To impart both theoretical and practical knowledge through the state-of-the-art concepts and technologies in Computer Science and Engineering.
- To inculcate values of professional ethics, leadership qualities and lifelong learning.
- To prepare professionals for employment in industry, research, higher education, and entrepreneurship to benefit the society.

Program Educational Objectives (PEOs):
After three years of graduation, our graduates in Computer Science & Engineering should be able to:
1. Apply appropriate theory, practices, and tools to the specification, design, implementation, maintenance, and evaluation of software systems of Computer Science & Engineering in the workplace, for advanced studies or for societal needs.
2. Function effectively in the workplace or maintain employment through lifelong learning such as professional conferences, certificate programs or other professional educational activities, ethics, and societal awareness.
3. Contribute to their computing profession and society by working in teams to design, implement, and/or maintain components of computer software systems.

Program Outcomes (POs):
Engineering Graduates will be able to:
1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. 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.
3. 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.
4. 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.
5. 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.

6. 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.

7. 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.

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

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

10. 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.

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

12. 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.

Program Specific Outcomes (PSOs):

1. Foundations of Computing: Apply the knowledge of principles and working of the hardware and/or software aspects of computer systems in the domains of Systems Engineering, Network Engineering, Software Engineering, Data Engineering and Intelligent Systems.

# DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

## SCHEME OF TEACHING AND EXAMINATION

### III SEMESTER B.E.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
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### DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

#### SCHEME OF TEACHING AND EXAMINATION

#### IV SEMESTER B.E.

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<th>Sl. No.</th>
<th>Sub. Code</th>
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Course Learning Objectives:
The primary Course Learning Objective is to Prepare the background in abstraction, notation and critical thinking of mathematics related to computer science. The course will enable students to:
1. Learn the set theoretic concept and its application in automata theory.
2. Understand the association of functions, relations, partial ordered set and lattices with problems related to theoretical computer science and network models.
4. Study the core idea of mathematical induction, recursive relations and their application in the analysis of algorithms. Understand the application of mathematical logic and methods of proof in problems associated with formal verification, reasoning and decision making.

UNIT – I

SET THEORY:
Sets and subsets, Operations on Sets: Basic set operations, algebraic properties of sets. Computer Representation of Sets (Textbook – 2, Chapters: 1.1., 1.2, 1.3)

RELATIONS AND ITS PROPERTIES:
Product sets and partitions, Relations and Digraphs, Paths in Relations and Digraphs, Properties of Relations, Equivalence Relations, Computer representation of Relations and Digraphs. Transitive Closure and Warshall’s Algorithm (Textbook – 2, Chapters: 4.1., 4.2, 4.3, 4.4, 4.5, 4.6, 4.8)

FUNCTIONS:
Types of Functions, Invertible Functions, Functions for Computer Science, Permutation Functions.
(Textbook – 2, Chapters: 5.1., 5.2, 5.3)

UNIT – II

ORDER RELATIONS AND STRUCTURES:
Partially Ordered Sets, Hasse diagrams, Extremal Elements of Partially Ordered Sets. Lattice: Definition and Examples. (Textbook – 2, Chapters: 7.1., 7.2, 7.3)

GRAPHS AND THEIR APPLICATIONS:
Graphs and Graph Models. Graph Terminology and Special Types of Graphs: Basic Terminology, Some Special Simple Graphs, Bipartite Graphs, Bipartite Graphs and
Matchings, HALL’S MARRIAGE THEOREM (theorem statement and examples). Some Applications of Special Types of Graphs, New Graphs from Old.
Connectivity: Paths, Connectedness in Undirected Graphs, Vertex and Edge connectivity and their applications, Connectedness in Directed Graphs.
Euler and Hamilton Paths and their applications, Planar Graphs and their Applications, Graph Coloring and its applications. (Textbook – 1, Chapters: 10.1, 10.2, 10.3, 10.4, 10.5, 10.7, 10.8)

COUNTING:
Addition Principle (Principle of Inclusion-Exclusion), The Pigeonhole Principle, Some Elegant Applications of the Pigeonhole Principle. (Textbook – 2, Chapters: 1.2, 3.3. Textbook – 1, Chapter: 6.2)

UNIT – III

MATHEMATICAL INDUCTION AND RECURSION:
Mathematical Induction, Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation. (Textbook -2, Chapters: 2.4, 3.5.)
Methods of Proof: Direct, Indirect and Proof by Contradiction. (Textbook -2, Chapters: 2.3)

FUNDAMENTALS OF LOGIC:
Basic Connectives and Truth Tables, The Laws of Logic, Rules of Inference.
(Reference Textbook-1, Chapters: 2.1, 2.2, 2.3)

Course Outcomes:
1. Use algebraic properties of set and Venn diagrams to prove basic set equalities. Show matrix and digraph representation a relation, and Apply relation properties to a given relation to determine its properties.
2. Determine if a relation is equivalence relation and hence find its quotient set. Apply Warshall's algorithm to find transitive closure of a relation. Classify functions as one-to-one, onto, bijective, one-to-one correspondence and invertible. Apply permutation functions for encoding and decoding simple text massages.
3. Show that a given relation is a Poset and draw a Hasse diagram for it. Compute Extremal elements of a Poset and hence check if a Poset is a Lattice. Classify a graph as simple, multigraph and bipartite. Apply bipartite graphs to solve matching problems such as job assignment and marriage problem.
4. Identify suitable data structure for representing a graph. Determine if a graph is Eulerian, Hamiltonian and Planar. Solve vertex and edge connectivity, matching, colouring problems in graph theory. Apply addition and pigeonhole principle to solve counting problems.
5. Develop and simplify recurrence relations for problems such as Rabbits and Fibonacci numbers, Tower of Hanoi and Code Word Enumeration, and algorithms such as Binary Search, Fast Multiplication and Max-Min of a Sequence. Establish by deduction the validity of an argument using the inference rules. Use direct, indirect and proof by contradiction methods to prove the correctness of a logical statement.

Table-1: Mapping of COs to PIs, POs and BTL

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PIs)</th>
<th>Bloom's Taxonomy Level (BTL)</th>
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<td>1, 2</td>
<td>1.1.1, 1.3.1</td>
<td>L3</td>
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<td>CO2</td>
<td>1, 2</td>
<td>1.1.1, 1.3.1</td>
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<tr>
<td>CO3</td>
<td>1, 2</td>
<td>1.1.1, 1.3.1</td>
<td>L3</td>
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<td>CO4</td>
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<td>1, 2</td>
<td>1.1.1, 1.3.1, 2.2.3</td>
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Table-2: Mapping Levels of COs to POs / PSOs

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<tr>
<td>CO1</td>
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<td>CO5</td>
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3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

TEXTBOOKS:

REFERENCE BOOKS:

E-Books / Online Resources:
3. http://ocw.mit.edu/courses/mathematics/ (online course material)

MOOCs:
3. https://www.cs.odu.edu/~toida/nerzic/content/web_course.html
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.

