



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering



### INSTITUTE VISION

*“To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society”*

### INSTITUTE MISSION

*“To continuously strive for the overall development of students by educating them in a state-of-the-art-infrastructure, by retaining the best practices, faculties and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals”.*

### DEPARTMENT VISION

*“To be a center of excellence in providing education in the field of Computer Science and Engineering to produce technically competent and socially responsible IT professionals”*

### DEPARTMENT MISSION

*“To provide a theoretical foundation in computing with the exposure of latest tools and technologies, IT infrastructure and encourage students for continuous learning to make them competent professionals”*

### PROGRAM EDUCATIONAL OBJECTIVES (PEO's) :

*Pursue a successful career in the field of Computer Science & Engineering utilizing his/her knowledge and contribute to the profession as an excellent employee, or as an entrepreneur.*

*Apply the knowledge of mathematics & computer science fundamentals to analyze & formulate the solution to solve real time problems.*

*Exhibit the professional and ethical values, communication & teamwork skills, lifelong learning, multidisciplinary approach to address computer engineering and societal issues.*

### PROGRAM OUTCOMES (PO's) :

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

**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.*

**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.*

**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.*

**Modern tool usage:** *Create, select, and apply appropriate techniques, resources, and modern engineering and IT*



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tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**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.

**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.

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

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

**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.

**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.

**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 (PSO's) :

**PSO1:** Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Bigdata Analytics, Machine Learning and Networking.

**PSO2:** Make use of modern computer tools for creating innovative career paths to be an entrepreneur and desire for higher studies.

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## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

### 1.0 Student Help Desk

| Sl. No.         | Purpose   | Contact Person                             |                     |
|-----------------|---|--|---------------------|
|                 |   | Faculty                                    | Instructor          |
| 1.              | Attestations / Exam forms signature.                                      | Dr. Parashuram Baraki                      | --                  |
| 2.              | Academics   | Sri. S. V. Manjaragi                       | Mr. A. R. Bhiste    |
| 3.              | Industry- Institute-Interaction (Alliance/ MoU, Ind. Visit etc.)          | Sri. Y. M. Naik                            | --                  |
| 4.              | Seminar/FDP/Workshops/HIT-QUEST/Conference/ Alumni                        | Sri. S. G. Gollagi<br>Mrs. A. A. Daptardar | Mrs. Rutuja Patil   |
| 5.              | Project Coordinator   | Sri. Y. M. Naik                            | --                  |
| 6.              | STAC/Competitive Exams/VTU Exams (GATE/CAT/GRE etc., Ranks in VTU exams.) | Mrs. S. B. Hosagoudar<br>Sri. C. R. Belavi | --                  |
| 7.              | Training & Placement  | Sri. M. G. Huddar                          | --                  |
| 8.              | NBA Activities  | Sri. S. V. Manjaragi                       | Mr. A. K. Badakar   |
| 9.              | Technical Seminar Coordinator   | Sri. C. R. Belavi                          | --                  |
| 10.             | KSCST   | Sri. Y. M. Naik                            | --                  |
| 11.             | ISTE  | Sri. M. A. Chitale                         | --                  |
| 12.             | IEEE coordinator /LIC/Smart India Hackathon                               | Sri. M. G. Huddar                          | --                  |
| 13.             | Website   | Sri. C. R. Belavi                          | Mrs. Rutuja Patil   |
| 14.             | VTU Portal updation   | Sri. M. A. Gholap                          | Miss. S. B. Vairagi |
| 15.             | Internship Coordinator  | Sri. R. R. Patil                           | --                  |
| 16.             | Feedback /Edusat/e-Learning/EMS/ AICTE/ IA Coordinator                    | Sri. M. A. Chitale                         | Mr. A. K. Badakar   |
| 17.             | Robo-Vidya / IT Maintenance   | Sri. M. A. Gholap                          | Mr. A. B. Bennoli   |
| 18.             | Dept. Library   | Mr. A. R. Bhiste                           |                     |
| Institute Level |   |  |                     |
| 19.             | Student Welfare Convener  | Sri. R. R. Patil (9845455422 )             |                     |
| 20.             | TP Cell Coordinator   | Sri. Santosh Sajjan (9480849332)           |                     |
| 21.             | Anti Ragging Convener   | Sri. M.S.Futane (9480849334)               |                     |
| 22.             | Anti Squad Convener   | Sri. K.M.Akkoli (9739114856)               |                     |
| 23.             | Anti Sexual Harassment Convener   | Smt. J B Patil ( 9449308355)               |                     |
| 24.             | Grievance redressal Convener  | Sri. S S Tabhaj (9901398134)               |                     |
| 25.             | Extra-Curricular Activities   | Sri. T S Vandali (9686235904)              |                     |

### 2.0 Departmental Resources

Department of Computer Science and Engineering was established in the year 1996 and is housed in a total area of 1206 Sq. Mtrs.

#### 2.1 Faculty Position

| Sl.No. | Category                   | No. in Position | Average experience (in years) |
|--------|----------------------------|-----------------|-------------------------------|
| 1.     | Teaching faculty           | 12              | 12                            |
| 2.     | Technical Supporting Staff | 06              | 06                            |
| 3.     | Helper staff               | 03              | 19                            |



**Course Plan 2018-19 ODD – Semester - III  
Computer Science and Engineering**

**2.2 Major Laboratories**

| Sl.No. | Name of the laboratory   | Area in Sq. Mtrs | Amount Invested (Rs. in Lakhs) |
|--------|--------------------------|------------------|--------------------------------|
| 1.     | System Programming Lab.  | 70               | 12.64                          |
| 2.     | C Programming Lab.       | 70               | 18.75                          |
| 3.     | Algorithms/ Network Lab. | 70               | 11.71                          |
| 4.     | Microprocessors Lab.     | 70               | 21.92                          |
| 5.     | Web Programming/DBA Lab. | 70               | 09.00                          |
| 6.     | Computer Center          | 220              | 183.18                         |

**Total Investment in the Department**

**Rs. 257.20 Lakhs**

**3.0 Teaching Faculty Details**

| Sl. No. | Name                    | Designation   | Qualification  | Specialization | Professional Membership | Teaching Exp (in yrs) | Phone No.  |
|---------|-------------------------|---------------|----------------|----------------|-------------------------|-----------------------|------------|
| 1       | Dr.Parashuram Baraki    | H.O.D.& Prof. | M.Tech, Ph.D   | CSE            | LMISTE                  | 16.08                 | 9686042385 |
| 2       | Prof. S. G. Gollagi     | Asst. Prof.   | M. Tech.(Ph.D) | CSE            | LMISTE                  | 20.00                 | 9880383883 |
| 3       | Prof. N. K. Honnagoudar | Asst. Prof.   | M.E            | ECE            | LMISTE                  | 16.00                 | 9449495302 |
| 4       | Prof. Y. M. Naik        | Asst. Prof.   | M. Tech.       | ECE            | LMISTE                  | 18.00                 | 9901848125 |
| 3       | Prof. S. V. Manjaragi   | Asst. Prof.   | M. Tech.(Ph.D) | CSE            | LMISTE                  | 13.10                 | 9986658309 |
| 5       | Prof. R. R. Patil       | Asst. Prof    | M. Tech        | CSE            | LMISTE                  | 13.00                 | 9845455422 |
| 6       | Prof. A.A. Daptardar    | Asst. Prof    | M. Tech.       | CSE            | LMISTE                  | 11.02                 | 9620851002 |
| 7       | Prof. C.R. Belavi       | Asst. Prof    | M. Tech.       | CSE            | LMISTE                  | 10.00                 | 7829241219 |
| 8       | Prof. M.G. Huddar       | Asst. Prof    | M. Tech.(Ph.D) | CSE            | LMISTE                  | 09.00                 | 7411043272 |
| 9       | Prof. S.B.Hosgoudar     | Asst. Prof    | M. Tech        | CSE            | LMISTE                  | 08.00                 | 9535287338 |
| 10      | Prof. M. A. Chitale     | Asst. Prof    | M. Tech.       | CNE            | LMISTE                  | 05.00                 | 9480787474 |
| 11      | Prof. M.A.Gholap        | Asst. Prof    | M. Tech.       | CSE            | LMISTE                  | 04.00                 | 7353122323 |



# Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

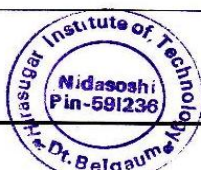
## 4.0 Institute Academic Calendar

|  |  |   |
|--|--|---|
|  | <p>S J P N Trust's<br/> <b>Hirasugar Institute of Technology, Nidasoshi.</b><br/> <i>Inculcating Values, Promoting Prosperity</i><br/>         Approved by AICTE New Delhi, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.</p> | Institute<br>File I-11<br>2018-19 (Odd)<br>Rev: 0 |
|--|--|---|

### CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2018-19

| Date                     | Events   | Calendar   |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|--------------------------|--|--|----------------|----|----|----|--|--|--|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|
| 01-08-2018               | Commencement of III/V Sem Classes  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">August-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr> <tr><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td></tr> <tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td></td></tr> </table>  | August-2018    |    |    |    |  |  |  | S | M | T | W | T | F | S |  |   |   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |  |  |  |  |  |
| August-2018              |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          |  |  | 1              | 2  | 3  | 4  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 5                        | 6  | 7  | 8              | 9  | 10 | 11 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 12                       | 13   | 14   | 15             | 16 | 17 | 18 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 19                       | 20   | 21   | 22             | 23 | 24 | 25 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 26                       | 27   | 28   | 29             | 30 | 31 |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 06-08-2018               | Commencement of VII Sem Classes  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 13-08-2018 to 01-09-2018 | Commencement of Induction Program for I Semester students                              |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 14-08-2018               | Fresher's Day (I Sem)  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 15-08-2018               | Independence Day   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 26-08-2018               | Women's Equality Day   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 05-09-2018               | Teachers Day   | 15- Independence day, 22- Bakrid   |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 08-09-2018 & 09-09-2018  | Indoor Games   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">September-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>  | September-2018 |    |    |    |  |  |  | S | M | T | W | T | F | S |  |   |   |   |   |   | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |  |  |  |  |  |
| September-2018           |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          |  |  |                |    |    | 1  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 2                        | 3  | 4  | 5              | 6  | 7  | 8  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 9                        | 10   | 11   | 12             | 13 | 14 | 15 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 16                       | 17   | 18   | 19             | 20 | 21 | 22 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 23                       | 24   | 25   | 26             | 27 | 28 | 29 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 30                       |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 10-09-2018 to 12-09-2018 | First Internal Assessment of III/V/VII Sem   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 14-09-2018 & 15-09-2018  | Feed Back-1  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 15-09-2018               | Engineers Day  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 17-09-2018               | Display of First Internal Assessment Marks & Submission of Feedback-1 report to office |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 22-09-2018               | EDP Activities   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 02-10-2018               | Gandhi Jayanti & Swachh Bharat Abhiyan   | 13- Ganesh Chaturthi, 21- Moharam  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 15-10-2018 to 17-10-2018 | First Internal Assessment of I Sem<br>Second Internal Assessment of III/V/VII Sem      | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">October-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr> <tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td></tr> <tr><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td></tr> </table>   | October-2018   |    |    |    |  |  |  | S | M | T | W | T | F | S |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |    |  |  |  |  |  |
| October-2018             |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          | 1  | 2  | 3              | 4  | 5  | 6  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 7                        | 8  | 9  | 10             | 11 | 12 | 13 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 14                       | 15   | 16   | 17             | 18 | 19 | 20 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 21                       | 22   | 23   | 24             | 25 | 26 | 27 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 28                       | 29   | 30   | 31             |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 22-10-2018 & 23-10-2018  | Feed Back-2  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 25-10-2018               | Submission of Feedback-2 Report to Office  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 25-10-2018               | Display of Second Internal Assessment Marks  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 28-10-2018               | Compensatory Working Day of Connecting Holiday 20-10-2018 (Half Day)                   | 2- Gandhi Jayanti, 8- Mahalaya Amavasya, 18- Ayudha Pooja, 19- Vijayadashami, 24- Valmiki Jayanti  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 01-11-2018               | Kannada Rajyotsava   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">November-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td></td></tr> </table>  | November-2018  |    |    |    |  |  |  | S | M | T | W | T | F | S |  |   |   |   | 1 | 2 | 3 | 4 | 5 | 6 | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |    |    |  |  |  |  |  |
| November-2018            |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          |  |  |                | 1  | 2  | 3  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 4                        | 5  | 6  | 7              | 8  | 9  | 10 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 11                       | 12   | 13   | 14             | 15 | 16 | 17 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 18                       | 19   | 20   | 21             | 22 | 23 | 24 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 25                       | 26   | 27   | 28             | 29 | 30 |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 18-11-2018               | Compensatory Working Day of Connecting Holiday 07-11-2018                              |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 16-11-2018 to 18-11-2018 | Second Internal Assessment of I Sem<br>Third Internal Assessment of III/V/VII Sem      |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 22-11-2018 to 24-11-2018 | Lab Internal Assessment of III/V/VII Sem   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 28-11-2018               | Display of Third & Final Internal Assessment Marks(III/V/VII Sem)                      |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 30-11-2018               | Last Working Day of III/V Sem  | 1- Kannada Rajyotsava, 6- Naraka Chaturdashi, 8- Balipadyami, 21- Id-e-Milad, 26- Kanakadasa Jayanthi  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 04-12-2018               | Last Working Day of VII Sem  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">December-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td>31</td><td></td><td></td><td></td><td></td><td></td></tr> </table> | December-2018  |    |    |    |  |  |  | S | M | T | W | T | F | S |  |   |   |   |   |   | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |  |  |  |  |  |
| December-2018            |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          |  |  |                |    |    | 1  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 2                        | 3  | 4  | 5              | 6  | 7  | 8  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 9                        | 10   | 11   | 12             | 13 | 14 | 15 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 16                       | 17   | 18   | 19             | 20 | 21 | 22 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 23                       | 24   | 25   | 26             | 27 | 28 | 29 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 30                       | 31   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 03-12-2018 to 14-12-2018 | Practical Exams of III/V Sem   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 17-12-2018 to 18-01-2019 | Theory Exams of III/V Sem  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 06-12-2018 to 14-12-2018 | Practical Exams of VII Sem   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 17-12-2018 to 18-01-2019 | Theory Exams of VII Sem  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 03-01-2019 to 05-01-2019 | Third Internal Assessment of I Sem   | 25- Christmas  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 09-01-2019 to 11-01-2019 | Lab Internal Assessment of I Sem   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">January -2019</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr> <tr><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td></tr> <tr><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td></tr> </table>  | January -2019  |    |    |    |  |  |  | S | M | T | W | T | F | S |  |   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |  |  |  |  |  |
| January -2019            |  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| S                        | M  | T  | W              | T  | F  | S  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
|                          |  | 1  | 2              | 3  | 4  | 5  |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 6                        | 7  | 8  | 9              | 10 | 11 | 12 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 13                       | 14   | 15   | 16             | 17 | 18 | 19 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 20                       | 21   | 22   | 23             | 24 | 25 | 26 |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 27                       | 28   | 29   | 30             | 31 |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 17-01-2019               | Display of Third & Final Internal Assessment Marks (I Sem)                             |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 17-01-2019               | Last Working Day of I Sem  |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 21-01-2019 to 30-01-2019 | Practical Exams of I Sem   |  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |
| 04-02-2019 to 18-02-2019 | Theory Exams of I Sem  | 14-Sankranti, 26-Republic Day  |                |    |    |    |  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |