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

**DIGITAL SYSTEM DESIGN**

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**Course Learning Objectives:**
This Course will enable students to:

2. Describe and Design Digital multiplexers, Decoders, Encoders, Adders and Subtractors, Binary comparators.
3. Learn to Analyse and Design different Latches and Master-Slave Flip-Flops.
4. Describe, Design and Analyze Synchronous and Asynchronous counters.
5. Analyze advanced digital logic design using HDL.

**UNIT – I**

**The Basic Gates:** Review of Basic Logic gates, Positive and Negative Logic.

**Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs, Quads, and Octets, Karnaugh Map Simplifications, Don’t-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by Quine-McClusky Method.

(Text book 1: - Ch 2: 2.1,2.2, 2.4, Ch3: 3.2 to 3.8, 3.11)

**HDL Using VERILOG:** Introduction, HDL Implementation Models,

(Text book 1: -Ch 2:2.5.)

Self-study: 3.1

**UNIT – II**

**Data-Processing Circuits:** Multiplexers, De-multiplexers, Decoders-1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator.

**HDL Using VERILOG:** HDL Implementation of Data Processing Circuits

**Arithmetic Circuits:** 2’s Compliment Arithmetic, Arithmetic Building Blocks, The Adder Subtractor, Fast Adder,

**HDL Using VERILOG:** HDL Implementation of Arithmetic Circuits

(Text book 1: -Ch 4:- 4.1 to 4.9, 4.14, Chap 6:- 6.6 to 6.9, 6.12)

Self-Study: 6.1 to 6.5
Flip- Flops: RS Flip-Flops, T Flip flop, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIPFLOPs and JK Master-slave FLIP-FLOP.

(Text book 1: -. Ch 8: - 8.1 to 8.5, 8.8, 8.10, 8.12. Ch 11: - 11.1 to 11.4)  
15 Hours

UNIT – III

Various Representation of FLIP-FLOPs.  
Flip- Flops: Design of synchronous sequential circuits using Moore and Mealy models
HDL Using VERILOG: HDL Implementation of FLIP-FLOP
(Text book 1: -. Ch 8: -8.13)
Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Shift Register, Applications of Shift Registers,  
(Text book 1: - Ch 9: 9.1 to 9.5, 9.7.)
Counters: Asynchronous Counters, Synchronous Counters, Counter Design as a Synthesis problem,  
(Text book 1:- Ch 10: 10.1, 10.3, 10.7.)  
9 Hours

Course Outcomes:
At the end of the course the student will be able to:
1. Apply the knowledge of combinational logic and the simplification techniques to reduce the logic expressions using Karnaugh map and Quine-Mcclusky methods
2. Apply the simplification techniques to realize combinational logic circuits using laws of Boolean algebra.
3. Realize the data processing circuits using multiplexers, demultiplexers, decoders and encoders.
4. Construct arithmetic building blocks using adders and subtractors. Describe various kinds of flip-flops with different representations
5. Demonstrate the working of registers using flip-flops, design sequential circuits and counters.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
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<td>1.4.1, 2.3.1,</td>
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<tr>
<td></td>
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<td>3.4.3,5.1.1</td>
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</table>
Table-2: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
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<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXTBOOK:

REFERENCE BOOKS:

E-Books / Online Resources:
1. https://drive.google.com/drive/folders/0B6YWHApOtmcEQ3bHVzYtc00 by M Morris Mano
2. https://sites.google.com/site/dldcse241/ematerials/ebooks

MOOCs:
1. Universitat Autònoma de Barcelona: Digital Systems: From Logic Gates to Processors (Coursera)
2. Stanford University: Michael Genesereth, Associate Professor, Introduction to Logic. 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.

***************
OBJECT ORIENTED PROGRAMMING IN C++

| Course Code | 20CS303 | CIE Marks | 50 |
| Total Hours | 39      | SEE Marks  | 50 |
| Credits     | 3       |            |    |

**Course Learning Objectives:**

This Course will enable students to:

1. Understand the basic principles of Object-oriented programming and, enables implementing through C++ programming language.
2. Outline the structure of C++ program, use of its operators, expressions and the concepts of classes and objects to write a program.
3. Design
4. the program using the concepts of constructors, different types of functions.
5. Apply the concepts of inheritance, overloading for programming.
6. Demonstrate the use virtual functions, templates, exception handling and Operator overloading.

**UNIT – I**

**Principles of object – oriented programming:**
A look at Procedure Oriented Programming, object Oriented Programming Paradigm, Basic Concepts of OOP, Benefits of OOP, Applications of OOP.

**Beginning with C++:**
What is C++, Structure of C++ program, Basic Data types, derived data types, user defined data types, dynamic initialization of variables, reference variables, scope resolution operator, memory management operators, type cast operators.

**Functions in C++:**
Function prototyping, Inline Functions, Default Arguments, Function Overloading

**Classes and objects:**
Specifying a Class, Defining Member Functions, Static Data Members, and Static Member Functions. Arrays of Objects, Objects as Functions Arguments, Friend Functions, Returning Objects.

**Constructors and Destructors**
Introduction, Constructors, Parameterized Constructors, Multiple Constructors in a Class. Constructors with Default Arguments, Copy Constructors, Dynamic Constructors, Destructors.

(Chapters – 1,2,3,4,5) 15 Hours

**UNIT – II**

**Inheritance:** Introduction, Defining Derived Classes, Single Inheritance, Protected Access Specifier, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes.

**Operator Overloading and Type Conversions:** Defining Operator Overloading, Overloading the Increment and the Decrement Operators (Prefix and Postfix), Rules for overloading operators.

**Exception Handling:** Basics of Exception Handling, Exception Handling Mechanism
Pointers, Virtual Functions: Pointers to Objects, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions.
(Chapters – 6,7,8) 15 Hours

UNIT – III

Polymorphism and Streams
C++ streams and stream classes, formatted and unformatted I/O operations, open, close, read and write with a file, Classes for file stream operations
Function Templates, Class Templates.
Introduction to standard template library – components, containers, algorithms and iterators.
(Chapters – 9,10,11,12,13,14) 9 Hours

Course Outcomes:
At the end of the course the student will be able to:
1. Apply the basic concepts of C++ for problem solving and write program using basic constructs of C++ language.
2. Develop solutions to problems using the concepts of functions and its variants, classes and objects. Apply the concepts of constructors and its variants to demonstrate the object initialization.
3. Demonstrate code reusability and polymorphism using the concept of inheritance and operator overloading.
4. Develop the program in C++ using the concept of exception handling, pointers, and virtual functions.
5. Use the object oriented approaches of function templates and class templates to design programs. Perform file handling operations using the streams concept of C++.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1,2</td>
<td>1.4.1, 2.1.2, 2.2.3,2.3.1</td>
<td>L3</td>
</tr>
<tr>
<td>CO2</td>
<td>1,2,3,5</td>
<td>1.4.1, 2.1.1,2.1.2,2.2.2,2.2.3, 2.3.1, 3.2.1,3.4.2, 5.1.1, 5.1.2</td>
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<td>L3</td>
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<td>CO4</td>
<td>1,2,3,5</td>
<td>1.4.1, 2.1.1,2.1.2,2.2.2,2.2.3, 2.3.1, 3.2.1,3.4.2, 5.1.2</td>
<td>L3</td>
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<td>1.4.1, 2.1.2, 2.2.3,2.3.1,5.1.2</td>
<td>L3</td>
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</table>
Table 2: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
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<td>CO3</td>
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<td>2</td>
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<tr>
<td>CO4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

TEXTBOOK:

REFERENCE BOOKS:

E-Books / Online Resources:
1. Tour of C++, Second edition, Bjarne Stroustrup,

MOOC:
2. https://nptel.ac.in/courses/106105151

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.
# COMPUTER ORGANIZATION AND ARCHITECTURE

<table>
<thead>
<tr>
<th>Course Code</th>
<th>20CS304</th>
<th>CIE Marks</th>
<th>50</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Total Hours</td>
<td>50</td>
<td>Credits</td>
<td>04</td>
</tr>
</tbody>
</table>

## Course Learning Objectives:

This course will enable students to:

1. **Learn** the basic structure and operation of a digital computer
2. **Learn** arithmetic unit and **perform** fixed point and floating-point addition, subtraction, multiplication and division in binary 2’s complement number system
3. **Understand** the basic processing unit in terms of control unit, execution of instructions, write control sequences for instructions. **Learn** the instruction and thread level parallelism.
4. **Explore** the design of hierarchical memory system including cache memories and virtual memory. Compare the performance.
5. **Discuss** serial and parallel communication with I/O devices and standard I/O interfaces available.

## UNIT – I

**BASIC COMPUTER ORGANIZATION:**
Basic structure of computer and its components, Machine Instructions and Programs, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Stacks and Queues, Subroutines- Subroutine nesting and processor stack, parameter passing. 10 Hours

## UNIT – II

**ARITHMETIC OPERATIONS:**
Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations on numbers in IEEE format. 10 Hours

## UNIT – III

**BASIC PROCESSING UNIT:**
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control.

**INSTRUCTION LEVEL PARALLELISM:**

**THREAD LEVEL PARALLELISM:**
Moore’s law, Overview of a typical dual core architecture, Introduction to thread level parallelism. *(Text book-3 Chapter-1)* 10 Hours

UNIT – IV

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

UNIT – V

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)

Course Outcomes:
Upon completion of this course, students will be able to:
1. Outline the basic structure and operation of a digital computer
2. Learn arithmetic unit and perform fixed point and floating point addition, subtraction, multiplication and division in binary 2’s complement number system
3. Understand the fine grain details of basic processing unit in terms of control unit, execution of instructions and learn the scope for instruction and thread level parallelism. Implementation of instructions for single and multiple bus configuration.
4. Demonstrate the computer architecture concepts in the design of hierarchical memory system including cache memories and virtual memory.
5. Explain different ways of communication with I/O devices and standard I/O interfaces.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom's Taxonomy Level (BTL)</th>
</tr>
</thead>
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<tr>
<td>CO1</td>
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<td>1.3.1, 1.4.1</td>
<td>L2</td>
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<td>1.4.1, 2.2.1</td>
<td>L2</td>
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</table>
Table-2: Mapping Levels of COs to POs / PSOs

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<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
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<td>2</td>
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<td>CO4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

TEXTBOOKS:

REFERENCE BOOKS:

E-Books / Online Resources:
2. http://www.cse.iitm.ac.in/~vplab/courses/comp_org/

MOOC:
1. http://nptel.ac.in/courses/106103068/

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.

******************
DATA STRUCTURES

<table>
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<td>Total Hours</td>
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<td>Credits</td>
<td>4</td>
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</tbody>
</table>

Course Learning Objectives:

This course will enable students to:

1. **Outline** the concepts of data structures, types, operations, structures, pointers and **implement** pointers, structures and pointer to structures.
2. **Implement** linear data structures stacks, queues and usage of stacks in various applications.
3. **Implement the operations of** singly linked lists and circular linked lists, doubly linked list and circular doubly lists.
4. **Identify and differentiate** different types of binary trees and binary search trees data structures and also implement them.
5. **Illustrate and classify** threaded binary trees, expression trees, AVL trees, BTrees, B+ tree and techniques of hashing.

UNIT – I

INTRODUCTION:
Data Structure, Classification (Primitive and non-primitive), data structure operations.

POINTERs:
Definition and Concepts, Accessing variables through pointers, Pointers and functions, Arrays and pointers, Array of pointers.
Structures, nested structures, pointers to structures (programming examples to be worked out for above concepts).

UNIT – II

LINEAR DATA STRUCTURES – STACKS:
Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks,

APPLICATIONS OF STACK:
Conversion of Expressions, Evaluation of expressions, Recursion: Implementation, Simulating Recursion, examples on Recursion

LINEAR DATA STRUCTURES – QUEUES:

Introduction and Definition Representation of Queue: Array and Structure representation of queue, various queue structures: ordinary queue, circular queue, priority queue.
UNIT – III

LINEAR DATA STRUCTURES - SINGLY LINKED LISTS:
Dynamic Memory allocation functions. Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List, Circular Linked List

LINEAR DATA STRUCTURES - DOUBLY LINKED LISTS:
Doubly Linked List: Representation and Operations, Circular doubly Link list: Representation and Operations. Linked List representation of stack, Linked List representation of queue. 10 Hours

UNIT – IV

NONLINEAR DATA STRUCTURES - TREE DATA STRUCTURES-1:
Basic Terminologies, Binary Trees: Properties, Representation of Binary Tree: Linear representation, Linked representation, Operations on Binary Tree: Insertion, Simple Deletion, Traversals. Introduction to Binary Search Tree. 10 Hours

UNIT – V

NONLINEAR DATA STRUCTURES - TREE DATA STRUCTURES-2:
Expression Tree: Constructing expression tree from postfix expression, traversals, Application of tree: Evaluation of expression, programming examples Threaded binary Tree: types, B-Trees, B+ Trees, AVL Trees: Definition, Constructing a general AVL tree.