Dr. Shilpa Shrigiri  
 IQAC Co-ordinator



Dr. S C Kamate  
 PRINCIPAL

**Hirasugar Institute of Technology**  
**NIDASOSHI-591 236**



# Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

## 5.0 Department Academic Calendar

|  |   |  |
|--|---|--|
|  | <p>S J P N Trust's<br/><b>Hirasugar Institute of Technology, Nidasoshi.</b><br/><i>Inculcating Values, Promoting Prosperity</i><br/>Approved by AICTE New Delhi, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.</p> | <p>DEPT CSE<br/>File I<br/>2018-19 (Odd)<br/><b>Rev: 0</b></p> |
|--|---|--|

### CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2018-19

| Date                     | Events  | Calendar  |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|--------------------------|---|---|---------------------------------|----|----|----|----|--|--|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|
| 01-08-2018               | Commencement of III/V Sem Classes   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">August-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr> <tr><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td></tr> <tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td></td></tr> </table>   | August-2018                     |    |    |    |    |  |  | S | M | T | W | T | F | S |  |   |   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |  |  |  |  |  |  |
| August-2018              |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| S                        | M   |   | T                               | W  | T  | F  | S  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   |   |                                 | 1  | 2  | 3  | 4  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 5                        | 6   |   | 7                               | 8  | 9  | 10 | 11 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 12                       | 13  |   | 14                              | 15 | 16 | 17 | 18 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 19                       | 20  |   | 21                              | 22 | 23 | 24 | 25 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 26                       | 27  |   | 28                              | 29 | 30 | 31 |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 06-08-2018               | Commencement of VII Sem Classes   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 08-08-2018               | STAC Awareness Program  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 13-08-2018 to 01-09-2018 | Commencement of Induction Program for I Semester students                           |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 14-08-2018               | Fresher's Day (I Sem)   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 26-08-2018               | Women's Equality Day  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 29-08-2018               | Fresher's Welcome Function  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 05-09-2018               | Teachers Day, Quiz  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">September-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> | September-2018                  |    |    |    |    |  |  | S | M | T | W | T | F | S |  |   |   |   |   |   | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |  |  |  |
| September-2018           |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| S                        | M   |   | T                               | W  | T  | F  | S  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   |   |                                 |    |    |    | 1  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 2                        | 3   |   | 4                               | 5  | 6  | 7  | 8  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 9                        | 10  |   | 11                              | 12 | 13 | 14 | 15 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 16                       | 17  |   | 18                              | 19 | 20 | 21 | 22 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 23                       | 24  |   | 25                              | 26 | 27 | 28 | 29 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 30                       |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 08-09-2018 to 09-09-2018 | Indoor Games  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 10-09-2018 to 12-09-2018 | First Internal Assessment of III/V/VII Sem  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 15-09-2018               | Engineers Day   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 14-09-2018 & 15-09-2018  | Feed Back - 1   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 17-09-2018               | Display of First Internal Assessment Marks & Submission of Feed Back - 1 to Office  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 19-09-2018               | Painting / Rangoli  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 22-09-2018               | EDP Activities  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 26-09-2018               | Blind Coding  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 02-10-2018               | Gandhi Jayanti & Swachh Bharat Abhiyan  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">October-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr> <tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td></tr> <tr><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td></tr> </table>  | October-2018                    |    |    |    |    |  |  | S | M | T | W | T | F | S |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |  |  |  |  |  |  |
| October-2018             |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| S                        | M   |   | T                               | W  | T  | F  | S  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          | 1   |   | 2                               | 3  | 4  | 5  | 6  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 7                        | 8   |   | 9                               | 10 | 11 | 12 | 13 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 14                       | 15  |   | 16                              | 17 | 18 | 19 | 20 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 21                       | 22  |   | 23                              | 24 | 25 | 26 | 27 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 28                       | 29  |   | 30                              | 31 |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 05-10-2018 & 06-10-2018  | Workshop  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 10-10-2018               | Indoor Activities : Musical Chair, Tug of War, Mehandi, Cook without Fire           |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 15-10-2018 to 17-10-2018 | First Internal Assessment of I Sem<br>Second Internal Assessment of III/V/VII Sem   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 22-10-2018 & 23-10-2018  | Feed Back - 2   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 25-10-2018               | Display of Second Internal Assessment Marks & Submission of Feed Back - 2 to Office |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 28-10-2018               | Compensatory working Day of Connecting Holiday                                      |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 31-10-2018               | Technical Talk  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 01-11-2018               | Kannada Rajyotsava  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">November-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td></td></tr> </table>   | November-2018                   |    |    |    |    |  |  | S | M | T | W | T | F | S |  |   |   |   | 1 | 2 | 3 | 4 | 5 | 6 | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |    |  |  |  |  |  |  |
| November-2018            |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| S                        | M   |   | T                               | W  | T  | F  | S  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   |   |                                 |    | 1  | 2  | 3  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 4                        | 5   |   | 6                               | 7  | 8  | 9  | 10 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 11                       | 12  |   | 13                              | 14 | 15 | 16 | 17 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 18                       | 19  |   | 20                              | 21 | 22 | 23 | 24 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 25                       | 26  |   | 27                              | 28 | 29 | 30 |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 07-11-2018               | Crypt Ur Mind   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 16-11-2018 to 18-11-2018 | Second Internal Assessment of I Sem<br>Third Internal Assessment of III/V/VII Sem   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 18-11-2018               | Compensatory working Day of Connecting Holiday (07-11-2018)                         |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 22-11-2018 to 24-11-2018 | Lab Internal Assessment of III/V/VII Sem  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 28-11-2018               | Display of Third & Final Internal Assessment Marks(III/V/VII Sem)                   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 30-11-2018               | Last Working Day of III / V Sem   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 04-12-2018               | Last Working Day of VII Sem   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 03-12-2018 to 14-12-2018 | Practical Exams of III / V Sem  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 06-12-2018 to 14-12-2018 | Practical Exams of VII Sem  |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 17-12-2018 to 18-01-2019 | Theory Exams of III / V / VII Sem   | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">December-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>  | December-2018                   |    |    |    |    |  |  | S | M | T | W | T | F | S |  |   |   |   |   |   | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |  |  |  |
| December-2018            |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| S                        | M   |   | T                               | W  | T  | F  | S  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   |   |                                 |    |    |    | 1  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 2                        | 3   |   | 4                               | 5  | 6  | 7  | 8  |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 9                        | 10  |   | 11                              | 12 | 13 | 14 | 15 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 16                       | 17  |   | 18                              | 19 | 20 | 21 | 22 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 23                       | 24  |   | 25                              | 26 | 27 | 28 | 29 |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
| 30                       |   |   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   |   | 15- Independence day, 22-Bakrid |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   | 13- Ganesh Chaturthi, 21-Moharam  |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   | 2- Gandhi Jayanti, 8- Mahalaya Amavasya, 18-Ayudha Pooja, 19- Vijayadashami, 24- Valmiki Jayanti  |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   | 1- Kannada Rajyotsava, 6- Naraka Chaturdashi, 8- Balipadyami, 21- Id-e-Milad, 26- Kanakadasa Jayanthi   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|                          |   | 25- Christmas   |                                 |    |    |    |    |  |  |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |

STAC Coordinator

HOD  
H.O.D  
Computer Science & Engg.  
HIT, Nidasoshi.



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

### 6.0 Scheme of Teaching & Examination

CHOICE BASED CREDIT SYSTEM (CBCS)  
B.E. Computer Science & Engineering/ B.E. Information Science & Engineering

| Sl. No | Sub-Code       | Title   | Teaching Dept. | Teaching hours/ week                |                | Examination       |           |           |             | Credits |
|--------|----------------|---|----------------|-------------------------------------|----------------|-------------------|-----------|-----------|-------------|---------|
|        |                |   |                | Theory                              | Pract/Drawing. | Duration in Hours | SEE Marks | CIE Marks | Total Marks |         |
| 1      | 17MAT31        | Engineering Mathematics - III                                       | Math's         | 04                                  | --             | 03                | 60        | 40        | 100         | 4       |
| 2      | 17CS32         | Analog and Digital Electronics                                      | CS/IS          | 04                                  | --             | 03                | 60        | 40        | 100         | 4       |
| 3      | 17CS33         | Data Structures and Applications                                    | CS/IS          | 04                                  | --             | 03                | 60        | 40        | 100         | 4       |
| 4      | 17CS34         | Computer Organization   | CS/IS          | 04                                  | --             | 03                | 60        | 40        | 100         | 4       |
| 5      | 17CS35         | Unix and Shell Programming  | CS/IS          | 03                                  | --             | 03                | 60        | 40        | 100         | 3       |
| 6      | 17CS36         | Discrete Mathematical Structures                                    | CS/IS          | 04                                  | --             | 03                | 60        | 40        | 100         | 4       |
| 7      | 17CSL37        | Analog and Digital Electronics Laboratory                           | CS/IS          | 1I+2P                               |                | 03                | 60        | 40        | 100         | 2       |
| 8      | 17CSL38        | Data Structures Laboratory  | CS/IS          | 1I+2P                               |                | 03                | 60        | 40        | 100         | 2       |
| 9      | 17KL/CPH 39/49 | Kannada/Constitution of India, Professional Ethics and Human Rights | Humanities     | 01                                  |                | 01                | 30        | 20        | 50          | 01      |
| Total  |                |   |                | Theory:24 Hrs<br>Practical:: 06 Hrs |                | 25                | 510       | 340       | 850         | 28      |

Kannada/Constitution of India, Professional Ethics and Human Rights: 50 % of the programs of the Institution have to teach Kannada/Constitution of India, Professional Ethics and Human Rights in cycle based concept during III and IV semesters.

Audit Course:

\*All lateral entry students (except B.Sc candidates) have to register for Additional Mathematics – I, which is 03 contact hours per week.

|   |            |                           |       |    |  |    |    |    |    |    |
|---|------------|---------------------------|-------|----|--|----|----|----|----|----|
| 1 | 17MATDIP31 | Additional Mathematics –I | Maths | 03 |  | 03 | 60 | -- | 60 | -- |
|---|------------|---------------------------|-------|----|--|----|----|----|----|----|

Language English (Audit Course) be compulsorily studied by all lateral entry students (except B.Sc candidates)



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                                     |                                    |                   |    |
|-------------------------------------|------------------------------------|-------------------|----|
| <b>Subject Title</b>                | <b>Engineering Mathematics-III</b> |                   |    |
| <b>Subject Code</b>                 | 17MAT31                            | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs / Week</b> | 04                                 | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b>  | 50                                 | <b>Exam Hours</b> | 03 |
| <b>CREDITS – 04</b>                 |                                    |                   |    |

|  |                                     |                        |
|--|-------------------------------------|------------------------|
| <b>FACULTY DETAILS:</b>                |                                     |                        |
| <b>Name:</b> Prof S. I. Shivamoggimath | <b>Designation:</b> Asst. Professor | <b>Experience:</b> 5.5 |
| <b>No. of times course taught:</b> 03  | <b>Specialization:</b> Mathematics  |                        |

### 1.0 Prerequisite Subjects:

| Sl. No | Branch                       | Semester | Subject                    |
|--------|------------------------------|----------|----------------------------|
| 01     | Computer Science Engineering | II       | Engineering Mathematics-II |

### 2.0 Course Objectives

The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variations..

### 3.0 Course Outcomes

On completion of this course, students are able to:

| CO                                | Course Outcome   | POs       |
|-----------------------------------|--|-----------|
| C201.1                            | Know the use of periodic signals and Fourier series to analyze circuits and system communications  | 1,2,3     |
| C201.2                            | Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.                          | 1,2,3     |
| C201.3                            | Employ appropriate numerical methods to solve algebraic and transcendental equations   | 1,2,3     |
| C201.4                            | Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems. | 1,2,3     |
| C201.5                            | Determine the extremals of functional and solve the simple problems of the calculus of variations.   | 1,2,3     |
| <b>Total Hours of instruction</b> |  | <b>50</b> |



**4.0 Course Content**

| MODULES   | RBT Levels | No. Of Hours |
|---|------------|--------------|
| <b>MODULE-I</b><br><b>Fourier series:</b><br>Periodic functions, Dirichlet’s condition, Fourier Series of Periodic functions with period $2\pi$ and with arbitrary period $2c$ , Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis-Illustrative examples from engineering field.   | L1 & L2    | 10           |
| <b>MODULE-II</b><br><b>Fourier Transforms:</b><br>Infinite Fourier transform, Fourier Sine and Cosine transforms, inverse Fourier transforms<br><b>Z-transform:</b><br>Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.  | L1 & L2    | 10           |
| <b>MODULE-III</b><br><b>Statistical Methods:</b><br>Review of measures of central tendency and dispersion. Correlation-Karl Pearson’s coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems<br><b>Curve fitting:</b><br>Curve fitting by the method of least squares, Fitting of the curves of the form $y = ax+b$ , $y = ax^2+bx+c$ & $y = ae^{bx}$<br><b>Numerical Methods:</b><br>Numerical solution of algebraic and transcendental equations by: Regular-Falsi method and Newton –Raphson method | L1 & L2    | 10           |
| <b>MODULE-IV</b><br>2. <b>Finite differences:</b><br>3. Forward and backward differences, Newton’s forward and backward interpolation formulae Divided differences-Newton’s divided difference formula. Lagrange’s interpolation formula and inverse interpolation formula.(all formulae without proof)-Problems.<br><b>Numerical integration:</b> Simpson’s $(1/3)^{th}$ and $(3/8)^{th}$ rules, Weddle’s rule (without proof ) –Problems  | L1 & L2    | 10           |
| <b>MODULE-V</b><br>4. <b>Vector integration:</b><br>5. Line integrals-definition and problems, surface and volume integrals-definition, Green’s theorem in a plane, Stokes and Gauss divergence theorem (without proof) and problems.<br>6. <b>Calculus of Variations:</b><br>Variation of function and Functional, variational problems, Euler’s equation, Geodesics, hanging chain, problems  | L2 & L3    | 10           |

**5.0 Relevance to future subjects**

| Sl. No | Semester      | Subject                            | Topics  |
|--------|---------------|------------------------------------|---|
| 01     | Common to all | Common to all engineering Subjects | Signal and Analysis, Field Theory, Thermodynamics, Fluid Dynamics etc |



## 6.0 Relevance to Real World

| Sl. No | Real World Mapping   |
|--------|--|
| 01     | Numerical methods are used to solve engineering problems. For examples will be drawn from a variety of engineering problems, including heat transfer, vibrations, dynamics, fluid mechanics, etc.                        |
| 02     | Special functions are used to wave propagation and scattering, fiber optics, heat conduction in solids, and vibration phenomena.   |
| 03     | In signal processing, sampling is the reduction of a continuous signal to a discrete signal. A common example is the conversion of a sound wave (a continuous signal) to a sequence of samples (a discrete-time signal). |