HASHING:
Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. 10 Hours

Course Outcomes:

1. Acquire the fundamental knowledge of various types of data structures and pointers using that knowledge and design the programs using pointers.
2. Apply the fundamental programming knowledge of data structures to design abstract data types such as stack, queue and use them for solving problems.
3. Design various functions for implementation of singly linked lists, circular linked lists and doubly linked list.
4. Implement and apply the concept of binary trees and binary search tree data structure.
5. Identify different representations of trees and acquire the knowledge of threaded binary trees, expression trees, AVL trees, B-Trees and hashing
### Table-1: Mapping of COs to PIs, POs and BTL

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
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<tbody>
<tr>
<td>CO1</td>
<td>1,2</td>
<td>1.3.1, 1.4.1, 2.1.3</td>
<td>L2</td>
</tr>
<tr>
<td>CO2</td>
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<td>1.4.1, 2.1.2, 2.1.3, 2.4.1, 3.3.2</td>
<td>L4</td>
</tr>
<tr>
<td>CO4</td>
<td>1,2</td>
<td>1.3.1, 1.4.1, 2.1.3</td>
<td>L3</td>
</tr>
<tr>
<td>CO5</td>
<td>1,2</td>
<td>1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.4.1</td>
<td>L3</td>
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</tbody>
</table>

### Table-2: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
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<td>2</td>
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<tr>
<td>CO5</td>
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<td>1</td>
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</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

### TEXTBOOKS:

### REFERENCE BOOKS:

### E-Books / Online Resources:

### MOOC:
1. Introduction to Data Structures by edx, URL: [https://www.edx.org/course/](https://www.edx.org/course/)
2. Data structures by Berkley, URL: [https://people.eecs.berkeley.edu/](https://people.eecs.berkeley.edu/)
3. Advance Data Structures by MIT OCW, URL: [https://www.mooclab.club/](https://www.mooclab.club/)

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.
ಅಧ್ಯಯನದ ವಿಷಯವನ್ನು ನಿಂತಹ ಹಿಂದೆಯೂ ಹಿಲ್ಮುಡು.

- ದೊಡ್ಡ ಮಾರ್ಗದಲ್ಲಿ ತಾಜ್ಜುಗುವಿಕೆಗಳು ಬಿಡಿ ಕನನಡ ನೌಕೆಯ ನಿಯಂತ್ರಣವಾಗಿದೆ.
- ಮಾರ್ಗಮಟಿ ಕನನಡ ಪ್ರಶ್ನಿ ಮೂಲಕ ಅಧ್ಯಯನ ಮಖನ್ನು ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನ ವ್ಯವಹಾರದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.
- ಮಾಡಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳು ಮತ್ತು ಕನನಡ ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ಥಳವನ್ನು ಸುತ್ತದಂತೆ ಬಿಡಿಕೆಯಿಂದ ಮೂಲಕ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ಪ್ರಶ್ನಿ ಸಿದ್ಧಾಂತದಲ್ಲಿ ಕನನಡ ವಿದ್ಯಾರ್ಥಿಗಳು ಸುತ್ತದಂತೆ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.
- ವಿದ್ಯಾರ್ಥಿಗಳು ವಿದ್ಯಾತ್ಮಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಚೂತು ಕನನಡ ವಿಜ್ಞಾನದಲ್ಲಿ ಸೆಳ್ಳಿಸಿದಂತೆ ಮೂಲಕ ಬಿಡಿ.

ಅಧ್ಯಯನ

ಅಧ್ಯಯನ - 1 ಕನನಡ ಪ್ರಕರಣ - ಸಮಯುಕ್ತ ಮಾರ್ಗದಲ್ಲಿ.
ಅಧ್ಯಯನ - 2 ಪ್ರಕರಣ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಅಧ್ಯಯನ ಪ್ರವಾಸ ಮತ್ತು ತಿಳಿಸಿದ ಮಾರ್ಗದಲ್ಲಿ.
ಅಧ್ಯಯನ - 3 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ ಅಧ್ಯಯನ ಪ್ರವಾಸ ಮತ್ತು ತಿಳಿಸಿದ ಮಾರ್ಗದಲ್ಲಿ.
ಅಧ್ಯಯನ - 4 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 5 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 6 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 7 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ (ಸುಂದರ ವಿಜ್ಞಾನದಲ್ಲಿ), ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 8 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 9 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.
ಅಧ್ಯಯನ - 10 ಅಧ್ಯಯನ ಪ್ರತ್ಯೇಕ ವಿಜ್ಞಾನದಲ್ಲಿ.

****
The course will enable the students to understand Kannada and communicate in Kannada language.

Chapter – 1: Vyavaharika Kannada – Parichaya (Introduction toVyavaharika Kannada)

Chapter – 2: Kannada Aksharamale haagu uchcharane (Kannada Alphabets and Pronunciation)

Chapter – 3: Sambhashanegaagi Kannada Padagalu (Kannada Vocabulary for Communication)

Chapter – 4: Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana)

Chapter – 5: Activities in Kannada.

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

OBJECT ORIENTED PROGRAMMING IN C++ LAB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>20CS306</th>
<th>CIE Marks</th>
<th>50</th>
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<tr>
<td>Teaching Hours /Week (L:T:P:S)</td>
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<tr>
<td>Total Hours</td>
<td>24</td>
<td>Credits</td>
<td>1</td>
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</table>

Experiments
Students have to write, execute and test programs covering the syllabus of 19CS301.

Typical problems that may be tried are
1. Function overloading and inline function
2. Simple class and objects creation.
3. Array of objects.
4. Object as arguments.
5. Friend functions
6. Static data member and function.
7. Constructors and its types
8. Inheritance and its types.
9. Virtual functions and pure virtual functions.
10. Templates concept.
11. Exception handling mechanism.

Note: Students may implement the programs using C++ language on Windows /Linux platform.

DIGITAL SYSTEMS DESIGN LAB

<table>
<thead>
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<th>Course Code</th>
<th>20CS307</th>
<th>CIE Marks</th>
<th>50</th>
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<tr>
<td>Teaching Hours /Week (L:T:P:S)</td>
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</tr>
<tr>
<td>Total Hours</td>
<td>36</td>
<td>Credits</td>
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</tbody>
</table>

Experiments
1. To study and verify the truth table of logic gates
2. Realization of a given Boolean function using Basic gates and Universal gates
3. Realization of Basic gates using Universal gates.
4. Prove and implement DeMorgans theorem
5. Design and implementation of a Half-adder and a Full-adder using minimum number of 2-input NAND gates
6. Design and implementation of adder/subtractor circuit using IC7483
7. To design and realize the following using IC 7483.
   a. BCD to Excess- 3 Code
   b. Excess-3 to BCD Code.
8. Given any four variable logic expression, simplify using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
9. Design and implementation of a Full adder and a Full subtractor using 3:8 decoder and 4 input NAND gates.
10. Realization of one & two bit comparator circuit using IC7485
11. To set up and test a 7-segment static display system to display numbers 0 to 9.
12. Design and implementation of the following using 4-bit shift register
   a. Ring counter
   b. Johnson counter
13. Design and implement following flipflops:
   a. RS Flipflop(Set and Reset)
   b. D Flipflop(DATA)
   c. T Flipflop(Toggle)
14. Design and implement following flipflops:
   a. JK Flipflop
b. JK Master-Slave (JK MS) flipflop.