## 7.0 Gap Analysis and Mitigation

| Sl. No | Delivery Type | Details                |
|--------|---------------|------------------------|
| 01     | Tutorial      | Topic: Sampling Theory |

## 8.0 Books Used and Recommended to Students

| Text Books  |
|---|
| 1) 'B.S. Grewal, Higher Engineering Mathematics, 43 <sup>rd</sup> Edition 2015, Khanna Publishers.                            |
| 2) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.  |
| Reference Books   |
| a) I N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, 7 <sup>th</sup> Edition, 2010. |
| 2. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.  |
| 3. H. K Dass and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Publishing, 1st Edition, 2011.                 |
| Additional Study material & e-Books   |
| 1. N.P.Bali & Manish.Goyal, A Text book of Engineering Mathematics, 7 <sup>th</sup> edition, Laxmi Publications.              |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References   |
|--|
| 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a> |
| 2. <a href="http://www.khanacademy.org/">http://www.khanacademy.org/</a>   |
| 3. <a href="http://www.class-central.com/subject/math">http://www.class-central.com/subject/math</a>             |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals   | Website   |
|--------|----------------------|---|
| 1      | + Plus Magazine      | <a href="https://plus.maths.org/issue44">https://plus.maths.org/issue44</a> . |
| 2      | Mathematics Magazine | <a href="http://www.mathematicsmagazine.com">www.mathematicsmagazine.com</a>  |



## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

- 30 marks –from three internal assessment test
- 10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- a. Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- b. Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

### Question Paper Pattern (IA):

1. Two main questions to be set from syllabus covered up to IA tests.
2. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
  - a. Q.No I or Q.No II = 15 Marks
  - b. Q.No III or Q.No IV = 15 Marks

**Total = 30 Marks**

### Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
Max. Marks: 100 and each question carries 20 marks.  
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

## 12.0 Course Delivery Plan

| Module | Lecture No. | Content of Lecturer   | % of Portion |
|--------|-------------|---|--------------|
| 1      | 1           | Periodic functions, Dirichlet's conditions                          | 20           |
|        | 2           | Fourier series of periodic functions of period $2\pi$               |              |
|        | 3           | Fourier series of periodic functions of arbitrary period $2c$       |              |
|        | 4           | Problems  |              |
|        | 5           | Fourier series of even functions                                    |              |
|        | 6           | Fourier series of odd functions                                     |              |
|        | 7           | Problems  |              |
|        | 8           | Half range Fourier series   |              |
|        | 9           | Practical harmonic analysis   |              |
|        | 10          | Problems  |              |
| 2      | 11          | Infinite Fourier transform  | 20           |
|        | 12          | Fourier sine transforms   |              |
|        | 13          | Fourier cosine transforms   |              |
|        | 14          | Inverse transforms  |              |
|        | 15          | z-transform-definition  |              |
|        | 16          | Standard z-transforms   |              |
|        | 17          | Damping rule, Shifting rule   |              |
|        | 18          | Initial value and final value theorems (without proof) and problems |              |
|        | 19          | Inverse z-transform   |              |
|        | 20          | Applications of z-transforms to solve difference equations          |              |



**Course Plan 2018-19 ODD – Semester - III**  
**Computer Science and Engineering**

|   |    |   |    |
|---|----|---|----|
| 3 | 21 | Statistical Methods: Review of measures of central tendency and dispersion            | 20 |
|   | 22 | Correlation-Karl Pearson's coefficient of correlation                                 |    |
|   | 23 | Problems  |    |
|   | 24 | Regression analysis- lines of regression (without proof) –problems                    |    |
|   | 25 | Curve fitting by the method of least squares, of the form, form $y= ax+b$ ,           |    |
|   | 26 | Curve fitting by the method of least squares: $y= a+bx+cx^2$                          |    |
|   | 27 | Curve fitting by the method of least squares $y = ae^{bx}$                            |    |
|   | 28 | Numerical solutions:<br>Numerical solution of algebraic and transcendental equations. |    |
|   | 29 | Regular-Falsi method  |    |
|   | 30 | Newton –Raphson method  |    |
| 4 | 31 | Finite differences: Forward & backward differences                                    | 20 |
|   | 32 | Newton's forward and backward interpolation formulae                                  |    |
|   | 33 | Problems  |    |
|   | 34 | Divided differences- Newton's divided difference formula                              |    |
|   | 35 | Problems  |    |
|   | 36 | Lagrange's interpolation & inverse interpolation formula                              |    |
|   | 37 | Problems  |    |
|   | 38 | Numerical integration: Simpson's one third rule                                       |    |
|   | 39 | Simpson's three eighth rule   |    |
|   | 40 | Weddle's rule (without proof) Problems  |    |
| 5 | 41 | Line integrals-definition and problems  | 20 |
|   | 42 | Surface and volume integrals-definition,  |    |
|   | 43 | Green's theorem in a plane  |    |
|   | 44 | Stokes theorem (without proof) problems.  |    |
|   | 45 | Gauss divergence theorem (without proof) problems                                     |    |
|   | 46 | Calculus of Variations:<br>Variation of function and Functional, variational problems |    |
|   | 47 | Euler's equation  |    |
|   | 48 | Problems  |    |
|   | 49 | Geodesics   |    |
|   | 50 | Hanging chain, problems   |    |

**13.0 Assignments, Pop Quiz, Mini Project, Seminars**

| Sl. No. | Title                              | Outcome expected   | Allied study             | Week No. | Individual / Group activity | Reference: book/website /Paper                                 |
|---------|------------------------------------|--|--------------------------|----------|-----------------------------|--|
| 1       | Assignment 1: University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 1 of the syllabus | 2        | Individual Activity.        | Book 1, of the reference list. Website of the Reference list   |
| 2       | Assignment 2: University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 2 of the syllabus | 4        | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |
| 3       | Assignment 3: University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 3 of the syllabus | 6        | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |



|   |                                       |  |                          |    |                      |  |
|---|---------------------------------------|--|--------------------------|----|----------------------|--|
| 4 | Assignment 4:<br>University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 4 of the syllabus | 8  | Individual Activity. | Book 1, 2 of the reference list. Website of the Reference list |
| 5 | Assignment 5:<br>University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 5 of the syllabus | 10 | Individual Activity. | Book 1, 2 of the reference list. Website of the Reference list |

## 14.0 QUESTION BANK

### MODULE-I: FOURIER SERIES

- Obtain a Fourier series to represent  $e^{-ax}$  from  $(-\infty, \infty)$
- Expand  $f(x) = x \sin x$ ,  $0 < x < 2$ , in a Fourier series.
- For a function  $f(x)$  defined by  $f(x) = |x|$ ,  $-\pi < x < \pi$ , obtain a Fourier series. Deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} = \frac{\pi^2}{8}$
- Find the Fourier series for the function  $f(x) = \frac{\pi-x}{2}$  in  $(0, 2\pi)$ . Hence deduce that  $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \dots$
- Find the Fourier series to represent  $f(x) = x+x^2$  from  $x=-\pi$  to  $x=\pi$  and deduce that  $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} = \frac{\pi^2}{12}$
- Expand  $f(x) = e^x$  as a Fourier series in the interval  $(-1, 1)$
- Obtain Fourier series for the function  $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$  and deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} = \dots$
- Develop  $f(x)$  in Fourier series in the interval  $(-2, 2)$  if  $f(x) = \begin{cases} 0, & -2 < x < 0 \\ 1, & 0 < x < 2 \end{cases}$
- Find the half range cosine series for the function  $f(x) = x^2$  in the range  $0 \leq x \leq 1$
- Find the complex form of the Fourier series of the periodic function  $f(x) = \cos ax$ , in  $-\pi < x < \pi$ .
- The following table gives the variation of periodic current over a period

|       |      |      |      |      |       |       |      |
|-------|------|------|------|------|-------|-------|------|
| t sec | 0    | T/6  | T/3  | T/2  | 2T/3  | 5T/6  | T    |
| A amp | 1.98 | 1.30 | 1.05 | 1.30 | -0.88 | -0.25 | 1.98 |

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.

- Obtain the Fourier series for the function

$$f(x) = \begin{cases} 1 - \frac{2x}{\pi} & -\pi \leq x \leq 0 \\ 1 + \frac{2x}{\pi} & 0 \leq x \leq \pi \end{cases} \quad \text{Hence deduce that } \frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$$

- Obtain the Fourier expansion of  $f(x) = 2x - x^2$  in  $0 \leq x \leq 2$
- Obtain the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of  $y$  as given below.

|   |   |    |    |    |    |    |
|---|---|----|----|----|----|----|
| x | 0 | 1  | 2  | 3  | 4  | 5  |
| y | 9 | 18 | 24 | 28 | 26 | 20 |



**MODULE-II: FOURIER TRANSFORMS**

1) Find the Fourier transform of

$$f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases} \quad \text{Hence evaluate } \int_0^{\infty} \frac{\sin x}{x} dx$$

2) Find the Fourier transform of the function

$$f(x) = \begin{cases} x, & |x| \leq \alpha \\ 0, & |x| > \alpha \end{cases} \quad \text{Where } \alpha \text{ is a positive constant?}$$

3) Find the Fourier transform of  $\cos ax^2$

4) Find the Fourier sine transform of  $e^{-ax/x}$

5) Find the Fourier sine and cosine transform of  $f(x) = \begin{cases} 1, & 0 \leq x < a \\ 0, & x \geq a \end{cases}$

6) Find the finite Fourier sine and cosine transform of  $f(x) = 2x, \quad 0 < x < 4$ .

7) Find the cosine transform of  $f(x) = \frac{1}{1+x^2}$

8) Find the Fourier sine transform of  $e^{-|x|}$

9) Find the Fourier transform of  $f(x) = \begin{cases} a^2 - x^2, & |x| < a \\ 0, & |x| > a \end{cases}$  and Evaluate  $\int_0^{\infty} \frac{\sin x - x \cos x}{x^3} dx$ .

10) Find the Fourier sine transform of  $f(x) = \frac{e^{-ax}}{x}, \quad a > 0$ .

11) Find the Fourier cosine transform of  $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ .

12) Find the Fourier transform of  $f(x) = e^{-|x|}$  and Evaluate  $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$ .

13) Find the Fourier transform of  $f(x) = e^{-|x|}$  and Evaluate  $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$ .

**Z- Transformation:**

1. P.T.  $Z_T(n^2) = \frac{z^2+z}{(z-1)^3}$

2. P.T.  $Z_T(n^3) = \frac{z^3+4z^2+2}{(z-1)^4}$

3) P.T.  $Z_T(\cos \theta) = \frac{z(z-\cos \theta)}{z^2-2z \cos \theta+1}$

4) P.T.  $Z_T(\sin \theta) = \frac{(z \sin \theta)}{z^2-2z \cos \theta+1}$

5) P.T.  $Z_T(a^n \cos n \theta) = \frac{z(z-a \cos \theta)}{z^2-2az \cos \theta+a^2}$

6) Find the Z-transform of  $\cos hn \theta$  &  $\sinh n \theta$ .

7) Find the Z-transform of  $(n+1)^2$

8) Using the inversion integral method find the inverse Z-transform of  $\frac{3z}{(z-1)(z-2)}$

9) Solve  $y_{n+2} + 6y_{n+1} + 9y_n = 2^n, \quad y_0 = y_1 = 0$  using Z-transform

10) Solve the difference equation  $y_{n+2} + 2y_{n+1} + y_n = n$  with  $y_0 = y_1 = 0$  using Z-Transform.

11) Obtain the z-transform of  $\cos n \theta$  and  $\sin n \theta$

12) Find the Inverse z-transform of  $\frac{2z^2+3z}{(z+2)(z-4)}$ .

13) If  $\bar{u}(z) = \frac{2z^2+3z+12}{(z-1)^4}$ , find the value of  $u_0, u_1, u_2, u_3$ .

14) Solve the difference equation  $u_{n+2} + 6u_{n+1} + 9u_n = 2^n, \quad u_0 = u_1 = 0$ .



**MODULE-III: STATISTICAL METHODS:**

1) Find the correlation coefficient and regression lines of y and x and x and y for the following data

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| y | 2 | 5 | 3 | 8 | 7 |

2) Find the coefficient of correlation for the following data.

|   |    |    |    |    |    |    |
|---|----|----|----|----|----|----|
| x | 10 | 14 | 18 | 22 | 26 | 30 |
| y | 18 | 12 | 24 | 6  | 30 | 36 |

3) Compute the rank correlation coefficient for the following data

|   |    |    |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|----|----|
| x | 68 | 64 | 75 | 50 | 64 | 80 | 75 | 40 | 55 | 64 |
| y | 62 | 58 | 68 | 45 | 81 | 60 | 68 | 48 | 50 | 70 |

4) Ten students got the following % of marks in two subjects x and y. Compute their rank correlation coefficient.

|            |    |    |    |    |    |    |    |    |    |    |
|------------|----|----|----|----|----|----|----|----|----|----|
| Marks in x | 78 | 36 | 98 | 25 | 75 | 82 | 90 | 62 | 65 | 39 |
| Marks in y | 84 | 51 | 91 | 60 | 68 | 62 | 86 | 58 | 53 | 47 |

**Curve Fitting and Optimization:**

1) Find the equation of the best fitting straight line for the data

|   |   |   |    |    |    |    |
|---|---|---|----|----|----|----|
| x | 0 | 1 | 2  | 3  | 4  | 5  |
| y | 9 | 8 | 24 | 28 | 26 | 20 |

2) A simply supported beam carries a concentrated load p at its midpoint corresponding to various values of p the Maximum deflection y is measured & is given below

|   |      |      |      |      |      |      |
|---|------|------|------|------|------|------|
| p | 100  | 120  | 140  | 160  | 180  | 200  |
| y | 0.45 | 0.55 | 0.60 | 0.70 | 0.80 | 0.85 |

Find the law of the form  $y = a+bp$  & hence estimate y when  $p = 150$ .

3) Fit a second degree parabola of best fit  $y = a+bx+cx^2$

|   |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|
| x | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| y | 1.1 | 1.3 | 1.6 | 2.0 | 2.7 | 3.4 | 4.1 |

4) Fit a second degree parabola  $y = ax^2+bx+c$  in the least square sense for the following data

|   |   |     |     |     |     |
|---|---|-----|-----|-----|-----|
| x | 0 | 1   | 2   | 3   | 4   |
| y | 1 | 1.8 | 1.3 | 2.5 | 2.3 |

5) The voltage v across a capacitor at time t sec is given by the following table

|   |     |    |    |    |     |
|---|-----|----|----|----|-----|
| t | 0   | 2  | 4  | 6  | 8   |
| v | 150 | 63 | 28 | 12 | 5.6 |

Use the method of least square of to fit a curve of the form  $v = ae^{kt}$  to this data

6) Find the co-efficient of correlation & regression of lines to the following data.

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 | 5 |
| y | 2 | 5 | 3 | 8 | 7 |

**Numerical Methods**

- 1) Find the real root of the equation  $10^x = 1.2$  by Regula-Falsi method correct to four decimal places.
- 2) Find by Newton's method, the real root of the equation  $3x = \cos x + 1$ .
- 3) Using the Newton's Raphson method, find a root of the following equations correct to the three decimal
- 4) Places. i)  $3\sin x - 2x + 5 = 0$  near 3, ii)  $x \sin x + \cos x = 0$  which is near  $x =$
- 5) Find by Newton's method, the root of the equation  $\cos x = x e^x$ .
- 6) Use Newton-Raphson method to find a real root of the equation  $x - \cos x = 0$



7) By applying Weddle's Rule evaluate  $\int_0^2 \frac{x}{1+x^2} dx$  by considering seven ordinates. Hence find the value of

$\int_0^2$

8) Evaluate  $\int_0^2 \frac{1}{1+x} dx$ , by using Simpson 1/3 rd rule, considering seven ordinates. Hence deduce the value of

$\int_0^2$

9) Find the interpolating formula that approximates to the function described by the following table

|   |   |   |    |     |
|---|---|---|----|-----|
| x | 0 | 1 | 2  | 5   |
| y | 2 | 3 | 12 | 147 |

10) Find 'y' when x=0.26 using appropriate interpolation formula to the following data,

|   |        |        |        |        |        |
|---|--------|--------|--------|--------|--------|
| X | 0.10   | 0.15   | 0.20   | 0.25   | 0.30   |
| Y | 0.1003 | 0.1511 | 0.2027 | 0.2553 | 0.3093 |

11) If y(5)=150 , y(7)=392 , y(11)=1492 , y(13)=2366 ,y(17) = 5202 then find y(9) by using Lagrange's Formula

12) Apply Lagrange's Inverse interpolation formula to find a root of the equation f(x)=0 given that

$$f(30) = -30, f(34) = -13, f(38) = 3, f(42) = 18.$$

13) Use Newton's divided difference formula to find f(4) given

|   |    |   |    |     |
|---|----|---|----|-----|
| x | 0  | 2 | 3  | 6   |
| y | -4 | 2 | 14 | 158 |

#### MODULE-IV: FINITE DIFFERENCES:

1) The following table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface

|            |       |       |       |       |       |       |       |
|------------|-------|-------|-------|-------|-------|-------|-------|
| x:height   | 100   | 150   | 200   | 250   | 300   | 350   | 400   |
| y:distance | 10.63 | 13.03 | 15.04 | 16.81 | 18.42 | 19.90 | 21.27 |

Find the values of y when x=218 feet and 410 feet

2) From the following table, estimate the number of students who obtained marks between 40 & 45

|                 |       |       |       |       |       |
|-----------------|-------|-------|-------|-------|-------|
| Marks           | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
| No. of students | 31    | 42    | 51    | 35    | 31    |

3) In the table below the value of y are consecutive terms of a series of which 23.6 are the 6<sup>th</sup> term. Find The first & tenth terms of the series

|   |     |     |      |      |      |      |      |
|---|-----|-----|------|------|------|------|------|
| x | 3   | 4   | 5    | 6    | 7    | 8    | 9    |
| y | 4.8 | 8.7 | 14.5 | 23.6 | 36.2 | 52.8 | 73.9 |

4) Given the values

|      |     |     |      |      |      |
|------|-----|-----|------|------|------|
| x    | 5   | 7   | 11   | 13   | 17   |
| f(x) | 150 | 392 | 1452 | 2366 | 5202 |

Find f(15) and f(19)

6) Use Newton's divided difference formula to find f(x) given the data

|      |    |   |    |     |
|------|----|---|----|-----|
| x    | 0  | 2 | 3  | 6   |
| f(x) | -4 | 2 | 14 | 158 |

7) Given the values

|      |     |     |      |      |      |
|------|-----|-----|------|------|------|
| x    | 5   | 7   | 11   | 13   | 17   |
| f(x) | 150 | 392 | 1452 | 2366 | 5202 |

Evaluate f(9) using divided difference formula for unequal intervals.



- 8) Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  by using Simpson's 1/3 rd rule taking four equal strips and hence deduce an approximate value of  $\square$
- 9) If  $y(1)=3$ ,  $y(3)=9$ ,  $y(4)=30$ ,  $y(6)=132$ , Find Lagrange's interpolation formula & hence find  $y$  at  $x=5$ .
- 12) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using
  - i) Simpson's 1/3<sup>rd</sup> rule , ii) Simpson's 3/8<sup>th</sup> rule, iii) Weddle's rule compare with its actual value.
- 13) Use Simpson's 1/3<sup>rd</sup> rule to find  $\int_0^{0.6} e^{-x^2} dx$  by taking seven ordinates.
- 14) Using Simpson's 3/8<sup>th</sup> rule , evaluate  $\int_0^{0.3} \sqrt{1-8x^3} dx$  by taking 7 ordinates.
- 15) Integrate numerically  $\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta} d\theta$

**MODULE-V: VECTOR INTEGRATION:**

- 1) If  $\vec{F} = xyi + yzj + zzk$  evaluate  $\int_c \vec{F} \cdot d\vec{r}$  where  $c$  is the curve represented by  $x=t, y=t^2, z=t^3$ ,  $-1 \leq t \leq 1$
- 2) Find the total work done by the force represented by  $3xyi - yj + 2zxk$  in the moving a particle round the circle  $x^2 + y^2 = 4$
- 3) Verify the Greens theorem  $\oint_c (xy + y^2)dx + x^2dy$  where  $c$  is the closed curve of the region bounded by  $y = x$  and  $y = x^2$
- 4) Find the area between the parabola  $y^2 = 4x$  and  $x^2 = 4y$  with the help of Greens theorem in a plane.
- 5) Verify the Stroke's theorem for the vector function  $\vec{F} = 2xyi + (x^2 - y^2)j$  over the circle  $x^2 + y^2 = 1, z = 0$
- 6) Verify the Stroke's theorem for  $\vec{F} = yi + zj + xk$  where  $S$  is upper half of the sphere  $x^2 + y^2 + z^2 = 1$  and  $C$  is its boundary.
- 7) Verify the Divergence theorem for  $\vec{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$  Taken over the rectangular parallelepiped  $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c$ .
- 8) Verify the Gauss divergence theorem for  $\vec{F} = 4xzi - y^2j + yzk$  over the unit cube.
- 9) Show that the Geodesics on a plane are straight line.
- 10) Find the Geodesics on a right circular cylinder of radius  $a$ .
- 11) Find the extremals of the functional  $\int_{x_0}^{x_1} \frac{(y')^2}{x^3} dx$
- 12) Evaluate  $\int_c xy dx + xy^2 dy$  by Stoke's theorem where  $c$  is the square in  $xy$ -plane with  $(1, 0), (-1, 0), (0,1) & (0, -1)$
- 13) Show that the shortest distance between any two points in a plane is a straight line.

**16.0 University Result**

| Examination | S+ | S  | A  | B  | C  | D  | E  | % Passing |
|-------------|----|----|----|----|----|----|----|-----------|
| JAN-2018    | 03 | 08 | 07 | 09 | 06 | 11 | 01 | 86.53     |
| JAN-2017    | 00 | 02 | 05 | 14 | 13 | 04 | 04 | 82.35     |

| Prepared by                | Checked by        |     |           |
|----------------------------|-------------------|-----|-----------|
|                            |                   |     |           |
| Prof. S. I. Shivamoggimath | Prof. S. L. Patil | HOD | Principal |



**Course Plan 2018-19 ODD – Semester - III  
Computer Science and Engineering**

|                                    |                                       |                   |    |
|------------------------------------|---------------------------------------|-------------------|----|
| <b>Subject Title</b>               | <b>ANALOG AND DIGITAL ELECTRONICS</b> |                   |    |
| <b>Subject Code</b>                | 17CS32                                | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs /</b>     | 04                                    | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b> | 50                                    | <b>Exam Hours</b> | 03 |
| <b>CREDITS – 04</b>                |                                       |                   |    |

|                                       |                                     |  |
|---------------------------------------|-------------------------------------|--|
| <b>FACULTY DETAILS:</b>               |                                     |  |
| <b>Name:</b> Prof .Y. M. Naik         | <b>Designation:</b> Asst. Professor | <b>Experience:</b> 15                      |
| <b>No. of times course taught:</b> 08 |                                     | <b>Specialization:</b> Digital Electronics |

### 1.0 Prerequisite Subjects:

| Sl. No | Branch                       | Semester | Subject                        |
|--------|------------------------------|----------|--------------------------------|
| 01     | Computer Science Engineering | III      | Analog And Digital Electronics |

### 2.0 Course Objectives

This course will enable students to

1. Recall and Recognize construction and characteristics of JFETs and MOSFETs and differentiate with BJT
2. Demonstrate and Analyze Operational Amplifier circuits and their applications
3. Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques.
4. Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.
5. Describe, Design and Analyze Synchronous and Asynchronous Sequential
6. Explain and design registers and Counters, A/D and D/A converters.

### 3.0 Course Outcomes

Having successfully completed this course, the student will be able to draw and use modeling software's to generate

| CO                                | Course Outcome  | POs            |
|-----------------------------------|---|----------------|
| C202.1                            | Explain the concepts of JFETs, MOSFETs and Operational Amplifiers.  | 1,2,3,4,7,9,10 |
| C202.2                            | Explain the operation of Decoders, Encoders, multiplexers, Adders and sub tractors, working of Latches, Flip-Flops. | 1,2,3,4,7,9,10 |
| C202.3                            | Simplify combinational logic using Karnaugh Maps and Quine-McClusky technique.                                      | 1,2,3,4,7,9,10 |
| C202.4                            | Analyze the Performance of Synchronous and asynchronous sequential circuits   | 1,2,3,4,7,9,10 |
| C202.5                            | Apply the knowledge gained in the design of counters, registers and A/D and D/A converters.                         | 1,2,3,4,7,9,10 |
| <b>Total Hours of instruction</b> |   | <b>50</b>      |



**4.0 Course Content**

**MODULE-I**

**10 Hours**

**Field Effect Transistors:** Junction Field Effect Transistors, MOSFETs Differences between JFETs and MOSFETs, Biasing MOSFETs, FET Applications, CMOS Devices. Wave-Shaping Circuits: Integrated Circuit(IC) Multivibrators. **Introduction to Operational Amplifier:** Ideal v/s practical Opamp, Performance Parameters, **Operational Amplifier Application Circuits:** Peak Detector Circuit, Comparator, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-To-Voltage Converter, Voltage-To- Current Converter

**Text Book 1: Ch5: 5.2, 5.3, 5.5, 5.8, 5.9, 5.1. Ch13: 13.10, Ch16: 16.3, 16.4**

**MODULE-II**

**10Hours**

**The Basic Gates:** Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. **Combinational Logic Circuits:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of- sums Method, Product-of- sums simplifications, Simplification by Quine-McClusky Method, Hazards and Hazard covers, HDL Implementation Models.

**Text Book 2: Ch2:2.4,2.5, Ch3: 3.2, to 3.11**

**MODULE-III**

**10 Hours**

**Data-Processing Circuits:** Multiplexers, Demultiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic Unit **Flip- Flops:** RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs

**Text book 2:- Ch4:- 4.1 to 4.9, 4.11, 4.12, 4.14. Ch6:-6.7, 6.10. Ch8:- 8.1to 8.5.**

**MODULE-IV**

**10 Hours**

**Flip- Flops:** FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP. **Registers:** Types of Registers, Serial In - Serial Out, Serial In -Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, Register implementation in HDL.Counters: Asynchronous counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus.

**Text book 2:- Ch 8: 8.6, 8.8, 8.9, 8.10, 8.13. Ch 9: 9.1 to 9.8. Ch 10: 10.1 to 10.4**

**MODULE-V**

**10 Hours**

**Counters:** Decade Counters, Pre settable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL. **D/A Conversion and A/D Conversion:** Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter- Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.

**Text book 2:- Ch 10: 10.5 to 10.9. Ch 12: 12.1 to 12.10**

**5.0 Relevance to future subjects**

| Sl. No | Semester  | Subject              | Topics                    |
|--------|-----------|----------------------|---------------------------|
| 01     | III & VII | Logic based subjects | Logic design and analysis |

**6.0 Relevance to Real World**



| Sl. No | Real World Mapping  |
|--------|---|
| 01     | Logic methods are used to solve engineering problems.                 |
| 02     | Combination logic circuits are used to design several application     |
| 03     | Analog to digital and digital to analog application in various fields |

## 7.0 Gap Analysis and Mitigation

| Sl. No | Delivery Type | Details                |
|--------|---------------|------------------------|
| 01     | Tutorial      | Topic: K-Map QM Method |

## 8.0 Books Used and Recommended to Students

| Text Books                          |  |
|-------------------------------------|--|
| 1.                                  | Anil K Maini, VarshaAgarwal: Electronic Devices and Circuits, Wiley, 2012.   |
| 2.                                  | Donald P Leach, Albert Paul Malvino & GoutamSaha: Digital Principles and Applications, 8 <sup>th</sup> Edition, Tata McGraw Hill, 2015 |
| Reference Books                     |  |
| 1.                                  | Stephen Brown, ZvonkoVranesic: Fundamentals of Digital Logic Design with VHDL, 2 <sup>nd</sup> Edition, Tata McGraw Hill, 2005         |
| 2.                                  | R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.  |
| 3.                                  | M Morris Mano: Digital Logic and Computer Design, 10 <sup>th</sup> Edition, Pearson, 2008  |
| Additional Study material & e-Books |  |
| 1.                                  | NA   |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References   |
|--|
| 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a> |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals | website |
|--------|--------------------|---------|
| 1      |                    |         |

## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

30 marks –from three internal assessment test

10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

### Question Paper Pattern (IA):

- Two main questions to be set from syllabus covered up to IA tests.



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

b. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.

a. Q.No I or Q.No II = 15 Marks

b. Q.No III or Q.No IV = 15 Marks

**Total = 30 Marks**

### Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
Max. Marks: 100 and each question carries 20 marks.  
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

## 12.0 Course Delivery Plan

| Module | Lecture No. | Content of Lecture   | % of Portion |
|--------|-------------|--|--------------|
| 1      | 1           | JFET, MOSFETs, DIFF Between JFET and MOSFETs, biasing of MOSFET              | 20           |
|        | 2           | FET applications, CMOS Devices,  |              |
|        | 3           | Wave shaping circuits: IC, Multivibrator,                                    |              |
|        | 4           | Ideal v/s practical OP amp, performance parameters, applications of Op Amp   |              |
|        | 5           | Peak detector circuits,  |              |
|        | 6           | Comparators, active filters,   |              |
|        | 7           | Nonlinear amplifier,   | 20           |
|        | 8           | Relaxation Oscillators   |              |
|        | 9           | Current to voltage converter   |              |
|        | 10          | Voltage to current converter   |              |
| 2      | 11          | Review of Basic logic gates, positive and negative logic Introduction to HDL | 20           |
|        | 12          | SOP method, truth table to k map,  |              |
|        | 13          | Pairs, Quads, and Octets, K map simplifications                              |              |
|        | 14          | Don't care conditions, POS method, POS simplifications.                      |              |
|        | 15          | Simplification by QM method  |              |
|        | 16          | Simplification by QM method with don't care conditions                       |              |
|        | 17          | Hazards and Hazards covers   |              |
|        | 18          | HDL implementation models  |              |
|        | 19          | Problems on K map  |              |
|        | 20          | Problems on QM Method  |              |
| 3      | 21          | Multiplexors, De multiplexers, 1 of 16 Decoder.                              | 20           |
|        | 22          | BCD to Decimal decoders, seven segment Decoders.                             |              |
|        | 23          | Encoders, Exclusive OR gates, Parity generators and checkers,                |              |
|        | 24          | Magnitude comparator ,programmable Array logic.(PAL)                         |              |
|        | 25          | Programmable Logic Array (PAL),HDL implementation.                           |              |
|        | 26          | Arithmetic building block, ALU   |              |
|        | 27          | RS Flip Flop, Gated Flip Flops   |              |
|        | 28          | Edge Triggered RS F/F  |              |
|        | 29          | Edge triggered D Flip Flop   |              |
|        | 30          | Edge Triggered JK Flip Flop  |              |
| 4      | 31          | Flip flop timing, JK master slave F/F,                                       | 20           |
|        | 32          | Switch contact bounce circuits, various representation of flip flops         |              |
|        | 33          | HDL implementation of F/F  |              |
|        | 34          | Types of registers, SISO, SIPO   |              |
|        | 35          | PISO, PIPO   |              |
|        | 36          | Universal shift registers, application of Shift registers.                   |              |



|   |    |  |    |
|---|----|--|----|
| 5 | 37 | Register Implementation of in HDL.                           | 20 |
|   | 38 | Counters, Asynchronous counters                              |    |
|   | 39 | Decoding gates, synchronous counters.                        |    |
|   | 40 | Changing the counter modulus.                                |    |
|   | 41 | Decade counters, Preset table counters                       |    |
|   | 42 | Counter Design as a Synthesis problem,                       |    |
|   | 43 | A Digital clock.,  |    |
|   | 44 | Counter Design using HDL                                     |    |
|   | 45 | Variable, resistor networks,                                 |    |
|   | 46 | Binary ladders, D/A converters, D/A Accuracy, and Resolution |    |
|   | 47 | A/D converters, simultaneous conversion,                     |    |
|   | 48 | A/D counter method, continuous A/D conversion                |    |
|   | 49 | Dual slope A/D conversion                                    |    |
|   | 50 | A/D accuracy and resolution                                  |    |

### 13.0 Assignments, Pop Quiz, Mini Project, Seminars

| Sl. No. | Title                             | Outcome expected   | Allied study             | Week No. | Individual / Group activity | Reference: book/website /Paper                                 |
|---------|-----------------------------------|--|--------------------------|----------|-----------------------------|--|
| 1       | Assignment:1 University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 1 of the syllabus | 2        | Individual Activity.        | Book 1, of the reference list. Website of the Reference list   |
| 2       | Assignment:2 University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 2 of the syllabus | 4        | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |
| 3       | Assignment:3 University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 3 of the syllabus | 6        | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |
| 4       | Assignment:4 University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 4 of the syllabus | 8        | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |
| 5       | Assignment:5 University Questions | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 5 of the syllabus | 10       | Individual Activity.        | Book 1, 2 of the reference list. Website of the Reference list |

### 14.0 QUESTION BANK

#### MODULE-1: FIELD EFFECT TRANSISTORS

1. Explain FET and its working.[ June /July-2017]
2. Differentiate between JFET and MOSFET [june-2018]
3. What are the applications of JFET and MOSFET
4. Explain the performance parameter of op-amp [June/July-2017]
5. What is MOSFET name its types .explain the construction of N-Channel MOSFET [june-2018]

#### MODULE-2: THE BASIC GATES

1. What is logic gate? Realize((A+B).C)D using only NAND Gates [June/July-2017]
2. Differentiate between Positive and Negative logic with truth tables[June/July-2017]
3. Differentiate between SOP and POS forms
4. Explain QM method implemented?  $f(a,b,c,d)=\sum m(0,1,3,10,11,12,13,14,15)$  [June/July-2017]



5. Using Q-M Method simplify the expression  $f(A,B,C,D)=\sum(0,3,5,6,7,11,14)$  [June-2018]
6. What are Hazards? Briefly describe about designing hazard free circuit [June-2018]

**MODULE-3: DATA-PROCESSING CIRCUITS**

1. What is MUX? And design 32:1 using two 61:1 MUX and one 2:1 MUX[June/July-2017]
2. With neat diagram explain 1 of 16 decoder.
3. Design seven segment decoder using PLA? [June/July-2017]
4. Differentiate between combinational and sequential circuit. [June/July-2017]
5. What is Decoder? Give the circuit for 3:8 decoder [June-2018]
6. What is magnitude comparator ? explain a 1-bit comparator wit truth table and circuit diagram? [June-2018]

**MODULE-4: FLIP- FLOPS**

1. Explain the working of JK master slave Flip flop using NAND gate. [June/July-2017]
2. Write a short note on JK Master slaye flip flop
3. How various flip Flop can be converted explain in brief.
4. Derive the characteristic equation for SR, D and JK Flip Flop. [June/July-2017]
5. Give a brief account a flip flop as a FSM? [June-2018]

**MODULE-5: COUNTERS**

1. Define Decade counter, preset table counters.
2. What is presettable counter? Explain it.
3. Design Asynchronous counter for the sequences  $0 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 0 \rightarrow 4 \rightarrow$ .using S R Flip-Flop [June/July-2017]
4. Write a short note on Digital clock.
5. Explain 2 bit simultaneous A/D converter [June/July-2017]
6. Explain digital clock with block diagram ? [June-2018]
7. What is the resolution of a 12 bit D/A convertor which uses binary ladder if the full scale out put is +10v [June-2018]
8. Design a 3 bit synchronous binary counter using JK Flip Flop [June-2018]

**15.0 University Result**

| Examination | S+ | S  | A  | B  | C  | D  | E  | % Passing |
|-------------|----|----|----|----|----|----|----|-----------|
| JAN-2017    | 00 | 03 | 07 | 14 | 16 | 06 | 02 | 94.11     |
| JAN-2018    | 00 | 00 | 03 | 05 | 23 | 08 | 07 | 88.46     |

| Prepared by    | Checked by     |     |           |
|----------------|----------------|-----|-----------|
|                |                |     |           |
| Prof. Y.M.Naik | Prof. Y.M.Naik | HOD | Principal |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                                     |   |                   |    |
|-------------------------------------|---|-------------------|----|
| <b>Subject Title</b>                | <b>DATA STRUCTURES and APPLICATIONS</b> |                   |    |
| <b>Subject Code</b>                 | 17CS33                                  | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs / Week</b> | 4                                       | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b>  | 50                                      | <b>Exam Hours</b> | 03 |

### FACULTY DETAILS:

|                                       |   |                           |
|---------------------------------------|---|---------------------------|
| <b>Name:</b> Prof. S.G.Gollagi        | <b>Designation:</b> Assistant Professor     | <b>Experience:</b> 20 yrs |
| <b>No. of times course taught:</b> 03 | <b>Specialization:</b> Computer Engineering |                           |

## 1.0 Prerequisite Subjects:

| Sl. No | Branch                     | Semester | Subject                                   |
|--------|----------------------------|----------|---|
| 01     | Computer Science and Engg. | I / II   | Programming in C and Data structures      |
| 02     | Computer Science and Engg. | I / II   | Mathematics: Set, Relation, Matrices etc. |

## 2.0 Course Objectives

1. Explain fundamentals of data structures and their applications essential for programming/problem solving
2. Understand and Analyze Linear Data Structures: Stack, Queues, and Lists
3. Understand and Analyze Non-Linear Data Structures: Trees, Graphs
4. Analyze and evaluate the sorting & searching algorithms
5. Assess appropriate data structure during program development/Problem Solving.

## 3.0 Course Outcomes

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

| COs                               | Course Outcome   | Cognitive Level | POs   |
|-----------------------------------|--|-----------------|-------|
| CO203.1                           | Make use of knowledge of Non-Primitive, Linear Data Structure – Arrays to solve the Problems.                            | L3              | 1,2,3 |
| CO203.2                           | Make use of Non-Primitive, Linear Data Structure – Stack, Queues, recursion to solve certain Problems.                   | L3              | 1,2,3 |
| CO203.3                           | Illustrate the various types of linked list structures with their applications including representations and operations. | L2              | 1,2,3 |
| CO203.4                           | Make use of Non-Linear Data Structure – Trees solve certain Problems   | L3              | 1,2,3 |
| CO203.5                           | Make use of Non-Primitive Non-Linear Data Structure – Graphs, Hashing etc. to solve certain Problems.                    | L3              | 1,2,3 |
| <b>Total Hours of instruction</b> |  | <b>50</b>       |       |

## 4.0 Course Content

### MODULE-1

**10 Hours**

**Introduction:** Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays, **Array Operations:** Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

**Text 1:** Ch 1: 1.2, Ch 2: 2.2 -2.7 ,\*\*\*\***Text 2:** Ch 1: 1.1 -1.4, Ch 3: 3.1-3.3,3.5,3.7, Ch 4: 4.1-4.9,4.14, Ref 3: Ch 1: 1.4

### MODULE-2

**10 Hours**

#### Stacks and Queues

**Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, **Recursion** - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. **Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples.  
10hrs

**Text 1:** Ch 3: 3.1 -3.7 \*\*\*\***Texts 2:** Ch 6: 6.1 -6.3, 6.5, 6.7-6.10, 6.12, 6.13.

### MODULE-3

**10 Hours**

**Linked Lists:** Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples

**Text 1:** Ch 4: 4.1 -4.8 except 4.6 \*\*\*\***Text 2:** Ch 5: 5.1 – 5.10

### MODULE-4

**10 Hours**

**Trees:** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples

**Text 1:** Ch 5: 5.1 –5.5, 5.7 \*\*\*\***Text 2:** Ch 7: 7.1 – 7.9

### MODULE-5

**10 Hours**

**Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. **Sorting and Searching:** Insertion Sort, Radix sort, Address Calculation Sort. **Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **Files and Their Organization:** Data Hierarchy, File Attributes Text Files and Binary Files, Basic File Operations, File Organizations and Indexing.

**Text 1:** Ch 6: 6.1 –6.2, Ch 7:7.2, Ch 8:8.1-8.3 \*\*\*\***Text 2:** Ch 8: 8.1 – 8.7, Ch 9:9.1-9.3, 9.7, and 9.9  
**Reference 2:** Ch 16: 16.1 - 16.7

## 5.0 Relevance to future subjects

| Sl. No | Semester | Subject                           | Topics |
|--------|----------|-----------------------------------|--------|
| 01     | IV       | Design and Analysis of Algorithms | -      |
| 02     | V/VI     | DBMS, SSCD, CN                    | -      |

## 6.0 Relevance to Real World

| Sl. No | Real World Mapping   |
|--------|--|
| 01     | Implementation of solution to the problems using appropriate Data structures and algorithms. |
| 02     |  |



## 7.0 Gap Analysis and Mitigation

| Sl. No | Delivery Type | Details  |
|--------|---------------|--|
| 01     | Tutorial      | Topic: Introduction, Stack and Queues, Linked List |
| 02     | NPTEL         | Topic: Tress and Graphs                            |

## 8.0 Books Used and Recommended to Students

| Text Books  |
|---|
| 1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014                |
| 2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014                               |
| Reference Books   |
| 1. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012   |
| 2. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2013. |
| 3. Data Structures using C - A M Tenenbaum, PHI, 1989.  |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References                               |
|--|
| 1) <a href="http://apps.topcoder.com/">http://apps.topcoder.com/</a>   |
| 2) <a href="http://www.ideserve.co.in/">http://www.ideserve.co.in/</a> |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals                      | Website   |
|--------|---|---|
| 1      | ACM journals                            | <a href="http://www.dl.acm.org/pubs.cfm">www.dl.acm.org/pubs.cfm</a>  |
| 2      | IBM journal of Research and Development | <a href="https://link.springer.com/journal/453">https://link.springer.com/journal/453</a>                                       |
| 3      | Research papers/Data structures         | <a href="https://wiki.haskell.org/Research_papers/Data_structures">https://wiki.haskell.org/Research_papers/Data_structures</a> |

## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

30 marks –from three internal assessment test

10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- c. Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- d. Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

### Question Paper Pattern (IA):

3. Two main questions to be set from syllabus covered up to IA tests.
4. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
  - a. Q.No I or Q.No II = 15 Marks
  - b. Q.No III or Q.No IV = 15 Marks

**Total = 30 Marks**



**Question Paper Pattern and instructions (Main Exam):**

6. The question paper will have TEN questions.
7. There will be TWO questions from each module.
8. Each question will have questions covering all the topics under a module.
9. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
Max. Marks: 100 and each question carries 20 marks.  
Exam Duration: 3 Hrs.
10. The total marks scored out of 100 marks will be scaled down to 60 marks.