15. Design and implementation of a Mod-N (N<8) Synchronous up counter using J-K flip flop ICs.

Using Verilog/VHDL, simulate the following:
1. Code and simulate all Basic gates (any 5)
2. Simulation of 8:1 multiplexer.
3. Simulation of full adder.
4. Simulation of the following:
   a. Multiplexer
   b. Demultiplexer
5. Simulation of the following:
   a. Ring counter
   b. Johnson counter

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

DATA STRUCTURES LAB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>20CS308</th>
<th>CIE Marks</th>
<th>50</th>
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</tr>
<tr>
<td>Total Hours</td>
<td>36</td>
<td>Credits</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Experiments
Students have to write, execute and test programs covering the syllabus of 19CS305.
Typical problems that may be tried are
1. Pointer implementations using arrays and structures
2. Stack static implementation.
3. Queue static implementation.
4. Application of stack data structure.
5. Different types of queue.
7. Singly Linked list implementation.
8. Dynamic implementation of stack data structure.
9. Dynamic implementation of queue data structure.
10. Circular linked list implementation.
11. Doubly linked list and Circular doubly linked list implementation.
12. Binary Tree Construction and Tree traversal operations.
13. Construction of Binary Search Tree and postfix expression tree.

Note: Students may implement the programs using C/C++ language on Windows /Linux platform.

*******************************
LINEAR ALGEBRA AND PROBABILITY THEORY

Course Code : 20CS401  
CIE Marks : 50

Teaching Hours /Week (L:T:P:S) : 3-0-0-0  
SEE Marks : 50

Total Hours : 39  
Credits : 03

Course Learning Objectives:
This course will enable students to:
1. **Apply** the theory of matrices and vector spaces to solve various engineering problems.
2. **Understand** the notion of linear transformation, Gradient and Hessian of linear and quadratic function.
3. **Solve** problems using Bayes' theorem.
4. **Derive** the mean and variance of Binomial, Poisson and normal distributions.
5. **Find** marginal distribution and variance of two dimensional random variable.

UNIT – I

MATRIX & VECTOR SPACE

Vector spaces, subspaces, bases and dimension, coordinates, row space, column space and null space. Review of Matrix Properties, Trace, Norms, Relation between trace and Eigen values of a matrix, Eigen values and Eigen vectors of symmetric matrices. Gradient, Hessian, Gradient and Hessian of linear and quadratic functions.

14 Hours

UNIT – II

LINEAR TRANSFORMATIONS


PROBABILITY THEORY

Finite sample space, conditional probability and independence, Bayes' theorem (overview).

16 Hours

UNIT – III

One dimensional random variable, pdf, cdf, expectation and variance. Two and higher dimensional random variables, joint pdf and marginal pdf. DISTRIBUTIONS: Binomial, Poisson, normal and exponential distributions, simple problems.

9 Hours
Course Outcomes:
Upon completion of this course, students will be able to:

1. **Find** trace, eigen values and eigen vectors of the given symmetric matrix. Realize the importance of the notions of basis and dimension in the study of vector spaces.
2. **Demonstrate** the concept of linear transformation as a linear function from one vector space to another. **Obtain** the Gradient and Hessian of linear transformation.
3. **Classify** and **appreciate** probabilistic models for situations involving chance effect and appreciate the concepts of pdf, cdf, random variables and its consequences.
4. **Illustrate** some of the important distributions of discrete random variables and continuous random variables.
5. **Apply** the concepts of distributions in real life situations.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom's Taxonomy Level (BTL)</th>
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<td>1,2</td>
<td>1.1.2, 2.2.3, 2.4.4</td>
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<table>
<thead>
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<th>COs</th>
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<tr>
<td>CO2</td>
<td>3 2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2 1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3 2</td>
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DESIGN & ANALYSIS OF ALGORITHMS

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<td>Credits</td>
<td>:</td>
<td>4</td>
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</table>

Course Learning Objectives:

This Course will enable students to:
1. Analyze the non-recursive and recursive algorithms and to represent efficiency of these algorithms in terms of the standard Asymptotic notations.
2. Devise the Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3. Explain the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4. Get the idea of Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.
5. Describe and illustrate the idea of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

UNIT – I

INTRODUCTION:
What is an Algorithm? Fundamentals of Algorithmic, Problem Solving, Important Problem Types, Fundamental Data Structures. (Text Book-1: Chapter 1: 1.1 to 1.4)

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:
Analysis Framework, Asymptotic Notations and Standard notations and common functions (Text Book-2: Chapter 3: 3.1, 3.2), Mathematical Analysis of Non-recursive and Recursive Algorithms, (Text Book-1: Chapter 2: 2.1, 2.3, 2.4,) 11 Hours
UNIT – II

BRUTE FORCE:
Background, Selection Sort, Brute-Force String Matching.
(Text Book-1: Chapter 3: 3.1, 3.2)

DIVIDE AND CONQUER:
(Text Book-2: Chapter 4: 4.4, 4.5),
Merge sort, Quick sort, Binary Search, Multiplication of large integers and Strassen’s Matrix Multiplication.
(Text Book-1: Chapter 4: 4.1 to 4.3, 4.5) 9 Hours

UNIT – III

DECREASE & CONQUER:
General method, Insertion Sort, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting

TRANSFORM AND CONQUER:
General method, Balanced Search Trees, Heaps and Heap sort.

TIME AND SPACE TRADEOFFS:
(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2 to 7.3) 9 Hours

UNIT – IV

GREEDY TECHNIQUE:
(Text Book-2: Chapter 24: 24.1 to 24.3).
Minimum Spanning Trees: Prim’s Algorithm, Kruskal’s Algorithm, Optimal Tree problem: Huffman Trees

DYNAMIC PROGRAMMING:
General method, The Floyd-Warshall Algorithm, Johnson’s algorithm for sparse graphs
(Text Book-2: Chapter 25: 25.1 to 25.3),
The Knapsack problem (Text Book-1: Chapter 8: 8.4). 12 Hours

UNIT – V

LIMITATIONS OF ALGORITHMIC POWER
P, NP and NP-complete problems (Text Book-1: Chapter 11: 11.3)

BACKTRACKING:
General method, N-Queens problem, Subset-sum problem.
(Text Book-1: Chapter 12: 12.1)

BRANCH AND BOUND:
General method, Travelling Salesman problem, Knapsack Problem, Approximation algorithms for TSP. (Text Book-1: Chapter 12: 12.2, 12.3) 9 Hours
**Course Outcomes:**
At the end of the course the student will be able to:

1. **Explain** the algorithmic problem solving, algorithm design techniques and standard Asymptotic notations. **Apply** the general procedure of non-recursive and/or recursive algorithms to obtain worst-case running times of algorithms using asymptotic analysis.

2. **Interpret** the brute-force, divide-and-conquer paradigms and explain when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm to demonstrate its performance using these paradigms. For the given algorithm, develop the recurrence; **Analyze** and **Simplify** the recurrence to obtain the performance of divide-and-conquer algorithm.

3. **Explain** the Decrease and Conquer, Transform and Conquer algorithm design paradigms, string matching algorithms and hashing concepts. **Develop** and implement an algorithm and demonstrate its performance using these paradigms.

4. **Identify** and **explain** the greedy technique and dynamic-programming paradigm as to when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm and demonstrate its performance using these paradigms. **Discover** the shortest-path and minimum spanning tree problems by assuming shortest-paths algorithms and minimum spanning tree algorithms respectively.

5. **Describe** the Backtracking, Branch and Bound algorithm design paradigms and explain when an algorithmic design situation calls for it. **Relate** algorithms that employ these paradigms. **Develop** and implement an algorithm and demonstrate its performance using these paradigms. **Explain** the limitations of algorithmic power.

<table>
<thead>
<tr>
<th><strong>Course Outcomes (COs)</strong></th>
<th><strong>Program Outcomes (POs) Addressed</strong></th>
<th><strong>Performance Indicators (PI)</strong></th>
<th><strong>Bloom's Taxonomy Level (BTL)</strong></th>
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<tr>
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<td>CO2</td>
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Table: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
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</tr>
<tr>
<td>CO1</td>
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<tr>
<td>CO4</td>
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<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

TEXTBOOKS:

REFERENCE BOOKS:

E-Books / Online Resources:

MOOC:
1. http://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

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.

************
PYTHON PROGRAMMING

Course Code : 20CS403  |  CIE Marks : 50
Teaching Hours /Week (L:T:P:S) : 0-2-3-0  |  SEE Marks : 50
Total Hours : 36  |  Credits : 2.5

Course Learning Objectives:
This course will enable students to
1. Execute the basic UNIX commands, execute the commands to perform the file operations in UNIX platform.
2. Explain the elementary programming constructs and file operations and use it in Python programming.
3. Describe the concepts like strings, conversion of strings to numbers, lists, tuples, and dictionaries and apply these in python programming.
4. Illustrate the functions, recursive functions and object-oriented programming concepts in Python.
5. Write data handling program in python and design a multi-threaded and a Client/Server program and web application in Python.

<table>
<thead>
<tr>
<th>Week No.</th>
<th>Topics</th>
</tr>
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<tbody>
<tr>
<td>2.</td>
<td>Cat: Displaying and creating Files, cp: Copying a File, rm: Deleting files, mv: Renaming files, more: Paging output, The Ip Subsystem: Printing a file, file: Knowing the file types, wc: Counting lines, words and characters, od: Displaying data in octal, cmp: Comparing two Files, comm.: What is common?, diff: Converting one file to other. The shell’s interpretive cycle, Pattern matching- The wild-cards, Escaping and Quoting,</td>
</tr>
</tbody>
</table>
5. **Python:** The concept of data types; immutable variables; Conditions, Boolean logic, logical operators; ranges; control statements: if-else, loops (for, while); short circuit evaluation.

6. Text files; manipulating files and directories, text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

7. Subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Lists, tuples, and dictionaries.

8. Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

9. Arguments and return values; formal vs actual arguments. Named arguments. Recursive functions, Classes, objects, attributes and methods. exception handling, try block


11. Data Manipulation with Pandas- Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join,


13. Creating simple web clients, introduction to CGI, CGI module, building CGI applications

**Course Outcomes:**
Upon completion of this course, students will be able to:

1. **Execute** UNIX commands and **Illustrate** the concept of Shell, File system in UNIX by working with the permission related to the files. **Demonstrate** the file handling and change of the permission according to the user’s requirement.

2. **Execute and comprehend** the data handling commands of the UNIX.

3. Apply the knowledge of basic program constructs and file operations of python to **develop** the solutions for engineering problems. **Implement** programs using a suitable modern tool.

4. Illustrate the usage of strings, conversion of strings to numbers, lists, tuples and dictionaries to **develop** data handling programs in Python.

5. **Apply** the knowledge of functions and data handling libraries of Python to **analyze** the problem and **develop** solutions. **Implement** the concept of multiple
### Table 1: Mapping of COs to PIs, POs and BTL

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
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<tbody>
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</tr>
<tr>
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<td>1,2,3,5</td>
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<tr>
<td>CO5</td>
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### Table 2: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  2  3  4  5  6  7  8  9  10  11  12</td>
<td>1  2</td>
</tr>
<tr>
<td>CO 1</td>
<td>2  3</td>
<td>1  1  1  3</td>
</tr>
<tr>
<td>CO 2</td>
<td>2  3</td>
<td>1  1  1  3</td>
</tr>
<tr>
<td>CO 3</td>
<td>1  2  3  1</td>
<td>1  1  1  3</td>
</tr>
<tr>
<td>CO 4</td>
<td>1  2  3  1</td>
<td>1  1  1  3</td>
</tr>
<tr>
<td>CO 5</td>
<td>1  2  3  1</td>
<td>1  1  1  3</td>
</tr>
</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

**Graduate Attributes (GA)**

This course will map the following GA as per NBA:

1. Problem Analysis
2. Design / development of solutions
3. Conduct investigation of complex problems
4. Modern tool usage
5. The engineer and society
6. Environment and sustainability
7. Ethics
8. Project management and finance
TEXTBOOKS:

REFERENCE BOOKS:

E-Books / Online Resources:

MOOC:
1. http://nptel.ac.in/courses/106105166/26

**********
DATA COMMUNICATIONS

<table>
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<th>CIE Marks</th>
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<td>Total Hours</td>
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<td>Credits</td>
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</table>

Course Learning Objectives:
This course will enable students to:
1. Outline the theory behind the basic design of networks, standards and approaches to design networks.
2. Get the idea of representation of digital information and digital transmission and could be able to understand and design reliable transmission.
3. Outline the theory behind the various protocol used in data link layer, how to access the transmission medium based on various protocols and determine new design could design new protocols.
4. Get the idea of WANs and congestion control mechanisms.
5. Get the theory behind the LANs and WLANs.

UNIT – I

**Data Transmission**: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity. **10 Hours**

UNIT – II

**Digital Data Communication Techniques**: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations. **10 Hours**

UNIT – III

**Data Link Control Protocols**: Flow Control, Error Control, High-Level Data Link Control (HDLC).
**Multiplexing**: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, Asymmetric Digital Subscriber Line.
**Spread Spectrum**: The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum, Code-Division Multiple Access. **10 Hours**

UNIT – IV

Congestion Control in Data Networks: Effects of Congestion, Congestion Control, Traffic Management, Congestion Control in Packet-Switching Networks.  

UNIT – V

Local area networks: local area network overview, topologies and transmission media, LAN protocol architecture.

High-Speed LANs: The Emergence of High-Speed LANs, Ethernet, Fibre Channel.