**12.0 Course Delivery Plan**

| Module | Lecture No. | Content of Lecturer   | % of Portion |
|--------|-------------|---|--------------|
| 1      | 1           | <b>Introduction:</b> Data Structures, Classification of Data Structures: Primitive and Non-Primitive. | 20           |
|        | 2           | Data structure Operations: Create, Insert, Delete, Search, Sort, Merge, Traversal                     |              |
|        | 3           | Review of Arrays ,Structures, Unions  |              |
|        | 4           | Pointers, Self Referential Structures, Dynamic memory allocation.                                     |              |
|        | 5           | Representation of Linear Arrays in Memory, Dynamically allocated arrays.                              |              |
|        | 6           | <b>Array Operations:</b> Traversing, inserting, deleting, searching, and sorting.                     |              |
|        | 7           | Multidimensional Arrays, Polynomials.   |              |
|        | 8           | Sparse Matrices. <b>Strings:</b> Basic Terminology.   |              |
|        | 9           | Storing, Operations and Pattern Matching algorithms.  |              |
|        | 10          | Programming Examples  |              |
| 2      | 1           | <b>Stacks:</b> Definition, Stack Operations, Array Representation of Stacks,                          | 20           |
|        | 2           | Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion         |              |
|        | 3           | Evaluation of postfix expression.   |              |
|        | 4           | <b>Recursion</b> - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function.           |              |
|        | 5           | <b>Queues:</b> Definition, Array Representation, Queue Operations.                                    |              |
|        | 6           | Circular Queues, Circular queues using Dynamic arrays.  |              |
|        | 7           | Dequeues, Priority Queues.  |              |
|        | 8           | A Mazing Problem, Multiple Stacks and Queues.   |              |
|        | 9           | Programming Examples  |              |
|        | 10          | Programming Examples  |              |
| 3      | 1           | <b>Linked Lists:</b> Definition, Representation of linked lists in Memory                             | 20           |
|        | 2           | Memory allocation; Garbage Collection.  |              |
|        | 3           | Linked list operations: Traversing, Searching,  |              |
|        | 4           | Insertion and Deletion.   |              |
|        | 5           | Doubly Linked lists, Circular linked lists,   |              |
|        | 6           | Header linked lists, Linked Stacks and Queues   |              |
|        | 7           | Applications of Linked lists – Polynomials,   |              |
|        | 8           | Sparse matrix representation.   |              |
|        | 9           | Programming Examples  |              |
|        | 10          | Programming Examples  |              |
| 4      | 1           | <b>Trees:</b> Terminology, Binary Trees, Properties of Binary trees                                   | 20           |
|        | 2           | Array and linked Representation of Binary Trees   |              |
|        | 3           | Binary Tree Traversals - Inorder, Postorder, Preorder;  |              |
|        | 4           | Additional Binary tree operations.  |              |
|        | 5           | Threaded binary trees   |              |
|        | 6           | Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching.                          |              |



**Course Plan 2018-19 ODD – Semester - III**  
**Computer Science and Engineering**

|   |    |   |    |
|---|----|---|----|
|   | 7  | Application of Trees: Evaluation of Expression.   |    |
|   | 8  | Programming Examples  |    |
|   | 9  | Programming Examples  |    |
|   | 10 | Programming Examples  |    |
| 5 | 1  | <b>Graph:</b> Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs. | 20 |
|   | 2  | Elementary Graph operations.  |    |
|   | 3  | Traversal methods: Breadth First Search and Depth First Search.                               |    |
|   | 4  | <b>Sorting and Searching:</b> Insertion Sort, Radix sort...                                   |    |
|   | 5  | ...Address Calculation Sort.  |    |
|   | 6  | <b>Hashing:</b> The Hash Table organizations, Hashing Functions.                              |    |
|   | 7  | Static and Dynamic Hashing.   |    |
|   | 8  | Programming Examples.   |    |
|   | 9  | <b>Files and Their Organization:</b> Data Hierarchy, File Attributes Text Files and Binary.   |    |
|   | 10 | Files, Basic File Operations, File Organizations and Indexing                                 |    |

**13.0 Assignments, Pop Quiz, Mini Project, Seminars**

| Sl. No. | Title  | Outcome expected   | Allied study                   | Week No. | Individual / Group activity                          | Reference: book/website/Paper |
|---------|--|--|--------------------------------|----------|--|-------------------------------|
| 1       | Assignment-1: Questions on Introduction, arrays                  | Students have to study the Topics and write the Answers. | Module-1 of the syllabus.      | 4        | Individual Activity. Hand written solution expected. | Text books and class notes.   |
| 2       | Assignment-2: Questions on Stack, Queues and recursion.          | Students have to study the Topics and write the Answers. | Module-2 of the syllabus       | 7        | Individual Activity. Hand written solution expected  | Text books and class notes.   |
| 3       | Assignment-3: Questions on: Linked Lists.                        | Students have to study the Topics and write the Answers. | Module-3 of the syllabus.      | 11       | Individual Activity. Hand written solution expected. | Text books and class notes.   |
| 4       | Assignment-3: Questions on: Trees, Graphs, Hashing, sorting etc. | Students have to study the Topics and write the Answers. | Module-4 and 5 of the syllabus | 13       | Individual Activity. Hand written solution expected. | Text books and class notes.   |

**4.0 Assignment Questions**

| Assignment # | Questions                    | Marks |
|--------------|------------------------------|-------|
| 1            | Will be announced later .... | 25    |
| 2            | Will be announced later .... | 25    |
| 3            | Will be announced later .... | 25    |
| 4            | Will be announced later .... | 25    |

**15.0 QUESTION BANK**



1. What is an Algorithm? Explain the criteria that an algorithm must satisfy.(DEC-2016)
2. What is a pointer variable? Can we have multiple pointers to a variable? Explain L-value and R-value expression.
3. Write the Knuth Morris Pratt pattern matching Algorithm/Function in C and apply the same to search the pattern : “abcdabdcy” in the text “abcxabcxabcdabdcabdcy”(DEC-2016)
4. What is the difference between Static memory allocation and dynamic memory allocation? Explain.
5. Explain with an Examples :i) malloc( ) ii) calloc( ) iii) realloc( ) iv) free( )
6. Write a C program using pass by reference method to swap 2 characters.
7. Give any 2 advantages and disadvantages of using pointers.
8. How does a structure differ from a union? Mention any 2 uses of structure
9. Define an array, array pointer and array of pointer. Explain declaration and initialization of 1D array and 2D array.
10. What is structure and self-referential structure? Explain with a simple example to each.
11. What is union? Explain the differences between structure and union with an example
12. What is the output of the following code?

```
int num [5]= { 3,4,6,2,1};
int *p=num;
int *q= num+2;
int *r =&num[1];
Printf(“%d%d”,num[2],*(num+2));
Printf(“%d%d”, *p,*(p+1));
Printf(“%d%d”, *q,*(q+1));
Printf(“%d%d”, *r,*(r+1));
```

## MODULE-2

1. How do you define a data structure? How is stack represented? Give a C program to construct a stack of integers and perform all the necessary operations on it
2. Write the algorithm to implement a stack using dynamic array whose initial capacity is 1 and array doubling is used to increase the stack’s capacity whenever an element is added to a full stack. Implement the operation-Push, pop and display.(DEC-2016)
3. Write an algorithm to convert a valid infix expression to a postfix expression. Also evaluate the following suffix expression for the values: A=1 B=2 C=3. AB+C-BA+C\$-
4. What is the advantage of circular queue over ordinary queue? Mention any 2 applications of queues. Write an algorithm CQINSERT for static implementation of circular queue.
5. Explain the working of a simple queue, dequeue and priority Queue.
6. Define stack. Implement push and pop functions for stack using arrays.
7. Implement addq and deleteq functions for the circular queue.
8. Write the postfix form of the following expression: (a+b)\*d+e/(f+a\*d)+c
9. Write the prefix form of the following expression: (a+b)\*d+e/(f+a\*d)+c
10. Write the postfix form of the following expression: ((a/(b-c+d))\*(e-a)\*c)
11. Write the prefix form of the following expression: ((a/(b-c+d))\*(e-a)\*c)
12. What is recursion? Write a C function to find factorial and GCD

## MODULE-3

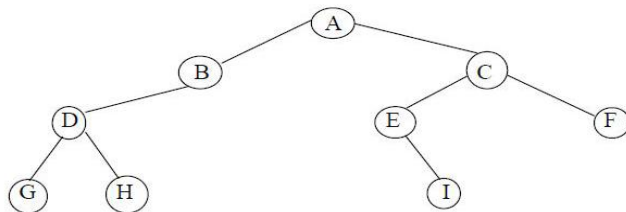
1. List out any two applications of linked list and any two advantages of doubly linked list over singly linked list.
2. Write a C program to simulate an ordinary queue using a singly linked list..
3. Write a C program to simulate Stack using a singly linked list.
4. Give an algorithm to insert a node at a specified position for a given singly linked list.
5. Write a C function to add two polynomials in C and explain its memory mapping.
6. What is sparse matrix? Explain sparse matrix representation in C with an example.
7. What is polynomial? What is the degree of the polynomial? Write a function to add two polynomials?
8. Write a c Program to merge two linked list.
9. Write a C program to remove duplicates in the linked list.



10. With neat Diagram, explain the circular linked list.
11. Write a c program to perform the following operations on doubly linked list: i) insert a node ii) delete a node.
12. For the given sparse matrix write the diagrammatic linked list representation.

**MODULE-4**

1. Define the following: i) Binary tree ii) Complete binary tree iii) Almost complete binary tree iv) Binary search tree v) Depth of a tree
2. Given the following graph, write the inorder, preorder and postorder traversals.



3. In brief describe any 4 applications of trees.
4. Construct a binary tree from the traversal order given below:  
PREORDER = A B D E F C G H L J K  
INORDER = D B F E A G C L J H K
5. Construct a expression tree for:  $((6 + (3 - 2) * 5) ^ 2 + 3)$  and traverse it in all 3 orders.
6. What is threaded binary tree? Explain right in and left in threaded binary trees.
- 7.

With reference to the Fig.Q5(a), answer the following:

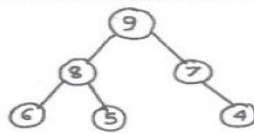


Fig.Q5(a)

- i) Is it a binary tree?
- ii) Is it a complete tree?
- iii) Give the preorder traversal.
- iv) Give the inorder traversal.
- v) Give the postorder traversal
- vi) Give the list notation (using pairs of round brackets).
- vii) Where will be the left child of node 4 pointing to, if it is converted to a threaded b-tree?
- viii) Is it a max heap?

8. What is tree? Explain.
  - i) Root node ii) degree iii) Siblings iv) Depth of the a tree and give examples. v) forest.
9. What is a binary tree? State its properties? How it is represented using array and linked list give example.
10. Describe the binary search tree, with example. Write a recursive function to search for a key value in a binary Search tree.
11. Construct the b-tree from the given traversals:  
Preorder – ABDCEF In order - BDAEFC Post order – DBFECA
12. Write a C program to evaluate an expression tree.
13. Briefly discuss an array and linked list representation of tree.

**MODULE-5**

1. Define and explain the following terminologies with suitable graph example  
i) graph ii) an edge iii) weighted edge iv) vertex v) degree of a vertex
2. Define and explain the following terminologies with suitable graph example







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- i) in-degree of a vertex ii) out-degree of a vertex iii) directed graph iv) an un-directed graph  
v) complete graph vi) incomplete graph vii) sub graph viii) simple path ix) cycle
3. What are restrictions on graphs?
  4. Explain a graph with two connected component and strongly connected component. Explain in detail the graph representations with an example
    - 2) Adjacency matrix
    - 3) Adjacency lists
    - 4) Adjacency multiclass
  5. Explain BFS and DFS algorithms with suitable examples.
  6. Explain the working of Radix sort method with example.
  7. What is hashing? Explain
  8. What do you mean by static hashing and dynamic hashing? Explain
  9. Explain different Collision-resolution Techniques.
  10. Explain in brief, different ways of File Organizations - Sequential, Indexed Sequential, Random Access.

### 16.0 University Result

| Examination | S+,S,A | B  | C,D,E  | % Passing |
|-------------|--------|----|--------|-----------|
| JAN-2018    | 2      | 13 | 14,8,7 | 84.62     |
| JAN-2017    | 0      | 13 | 15,9,7 | 88.50     |

| Prepared by   | Checked By  |  |   |
|---|---|--|---|
|  |  |  |  |
| Prof. S.G. Gollagi  | Dr. Parashuram Baraki   | HOD  | Principal   |



**Course Plan 2018-19 ODD – Semester - III**  
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|                                     |                              |                   |    |
|-------------------------------------|------------------------------|-------------------|----|
| <b>Subject Title</b>                | <b>COMPUTER ORGANIZATION</b> |                   |    |
| <b>Subject Code</b>                 | 17CS34                       | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs / Week</b> | 04                           | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b>  | 50                           | <b>Exam Hours</b> | 03 |
| <b>CREDITS – 04</b>                 |                              |                   |    |

**FACULTY DETAILS:**

|                                      |   |                             |
|--------------------------------------|---|-----------------------------|
| <b>Name: Prof. R. R. Patil</b>       | <b>Designation: Asst. Professor</b>                     | <b>Experience: 13 years</b> |
| <b>No. of times course taught:01</b> | <b>Specialization: Computer Science and Engineering</b> |                             |

**1.0 Prerequisite Subjects:**

| Sl. No | Branch                           | Semester | Subject                              |
|--------|----------------------------------|----------|--------------------------------------|
| 01     | Computer Science and Engineering | I/II     | Programming in C and Data Structures |

**2.0 Course Objectives**

This course will enable students to

1. Understand the basics of computer organization: structure and operation of computers and their peripherals.
2. Understand the concepts of programs as sequences or machine instructions.
3. Expose different ways of communicating with I/O devices and standard I/O interfaces.
4. Describe hierarchical memory systems including cache memories and virtual memory.
5. Describe arithmetic and logical operations with integer and floating-point operands.
6. Understand basic processing unit and organization of simple processor, concept of pipelining and other large computing systems.

**3.0 Course Outcomes**

After studying this course, students will be able to

| CO                                | Course Outcome  | Cognitive Level | POs                |
|-----------------------------------|---|-----------------|--------------------|
| C204.1                            | Explain the basic structure of computers, machine instructions and assembly language.           | U               | 1,2,4,5,6,10,11,12 |
| C204.2                            | Explain the fundamentals of I/O devices and interfacing.  | U               | 1,2,4,5,6,10,11,12 |
| C204.3                            | Explain the working principles of memory system.  | U               | 1,2,4,5,6,10,11,12 |
| C204.4                            | Analysis and design of arithmetic and logical operations.                                       | U               | 1,2,4,5,6,10,11,12 |
| C204.5                            | Explain the fundamentals of Basic Processing Unit, Embedded Systems and Large Computer Systems. | U               | 1,2,4,5,6,10,11,12 |
| <b>Total Hours of instruction</b> |   |                 | <b>50</b>          |



## 4.0 Course Content

### MODULE-1

**10Hours**

**Basic Structure of Computers: Basic Operational Concepts, Bus Structures,** Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

### MODULE-2

**10Hours**

**Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware,** Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.

### MODULE-3

**10Hours**

**Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, And Secondary Storage.

### MODULE-4

**10Hours**

**Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction** of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.

### MODULE-5

**10Hours**

**Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete** Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. **Pipelining, Embedded Systems and Large Computer Systems:** Basic Concepts of pipelining, Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller, Forms of parallel processing, Array Processors, The structure of General-Purpose Multiprocessors.