Course Outcomes:
Upon completion of this course, students will be able to:

1. **Acquire** the basics of data communications and Network standards.
2. **Identify** the data & signals, the channel rate and conversion techniques and **Demonstrate** the error detection and correction techniques.
3. **Comprehend** handling of multiple channels and transmission and data link control protocols.
4. **Acquire** the knowledge of WANs and congestion controls techniques.
5. **Acquire** the knowledge and **compare** LAN and WLAN technologies.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
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</thead>
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<tr>
<td>CO1 1,2</td>
<td>1.1.1, 1.4.1, 2.2.2</td>
<td>L2</td>
<td></td>
</tr>
<tr>
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<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
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<tr>
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<td>1 2</td>
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<tr>
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<td>1 1 1 1 1 1 3</td>
</tr>
<tr>
<td>CO2</td>
<td>3 2 1</td>
<td>1 1 1 1 1 3</td>
</tr>
<tr>
<td>CO3</td>
<td>3 3</td>
<td>1 1 1 1 3</td>
</tr>
<tr>
<td>CO4</td>
<td>3 2 1</td>
<td>1 1 1 1 3</td>
</tr>
<tr>
<td>CO5</td>
<td>2 3</td>
<td>1 1 1 1 3</td>
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</table>

<table>
<thead>
<tr>
<th>3: Substantial (High)</th>
<th>2: Moderate (Medium)</th>
<th>1: Poor (Low)</th>
</tr>
</thead>
</table>

Table-1: Mapping of COs to PIs, POs and BTL

Table-2: Mapping Levels of COs to POs / PSOs
TEXTBOOK:

REFERENCE BOOKS:

E-Books / Online Resources:
1. http://eng.uok.ac.ir/abdollahpouri/Network/A.Leon-Garcia
   Communication_Networks.pdf

MOOC:
1. http://nptel.ac.in/downloads/106105080/
3. http://nptel.ac.in/courses/106105082/

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.

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

MICROPROCESSORS AND PERIPHERALS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>CIE Marks</th>
<th>Teaching Hours /Week (L:T:P:S)</th>
<th>SEE Marks</th>
<th>Total Hours</th>
<th>Credits</th>
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<tr>
<td>20CS405</td>
<td>50</td>
<td>4-0-0-0</td>
<td>50</td>
<td>50</td>
<td>4</td>
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</table>

Course Learning Objectives:
This Course will enable students to:
1. Outline the internal architecture of 8086 microprocessor, concept of addressing modes, instruction set and develop and execute basic programs.
2. Develop and Execute modular assembly level language program for 8086 and must be able to write assembly level program for any processor by studying its architecture.
3. Interface microprocessor to external I/O devices namely logic controller, stepper motor, seven segment display, DAC, and keypad.
4. Generate machine code for 8086 instructions and Outline the working and benefits of 8259A Priority Interrupt Controller.
5. Describe the hardware components of 8086 microprocessor and compare the salient features of advanced microprocessors.
UNIT – I

8086 INTERNAL ARCHITECTURE
The Programming Model, Multipurpose registers, Special purpose Registers, Segment registers. Real mode memory addressing, Protected mode memory addressing, Flat mode addressing.

8086 ADDRESSING MODES:
Register addressing, Immediate addressing, Direct addressing, Register Indirect addressing, Based addressing with displacement, Indexed addressing with displacement, Based Indexed addressing, Based Indexed addressing with displacement.

8086 INSTRUCTIONS SET – 1
Data transfer instructions (including I/O transfers), Binary arithmetic instructions, Decimal (BCD, ASCII) arithmetic instructions, Logical instructions, Shift and rotate instructions, Control transfer instructions, PUSHF and POPF, XLAT instructions.

8086 PROGRAMMING BASED ON INSTRUCTION SET - 1:
Programs based on data transfer instructions, binary arithmetic instructions, logical instructions, shift and rotate instructions, control transfer instructions.

10 Hours

UNIT – II

MODULAR PROGRAMMING:
Using procedures, Using macros, Comparison between procedure and macro.

DATA CONVERSIONS:
ASCII to BCD/Hexadecimal, BCD/Hexadecimal to ASCII, 8 bit BCD to hexadecimal, 8 bit Hexadecimal to BCD.

USING THE KEY BOARD AND VIDEO DISPLAY:
DOS & BIOS interrupts, Disk files, Example Programs.

8086 ASSEMBLER DIRECTIVES:
ASSUME, DB, DW, DD, END, ENDP, ENDS, EQU, EVEN, EXTRN, GLOBAL, GROUP, INCLUDE, OFFSET, PROC, PUBLIC, SEGMENT, MACRO, END

10 Hours

UNIT – III

INTRODUCTION TO STM32L496ZGT6 MICRO CONTROLLER: (AVR, PIC, ARM), PIN diagram, Hardware Architecture (Arm). Schematic of communication devices, Motor driver, Power supply unit, Output components.

10 Hours

UNIT – IV

INTRODUCTION TO EMBEDDED C PROGRAMMING for micro controller operations. Built functions, I/O operations, Analog Digital Conversion algorithms, C+ data structure with libraries, interruption functions, Time operations, communications. Interfacing with peripherals with micro controller

10 Hours
UNIT - V

8086 HARDWARE SPECIFICATIONS:
8086 memory addressing, 8086 pin functions (minimum mode, maximum mode and both minimum and maximum mode).

8086 INSTRUCTION FORMAT (MOV INSTRUCTION ONLY):
Generating machine code for register-to-register data transfer, memory/register to register/memory data transfer, immediate data transfer, and segment register data transfer.

8086 INTERRUPTS
8086 Interrupts and Interrupt responses, 8086 Interrupt types, 8259A Priority Interrupt Controller – 8259A overview and system connections and cascading, Initializing an 8259A including Initialization Command Words (ICW) and Operational Command Words (OCW). (Text Book 2).

10 Hours

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

1. **Illustrate** the internal architecture of 8086 microprocessor, concept of addressing modes. Develop and execute simple 8086 programs using 8086 instruction set.
2. **Build and examine** modular assembly level language program for 8086 microprocessors.
3. **Interface** microprocessor to external I/O devices namely logic controller, stepper motor, seven segment display, DAC, keypad, and elevator.
4. **Construct** machine code for 8086 and describe the working and benefits of 8259A Priority Interrupt Controller.
5. **Describe** the hardware components of 8086 and **outline** the salient features of advanced microprocessors.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom’s Taxonomy Level (BTL)</th>
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<tbody>
<tr>
<td>CO1</td>
<td>1, 2</td>
<td>1.4.1, 2.1.2, 2.2.2</td>
<td>L3</td>
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<tr>
<td>CO2</td>
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<td>1.4.1, 2.1.3, 2.2.2, 3.1.1</td>
<td>L4</td>
</tr>
<tr>
<td>CO3</td>
<td>1, 2, 3</td>
<td>1.4.1, 2.1.2, 2.2.1, 2.2.3, 3.1.1, 3.4.2</td>
<td>L4</td>
</tr>
<tr>
<td>CO4</td>
<td>1, 2</td>
<td>1.4.1, 2.1.2, 2.2.2</td>
<td>L3</td>
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<tr>
<td>CO5</td>
<td>1, 2</td>
<td>1.4.1, 2.1.1, 2.2.2, 2.2.4, 2.2.5</td>
<td>L2</td>
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</table>
## Table: Mapping Levels of COs to POs / PSOs