## 5.0 Relevance to future subjects

| Sl. No | Semester | Subject        | Topics  |
|--------|----------|----------------|---|
| 01     | IV       | Microprocessor | Bus Structures , Input/output Organization, Memory System, Arithmetic and Basic Processing Unit |

## 6.0 Relevance to Real World

| Sl. No | Real World Mapping  |
|--------|---|
| 01     | Accessing I/O devices and interfacing and Working with principles of memory system. |
| 02     | Designing the arithmetic and logical operations                                     |



## 7.0 Gap Analysis and Mitigation

| Sl. No | Delivery Type | Details                                    |
|--------|---------------|--|
| 01     | Tutorial      | Seminar on basics of computer Architecture |
| 02     | NPTEL         | Study on hardware parts of a computer      |

## 8.0 Books Used and Recommended to Students

| Text Books                          |   |
|-------------------------------------|---|
| 1.                                  | Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7, 8, 9 and 12) |
| Reference Books                     |   |
| 1.                                  | William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.  |
| Additional Study material & e-Books |   |
| 1.                                  | Fundamentals of Computer organization and Design by Shivarama Dandamud  |
| 2.                                  | Fundamentals of Computer Organization and Architecture by Barr and Rewini   |
| 3.                                  | Computer Organization by ISRD Group   |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References |   |
|--|---|
| 1.                                       | <a href="https://en.wikibooks.org/wiki/IB/Group_4/Computer/Computer_Organisation">https://en.wikibooks.org/wiki/IB/Group_4/Computer/Computer_Organisation</a> |
| 2.                                       | <a href="http://nptel.ac.in/courses/106106092/">nptel.ac.in/courses/106106092/</a>  |
| 3.                                       | <a href="http://nptel.ac.in/courses/106103068/">nptel.ac.in/courses/106103068/</a>  |
| 4.                                       | <a href="http://www.cse.iitm.ac.in/~vplab/courses/comp_org.htm">www.cse.iitm.ac.in/~vplab/courses/comp_org.htm</a>  |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals  | Website   |
|--------|---|---|
| 1      | IJCOT - International Journal of Computer & Organization Trends | <a href="http://www.ijcotjournal.org/">www.ijcotjournal.org/</a>  |
| 2      | Journals - The Science and Information (SAI) Organization       | <a href="http://thesai.org/Publications">thesai.org/Publications</a>  |
| 3      | Computer Hardware Organizations Innovate with IEEE Information  | <a href="https://www.ieee.org/documents/ieee_focus_on_computer_hardware.pdf">https://www.ieee.org/documents/ieee_focus_on_computer_hardware.pdf</a> |

## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

30 marks –from three internal assessment test

10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

### Question Paper Pattern (IA):

- a. Two main questions to be set from syllabus covered up to IA tests.
- b. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
  - a. Q.No I or Q.No II = 15 Marks
  - b. Q.No III or Q.No IV = 15 Marks

**Total = 30 Marks**

### Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
Max. Marks: 100 and each question carries 20 marks.  
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

## 12.0 Course Delivery Plan

| Module | Lecture No. | Content of Lecture  | % of Portion |
|--------|-------------|---|--------------|
| 1      | 1           | <b>Basic Structure of Computers: Basic Operational Concepts, Bus Structures,</b>                | 20           |
|        | 2           | Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. |              |
|        | 3           | Machine Instructions and Programs   |              |
|        | 4           | Memory Location and Addresses, Memory Operations  |              |
|        | 5           | Instructions and Instruction Sequencing   |              |
|        | 6           | Addressing Modes, Assembly Language   |              |
|        | 7           | Basic Input and Output Operations   |              |
|        | 8           | Stacks and Queues, Subroutines,   |              |
|        | 9           | Additional Instructions   |              |
|        | 10          | Encoding of Machine Instructions  |              |
| 2      | 11          | <b>Input / Output Organization: Accessing I/O Devices</b>                                       | 20           |
|        | 12          | <b>Interrupts – Interrupt Hardware</b>  |              |
|        | 13          | Enabling and Disabling Interrupts   |              |
|        | 14          | Handling Multiple Devices   |              |
|        | 15          | Controlling Device Requests, Exceptions   |              |
|        | 16          | Direct Memory Access (DMA)  |              |
|        | 17          | Buses Interface Circuits  |              |
|        | 18          | Standard I/O Interfaces – Peripheral Component Interconnect (PCI) Bus                           |              |
|        | 19          | Small Computer System Interface (SCSI) Bus  |              |
|        | 20          | Universal Serial Bus (USB).   |              |
| 3      | 21          | <b>Memory System:</b> Basic Concepts of primary Memory,   | 20           |
|        | 22          | Semiconductor RAM Memories,   |              |
|        | 23          | Read Only Memories  |              |
|        | 24          | Speed, Size, and Cost,  |              |
|        | 25          | Cache Memories  |              |
|        | 26          | Mapping Functions,  |              |
|        | 27          | Replacement Algorithms,   |              |
|        | 28          | Performance Considerations  |              |
|        | 29          | Virtual Memories,   |              |
|        | 30          | Secondary Storage.  |              |
| 4      | 31          | <b>Arithmetic: Numbers</b>  | 20           |
|        | 32          | <b>Data, Fixed Point, Floating-point Representation</b>   |              |
|        | 33          | <b>Arithmetic Operations and Characters</b>   |              |
|        | 34          | <b>Addition and Subtraction</b> of Signed Numbers   |              |
|        | 35          | Design of Fast Adders   |              |
|        | 36          | Multiplication of Positive Numbers  |              |



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|    |   |   |    |
|----|---|---|----|
| 5  | 37  | Signed Operand Multiplication   | 20 |
|    | 38  | Fast Multiplication   |    |
|    | 39  | Integer Division  |    |
|    | 40  | Floating-point Numbers and Operations.  |    |
|    | 41  | <b>Basic Processing Unit:</b> Some Fundamental Concepts,                            |    |
|    | 42  | Execution of a Complete Instruction,  |    |
|    | 43  | Multiple Bus Organization,  |    |
|    | 44  | Hard-wired Control, Micro programmed Control.                                       |    |
|    | 45  | <b>Pipelining:</b> Basic Concepts of pipelining.                                    |    |
|    | 46  | <b>Embedded Systems and Large Computer Systems:</b><br>Examples of Embedded Systems |    |
| 47 | Processor chips for embedded applications,        |   |    |
| 48 | Simple Microcontroller,                           |   |    |
| 49 | Forms of parallel processing, Array Processors,   |   |    |
| 50 | The structure of General-Purpose Multiprocessors. |   |    |

**13.0 Assignments, Pop Quiz, Mini Project, Seminars**

| Sl. No. | Title   | Outcome expected   | Allied study                 | Week No. | Individual / Group activity                     | Reference: book/website /Paper |
|---------|---|--|------------------------------|----------|---|--------------------------------|
| 1       | Assignment 1: Some important University Questions on Module one.                              | Students study the Topics and write the Answers. Get practice to solve questions | Module one of the syllabus   | 3        | Individual Activity. Witten solutions expected. | Text book                      |
| 2       | Assignment 2: Some important University Questions on Module two                               | Students study the Topics and write the Answers. Get practice to solve questions | Module two of the syllabus   | 6        | Individual Activity. Witten solutions expected. | Text book                      |
| 3       | Assignment 3: Some important University Questions on module three.                            | Students study the Topics and write the Answers. Get practice to solve questions | Module three of the syllabus | 9        | Individual Activity. Witten solutions expected. | Text book                      |
| 4       | Assignment 4: Some important University Questions on and comprehensive questions module four. | Students study the Topics and write the Answers. Get practice to solve questions | Module four of the syllabus  | 11       | Group Activity power point presentation         | Text book and reference books  |
| 5       | Assignment 5: Some important University Questions on and comprehensive questions module five. | Students study the Topics and write the Answers. Get practice to solve questions | Module five of the syllabus  | 13       | Group Activity power point presentation         | Text book and reference books  |



**14.0**

**QUESTION BANK**

**MODULE-1**

1. With a neat diagram discuss the basic operational concept of a computer [June/July 2017]
2. Explain methods to improve the performance of computer [June/July 2017]
3. Explain Big-Endian , little Endian and assignment byte addressability [June/July 2017]
4. What are the addressing modes? Explain the different 4 types of addressing modes with examples [June/July 2017]
5. Write the use of Rotate and shift instruction with example [June/July 2017]
6. What is stack and queue? Write the line of code to implement the same. [June/July 2017]
7. Explain the following for a computer MAR, MDR, PC ALU, and Control unit.
8. Explain the operation of two bus structure.
9. Explain Clearly SPEC rating and its significance
10. Briefly explain the history of computer development from First generations to 4 the Generation
11. Mention the diff between CISC and RISC processors.
12. Explain with examples, all the generic addressing modes, with assembler syntax.
13. Mention the differences between CISC and RISC processors.
14. Write basic performance equation? Explain the role of the parameters on the performance of the computer.
15. Define the terms processor clock, RISC, SPEC rating, basic performance equation.
16. Write the basic performance equation? Explain the role of the parameters on the performance of the computer.

**MODULE -2**

1. Define bus arbitration? Explain in detail any one approach of bus arbitration. [June/July 2017]
2. What are priority interrupts? Explain any one interrupt priority scheme. [June/July 2017]
3. Write a note on register in DMA interface. [June/July 2017]
4. With a block diagram explain how the printer interfaced to processor. [June/July 2017]
5. Explain the following with respect o U.S.B [June/July 2017]
  - i) U.S.B Architecture
  - ii) U.S.B protocols
6. What is an assembler? Explain the functions of Assembler
7. Describe any three modes of addressing.
8. Write a program to evaluate the Expression  $S=A*B+C*D$
9. What are the diff types of addressing modes?
10. What is word alignment of a machine explain what are the consecutive addresses of aligned words for 16, 32 and 64.
11. Bring out the five key differences between subroutine and interrupt service routine.
12. 80what is the function of assembler directives? give two examples of assembler directives used for the reservation for memory locations for variables, state their functions.
13. Define an addressing mode explain the following addressing modes with examples: Indirect, indexed, relative and auto increment.
14. Explain how the parameters are passed to a subroutine?
15. Differentiate between stack and queue.
16. Explain the Big Endean and Little Endean assignment.
17. Write a short note on SCSI BUS and PCI bus
18. Explain the significance of USB and PCI bus
19. Explain the split bus organization with diagram
20. Explain the USB packet format clearly.
21. Draw the block diagram of USB structure connected to the host computer.
22. Briefly explain all fields of packets that are used for communication between a host and a device connected to an USB port.
23. In a computer system, PCI bus is used to connect devices to the processor bus. Consider a bus transaction in which the processor reads four 32 bit words from the memory.



### **MODULE -3**

1. Define. [June/July 2017]
  - i) Memory Latency
  - ii) Memory bandwidth
  - iii) Hit-rate
  - iv) Miss-penalty
2. With a neat diagram explain the internal organization of a 2Mx8 dynamic memory chip. [June/July 2017]
3. Explain associative mapping technique and set associative mapping technique. [June/July 2017]
4. What is virtual memory? With a diagram explain how virtual memory address is translated. [June/July 2017]
5. Write a note on [June/July 2017]
  - i) Magnetic tape system
  - ii) Flash memory
6. What is Stack? Explain its role in subroutine nesting
7. What is DMA? Explain the Generation of two channel DMA controller
8. Explain parameter passing with an example.
9. Explain with a diagram the interface circuit of printer connected to the processor
10. Explain the hard ware register that are needed in DMA controller chip and why is it necessary
11. For a DMA controller to be able to interrupt the processor?
12. What are the advantages do DMA and DMAC?.
13. Define following interrupt, vectored interrupt, interrupt nesting and an exception and give 2 examples.
14. Explain in brief with the help of diagram, the working principle of daisy chain with multiple priority levels and multiple devices in each level.
15. Explain I/o mapped I/o and describe any two methods of connecting multiple interrupting devices to CPU.
16. What is DMA? Explain the generation of two channel DMA controller.
17. Explain the synchronous bus. Also give the timing of an input transfer on a synchronous bus with a timing diagram.
18. Define full handshake.
19. Explain the following with respect to USB USB addressing and USB protocols.
20. Explain I/o mapped I/o and describe any two methods of connecting multiple interrupting devices to CPU.

### **MODULE -4**

1. Perform following operations on the 5-bit signed numbers using 2's compliment representation system. Also indicate overflow has occurred. [June/July 2017]
  - i)  $(-9) + (-7)$       ii)  $(+7) - (-8)$ .
2. Explain with a neat block diagram, 4 bit carry look ahead adder. [June/July 2017]
3. Explain the concept of carry save addition for the multiplication operation,  $M \times Q = P$  for 4-bit operands with diagram and suitable example. [June/July 2017]
4. Multiply the following signed 2's complement numbers using Booth's algorithm multiplicand =  $(010111)_2$ , multiplier =  $(110110)_2$  [June/July 2017]
5. Perform division operation on the following unsigned numbers using the restoration method. Dividend =  $(10101)_2$ , divisor =  $(00100)_2$  [June/July 2017]
6. With a neat diagram explain the floating point addition/ subtraction unit. [June/July 2017]
7. Describe the organization of  $64 \times 8$  memory using  $16 \times 1k$  static memory chips
8. Explain the internal organization of  $2M \times 8$  dynamic memory chip.
9. Differentiate between SRAM and SDRAM chips
10. Define the following Memory access time, memory cycle time, RAM, static memories.
11. Differentiate between the static RAM and DRAM giving four key differences. State the primary usage of SRAM and DRAM in contemporary computer systems.
12. Define memory latency and bandwidth in case of burst operation that is used for transferring a block of data to or from synchronous DRAM memory unit.



**MODULE -5**

1. Draw and explain multiple bus organization of CPU, and write the control sequence for the instruction Add R4, R5, R6 for the multiple bus organization. [June/July 2017]
2. Explain with neat diagram, micro-programmed control method for design of control unit and write the micro – routine for the instruction Branch < 0. [June/July 2017]
3. With block diagram, explain the working of microwave oven in an embedded system. [June/July 2017]
4. With block diagram, explain parallel I/O interface. [June/July 2017]
5. Write a note on Fast adders and Multiply10011& 01001.
6. Explain the representation of Floating point numbers using IEEE Format.
7. Explain the Restoring Division Algorithms method.
8. Indicate Fast multiplication using one example.
9. Compare the booth's algorithm and fast multiplication algorithms.
10. Explain with block diagram 4 bit carry look ahead adder.
11. Perform division of numbers 8by 3 using non restoring division algorithm.
12. Explain the fetching of word from memory with the help of timing diagram.
13. Explain the 3 bus organization of the data path with a neat diagram and write control sequence for the instruction ADD R4,R5,R6 for the 3 bus organization.
14. Compare between hardwired and micro-programmed control.
15. List the actions needed to execute the instruction Add R1,(R3).
16. Write the sequence of control to perform the actions for single bus structure. Explain the steps.

**15.0 University Result**

| Examination | S+ | S  | A  | B  | C  | D  | E  | %<br>Passing |
|-------------|----|----|----|----|----|----|----|--------------|
| JAN -2018   | 00 | 00 | 05 | 11 | 20 | 06 | 08 | 96.15        |
| JAN -2017   | 00 | 00 | 04 | 06 | 23 | 08 | 09 | 98.03        |

| Prepared by     | Checked by       |     |           |
|-----------------|------------------|-----|-----------|
|                 |                  |     |           |
| Prof. R.R.Patil | Prof. Y. M. Naik | HOD | Principal |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                                     |                                   |                   |    |
|-------------------------------------|-----------------------------------|-------------------|----|
| <b>Subject Title</b>                | <b>UNIX AND SHELL PROGRAMMING</b> |                   |    |
| <b>Subject Code</b>                 | 17CS35                            | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs / Week</b> | 03L                               | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b>  | 40                                | <b>Exam Hours</b> | 03 |
| <b>CREDITS – 03</b>                 |                                   |                   |    |

|                                       |                                     |   |
|---------------------------------------|-------------------------------------|---|
| <b>FACULTY DETAILS:</b>               |                                     |   |
| <b>Name:</b> Prof. Mahesh G. Huddar   | <b>Designation:</b> Asst. Professor | <b>Experience:</b> 9 Years                              |
| <b>No. of times course taught:</b> 02 |                                     | <b>Specialization:</b> Computer Science and Engineering |

### 1.0 Prerequisite Subjects:

| Sl. No | Branch                           | Semester | Subject                              |
|--------|----------------------------------|----------|--------------------------------------|
| 01     | Computer Science and Engineering | I/II     | Programming in C and Data Structures |

### 2.0 Course Objectives

Students should learn to:

1. Understand the UNIX Architecture, File systems and use of basic Commands.
2. Use of editors and Networking commands.
3. Understand Shell Programming and to write shell scripts.
4. Understand and analyze UNIX System calls, Process Creation, Control & Relationship.

### 3.0 Course Outcomes

After studying this course, students will be able to

| CO                                | Course Outcome   | Cognitive Level | POs           |
|-----------------------------------|--|-----------------|---------------|
| C205.1                            | Explain the basic features of UNIX OS and Interpret UNIX Commands, Shell basics, and shell environments. | L2              | 1, 2, 3, 4, 5 |
| C205.2                            | Explain the basic UNIX file system and Interpret directory & file commands.                              | L2              | 1, 2, 3, 4, 5 |
| C205.3                            | Develop shell programs and demonstrate filter commands.  | L2              | 1, 2, 3, 4, 5 |
| C205.4                            | Explain UNIX processes and process control.  | L2              | 1, 2, 3, 4, 5 |
| C205.5                            | Demonstrate use of editors and Perl script writing   | L2              | 1, 2, 3, 4, 5 |
| <b>Total Hours of instruction</b> |  |                 | <b>40</b>     |

### 4.0 Course Content

#### MODULE – 1

**8 Hours**

Introduction, Brief history, Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of Unix commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.

**Topics from chapter 2, 3 and 15 of text book 1, chapter 1 from text book 2**



**MODULE – 2**

**8 Hours**

Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.

**Topics from chapters 4, 5 and 6 of text book 1**

**MODULE – 3**

**8 Hours**

The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi. Different modes of vi. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands.

The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Topics from chapters 7, 8 and 13 of text book 1. Topics from chapter 2 and 9, 10 of text book 2

**MODULE – 4**

**8 Hours**

Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here ( << ) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.

**Topics from chapter 11, 12, 14 of text book 1, chapter 17 from text book 2**

**MODULE – 5**

**8 Hours**

Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.

Structure of a perl script. Running a perl script. Variables and operators. String handling functions. Default variables - \$\_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions. Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join(). File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.

**Topics from chapter 9 and 19 of text book 1. Topics from chapter 11 of reference book 1**

**5.0 Relevance to future subjects**

| Sl. No | Semester | Subject                 | Topics                  |
|--------|----------|-------------------------|-------------------------|
| 01     | VI       | UNIX System Programming | Commands implementation |



## 6.0 Relevance to Real World

| Sl. No | Real World Mapping                |
|--------|-----------------------------------|
| 01     | Implementation of system commands |

## 7.0 Gap Analysis and Mitigation

| Sl. No | Delivery Type  | Details                |
|--------|----------------|------------------------|
| 01     | YouTube Videos | UNIX shell programming |
| 02     | NPTEL          | UNIX shell programming |

## 8.0 Books Used and Recommended to Students

| Text Books                          |  |
|-------------------------------------|--|
| 1.                                  | Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill                               |
| 2.                                  | Behrouz A. Forouzan, Richard F. Gilberg : UNIX and Shell Programming- Cengage Learning – India Edition, 2009 |
| Reference Books                     |  |
| 1.                                  | M.G. Venkateshmurthy: UNIX & Shell Programming, Pearson Education  |
| 2.                                  | Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley, 2014  |
| Additional Study material & e-Books |  |
| 1.                                  | UNIX and Shell Programming – 2006 by <u>Archna Verma</u>   |
| 2.                                  | astering Linux Shell Scripting Paperback– Import, 24 Dec 2015 by <u>Andrew Mallett</u>                       |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References |   |
|--|---|
| 1.                                       | <a href="https://www.tutorialspoint.com/unix/">https://www.tutorialspoint.com/unix/</a> |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals                               | Website   |
|--------|--|---|
| 1      | Journal of Advances in Shell Programming (JoASP) | <a href="http://www.indiamags.com/journal-of-advances-in-shell-programming">http://www.indiamags.com/journal-of-advances-in-shell-programming</a> |

## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

30 marks –from three internal assessment test

10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

Question Paper Pattern (IA):



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

- a. Two main questions to be set from syllabus covered up to IA tests.  
 b. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
- |              |                     |                   |
|--------------|---------------------|-------------------|
| a.           | Q.No I or Q.No II   | = 15 Marks        |
| b.           | Q.No III or Q.No IV | = 15 Marks        |
| <b>Total</b> |                     | <b>= 30 Marks</b> |

### Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
 Max. Marks: 100 and each question carries 20 marks.  
 Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

## 12.0 Course Delivery Plan

| Module | Lecture No. | Content of Lecturer   | % of Portion |
|--------|-------------|---|--------------|
| 1      | 1           | Introduction, Brief history. Unix Components/Architecture. Features of Unix.  | 20           |
|        | 2           | The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt.   |              |
|        | 3           | General features of Unix commands/ command structure, Command arguments and options.  |              |
|        | 4           | Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands.  |              |
|        | 5           | Meaning of Internal and external commands. The type command: knowing the type of a command and locating it.   |              |
|        | 6           | The man command knowing more about Unix commands and using Unix online manual pages. The man with keyword option and whatis. The more command and using it with other commands. |              |
|        | 7           | Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behavior of terminals and keyboards.                            |              |
|        | 8           | The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add, modify and delete users.   |              |
| 2      | 9           | Unix files. Naming files. Basic file types/categories. Organization of files. Hidden files  | 20           |
|        | 10          | Standard directories. Parent child relationship. The home directory and the HOME variable   |              |
|        | 11          | Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames.   |              |
|        | 12          | Directory commands – pwd, cd, mkdir, rmdir commands.  |              |
|        | 13          | The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names   |              |
|        | 14          | File related commands – cat, mv, rm, cp, wc and od commands, File attributes and permissions and knowing them   |              |
|        | 15          | The ls command with options. Changing file permissions: the relative and absolute permissions changing methods.   |              |
|        | 16          | Recursively changing file permissions. Directory permissions  |              |
| 3      | 17          | The vi editor. Basics. The .exrc file. Different ways of invoking and quitting vi.  | 20           |
|        | 18          | Different modes of vi. Input mode commands. Command mode commands.  |              |
|        | 19          | The ex mode commands. Illustrative examples Navigation commands. Repeat command.  |              |
|        | 20          | Pattern searching. The search and replace command, The set, map and abbr commands. Simple examples using these commands.  |              |



**Course Plan 2018-19 ODD – Semester - III  
Computer Science and Engineering**

|   |    |  |    |
|---|----|--|----|
|   | 21 | The shells interpretive cycle. Wild cards and file name generation.  |    |
|   | 22 | Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee.   |    |
|   | 23 | Command substitution. Basic and Extended regular expressions.  |    |
|   | 24 | The grep, egrep. Typical examples involving different regular expressions.   |    |
| 4 | 25 | Shell programming. Ordinary and environment variables. The .profile. Read and readonly commands.   | 20 |
|   | 26 | Command line arguments. exit and exit status of a command.   |    |
|   | 27 | Logical operators for conditional execution. The test command and its shortcut.  |    |
|   | 28 | The if, while, for and case control statements.  |    |
|   | 29 | The set and shift commands and handling positional parameters. The here (<<) document and trap command   |    |
|   | 30 | Simple shell program examples, File inodes and the inode structure. File links – hard and soft links.  |    |
|   | 31 | Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options.  |    |
|   | 32 | The umask and default file permissions. Two special files /dev/null and /dev/tty.  |    |
| 5 | 33 | Meaning of a process. Mechanism of process creation. Parent and child process.   | 20 |
|   | 34 | The ps command with its options, Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file..                           |    |
|   | 35 | Signals. The nice and nohup commands. Background processes, The bg and fg command. The kill command. The find command with illustrative example.   |    |
|   | 36 | Structure of a perl script. Running a perl script. Variables and operators. String handling functions.   |    |
|   | 37 | Default variables - \$_ and \$. – representing the current line and current line number. The range operator. Chop() and chomp() functions.   |    |
|   | 38 | Lists and arrays. The @-variable. The splice operator, push(), pop(), split() and join().  |    |
|   | 39 | File handles and handling file – using open(), close() and die () functions.. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach |    |
|   | 40 | Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines.   |    |

### 13.0 Assignments, Pop Quiz, Mini Project, Seminars

| Sl.No. | Title  | Outcome expected   | Allied study             | Week No. | Individual / Group activity                     | Reference: book/website /Paper |
|--------|--|--|--------------------------|----------|---|--------------------------------|
| 1      | Assignment 1: University Questions on Module 1 | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 1 of the syllabus | 2        | Individual Activity. Printed solution expected. | Book 1                         |
| 2      | Assignment 2: University Questions on Module 2 | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 2 of the syllabus | 4        | Individual Activity. Printed solution expected. | Book 1                         |
| 3      | Assignment 3: University                       | Students study the Topics and write the  | Module 3 of the          | 6        | Individual Activity. Printed solution           | Book 1                         |



|   |  |  |                          |    |   |        |
|---|--|--|--------------------------|----|---|--------|
|   | Questions on Module 3                          | Answers. Get practice to solve university questions.   | syllabus                 |    | expected.                                       |        |
| 4 | Assignment 4: University Questions on Module 4 | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 4 of the syllabus | 8  | Individual Activity. Printed solution expected. | Book 1 |
| 5 | Assignment 5: University Questions on Module 5 | Students study the Topics and write the Answers. Get practice to solve university questions. | Module 5 of the syllabus | 10 | Individual Activity. Printed solution expected. | Book 1 |

## 15.0 QUESTION BANK

### MODULE– 1

1. Explain the architecture of UNIX operating system. [JUN-09/DEC-09/DEC-10/JUN-11/DEC-14]
2. Define UNIX Operating System.
3. Explain the following commands: type, tput, cat, pwd, mkdir, cd, rmdir and date. [DEC-09]
4. Differentiate between hard-link and soft-link in UNIX with example.
5. With a neat diagram explain the relationship between the kernel and shell of UNIX.
6. Describe the salient features of UNIX operating system. [DEC-09/JUN-10/DEC-10]
7. With example explain date and bc command
8. With the help of diagram, explain parent-child relationship. Explain the UNIX file system. [JUN-11]
9. What are the different types of files in UNIX, explain them briefly. [JUN-09/JUN-10]
10. Explain three groups in UNIX file system?
11. Write a short note on MAN command. [JUN-09/DEC-10]
12. Explain the following commands with examples – mailx, passwd, sty, who. [JUN-10]
13. Discuss the salient features of operating systems. [Jan 2017]
14. Explain the following commands i) echo ii) ls iii) who iv) date [Jan 2017]
15. Write a note on man documentation and explain keyword and whatis option. [Jan 2017]
16. Explain how to display and set the terminal characteristics. [Jan 2017]
17. Explain the contents of /etc/passwd and /etc/shadow in UNIX operating system. [Jan 2017]
18. Explain commands to add and delete user. [Jan 2017]

### MODULE– 2

1. Explain about file ownership.
2. Explain the different types of files supported in UNIX. [DEC-10][Jan 2017]
3. Briefly describe the different ways of setting file permissions. [JUN-09/JUN-10/JUN-11]
4. Explain the following - chmod, chown&chgrp.
5. Explain the absolute pathname and relative pathname with examples. [JUN-09/JUN-11/DEC-14]
6. Explain the significance of ls -l in detail.[Jan 2017]
7. Explain the following directory related commands – pwd, cd, mkdir, rmdir, Home [Jan 2017]
8. Explain the (.) dot and (..) double dot notations to represent present and parent directories.
9. Explain the following file related commands – cat, mv, rm, cp, wc and od[Jan 2017]
10. How to change directory permissions? Explain with examples.[Jan 2017]

### MODULE– 3

1. Explain the commands search for pattern and search & replace in VI editor.
2. What are the three modes of VI editor? Explain. [DEC-09/JUN-10/ DEC-10/JUN-11/DEC-14][Jan 2017]
3. What is navigation? What are the commands used for navigation in VI editor? [JUN-10][Jan 2017]
4. What is metacharacter? List out 5 metachatacters and explain them in detail with examples.
5. Explain how the text is entered and replaced in input mode of vi editor. [Jan 2017]



6. Explain -Standard Input, Standard Output & Standard Error. [JUN-09/DEC-09/DEC-10][Jan 2017]
7. Explain the following commands - bc as filter, who, who am I, cmp, wc with pipe, echo.
8. Explain the grep, with examples. [DEC-10/JUN-11][Jan 2017]
9. How to search for a pattern using grep? What are the options used by grep? [JUN-10]
10. Explain extended regular expression (ERE) set used by grep. [JUN-10]
11. Explain Basic Regular Expression (BRE) subset used for constructing regular expressions. [JUN-11]
12. Explain the Shell's interpretive life cycle. [Jan 2017]

#### **MODULE- 4**

1. What is shell programming? Explain the shell features of while & for with syntax. [DEC-10]
2. Write a shell program that will do the following tasks, in order – clear the screen, print the current directory and display current login users. [DEC-09]
3. Write a menu driven shell script to display the list of files, process of user, today's date & users of the system.[JUN-10]
4. Explain the shell features of “while” and “for” with syntax.[DEC-09/JUN-11][Jan 2017]
5. Explain with example set and shift commands in UNIX. [Jan 2017]
6. Write a shell script that accepts a word & five filenames as arguments, counts and reports the occurrence of the word in each of the files. [JUN-09]
7. Write a shell script to find the smallest of three numbers that are read from keyboard. [JUN-09]
8. Write a shell program to create a menu which displays the list of files, current date, process status and current users of the system. [JUN-11]
9. Explain the use of test and [ ] to evaluate expressions in shell.[DEC-10/JUN-11]
10. What are the special parameters used by the shell? [JUN-10]
11. Explain how numeric & string comparison is done by using test. [JUN-10]
12. What is the “exit” status of a command and where is it stored? [DEC-09]
13. Explain all filters in UNIX.
14. What is file permission? What are the different ways of setting file permissions? [JUN-10/ DEC-10]
15. Clearly differentiate between hard links and soft links. [JUN-09/DEC-09/JUN-11][Jan 2017]
16. Explain the following filters with example - head, tail, cut, paste, uniq. [JUN-10][Jan 2017]
17. Explain the following two files - /dev/null & /dev/tty.
18. Explain sort command with examples. [Jan 2017]

#### **MODULE – 5**

1. What is a process? Explain the mechanism of process creation. [JUN-09/JUN-11][Jan 2017]
2. Explain two types of Commands.
3. What is process status? Explain PS command with options.[DEC-09/DEC-14]
4. What are environment variables? State their significance. [JUN-10/JUN-11]
5. Explain string handling functions in Perl. [Jan 2017]
6. Explain with suitable examples split and join functions in Perl. [Jan 2017]
7. Explain file handling in Perl. [Jan 2017]
8. Explain the history command.
9. Explain the following environment variables – IFS, TERM, PATH, SHELL& LOGNAME. [DEC-09]
10. What are the shell variables that control the UNIX system called? Explain. [DEC-10]
11. How do you paginate file in UNIX using