| COs | | Program Outcomes (POs) | | PSOs |
|-----|-----|------------------------|-----|
| 1   | 2   | 3                      | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 1   | 2   |
| CO1 | 2   | 3                      |     |     |     |     |     |     |     |     |     |     |     |
| CO2 | 1   | 2                      | 3   |     |     |     |     |     |     |     |     | 3   |     |
| CO3 | 1   | 2                      | 3   |     |     |     |     |     |     |     |     |     | 3   |
| CO4 | 1   | 2                      |     |     |     |     |     |     |     |     |     |     |     |
| CO5 | 1   | 2                      |     |     |     |     |     |     |     |     |     |     | 3   |

3: Substantial (High)  
2: Moderate (Medium)  
1: Poor (Low)

### TEXTBOOKS:

### REFERENCE BOOKS:

### E-Books / Online Resources:
1. [https://en.wikibooks.org/wiki/Microprocessor_Design](https://en.wikibooks.org/wiki/Microprocessor_Design)
2. [https://www.youtube.com/playlist?list=PL1iLu2CSC9EWAo0ysorNl_nebwF6Rwkr0](https://www.youtube.com/playlist?list=PL1iLu2CSC9EWAo0ysorNl_nebwF6Rwkr0)

### MOOC:
1. [http://nptel.ac.in/courses/108107029/39](http://nptel.ac.in/courses/108107029/39)

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.

PRINCIPLES AND PRACTICES OF SOFTWARE ENGINEERING
Course Code : 20CS406
CIE Marks : 50
Teaching Hours /Week (L:T:P:S) : 3-0-0-0
SEE Marks : 50
Total Hours : 39
Credits : 03

Course Learning Objectives:

This Course will enable students to
1. Outline software engineering principles and activities involved in building large software programs.
2. Explain the importance of architectural decisions in designing the software.
3. Describe the process of Agile project development.
4. Recognize the importance of software testing and describe the intricacies involved in software evolution.
5. Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT – I

Introduction:
Requirements Engineering:
Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.

UNIT – II

System Models:
Context models, Interaction models, Structural models, Behavioral models.
Architectural Design:
Architectural design decisions. Architectural Views and patterns, Application architectures.
Design and implementation:
Object oriented Design using UML.
Agile Software Development:
Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.

UNIT – III

Project Management:
Risk management, Teamwork
Project Planning:
Software pricing, Plan-driven development, Project Scheduling
Quality Management:
Software quality, Reviews and inspections, Software measurement and metrics, Software standards.

09 Hours
Course Outcomes:
At the end of the course the student will be able to:
1. **Recognise** the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility.
2. **Describe** the waterfall, incremental and iterative models and architectural design in implementing the software.
3. **Make use of** the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4. **Describe** the methods for maintaining software system.
5. **Discuss** project planning and management and illustrate the quality of software products.

### Table-1: Mapping of COs to PIs, POs and BTL

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs) Addressed</th>
<th>Performance Indicators (PI)</th>
<th>Bloom's Taxonomy Level (BTL)</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1, 2, 3</td>
<td>1.1.1, 2.1.1, 2.1.2, 2.2.2, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 8.2.2</td>
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<td>L2</td>
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### Table-2: Mapping Levels of COs to POs / PSOs

<table>
<thead>
<tr>
<th>COs</th>
<th>Program Outcomes (POs)</th>
<th>PSOs</th>
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<td>3</td>
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<tr>
<td>CO5</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

3: Substantial (High)  2: Moderate (Medium)  1: Poor (Low)

**TEXTBOOK:**
REFERENCE BOOKS:

E-Books / Online Resources:
1. http://agilemanifesto.org/

MOOC:

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.

DESIGN & ANALYSIS OF ALGORITHMS LAB

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<th>CIE Marks</th>
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<td>Credits</td>
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Experiments:
In the laboratory the students must implement the following experiments in Java programming language:

1. Various Sorting/Searching algorithms
2. Graph traversals – DFS and BFS, Connectivity and Reachability of graphs
3. Topological Sorting
4. Descending Priority Queue using Heap
5. Horspool string matching algorithm
7. Prim’s, Kruskal’s, Dijkstra’s algorithms

MICROPROCESSORS AND PERIPHERALS LAB
Experiments:
Students have to write, execute and test programs covering the syllabus.
Typical problems that may be tried are

Part-A:
1. Searching
2. Sorting
3. String manipulation
4. usage of Macros and subroutines
5. DOS interrupt usage
6. BIOS interrupt usage

Part-B
1. LED on / off
2. Relay serial -on / off
3. Step motor -Clockwise, anticlockwise, delay
4. LCD -Text and Number display (Clockwise, Anticlockwise)
5. Counter on /off
6. Taking input from key matrix and displaying over serial monitor
7. Potentiometer -Setting variables

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

**ENHANCING SELF COMPETENCE**

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<td>Credits</td>
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</table>

Pre-requisites:
Students must have essential knowledge of English Language Communication.

Course Learning Objectives (CLO):
By the end of the course, students should be able to:
1. Introspect and learn about oneself.
2. Develop professional writing skills.
1. Acquaint with the various social behaviour and etiquette.
2. Apply the techniques of fundamental communication skills.
3. Develop necessary techniques for formal presentations and be acquainted with cultural diversities & issues related to gender sensitivity.

UNIT – I

Personality Traits:
Types & Kinds of personality, Ways to Identify Self (Entry -Exit survey- Tests; SWOT Analysis, Johari Window).  

UNIT – II

Effective Communication Skills:
One-way and two-way Communication (Square activities), Active listening, Speaking.

8 Hours

UNIT – III

Writing Skills:
Formal E-mails, Framing Requests, Greetings, Salutations, Close

8 Hours

UNIT – IV

Social Behavior and Etiquette:
Time Management, Personal Grooming, Hygiene, Dressing for different occasions, Making Small Talk, Showing Respect, Feedback.

7 Hours

UNIT – V

Professional Presentation Techniques:
Group discussion, Formal Presentation, Awareness of the cultural diversity of the workplace, the global work cultures, Introduction to Gender Sensitivity

10 Hours

Course Outcomes (CO):
By the end of the course, students will be able to:
CO1 - Understand the importance of human conduct.
CO2 - Demonstrate knowledge of theory and competence in office communication.
CO3 - Develop and assess various types of communication.
CO4 - Be Familiar with the current practices of social behaviour.
CO5 - Prepare and deliver presentation appropriate for the workplace.

REFERENCE BOOKS: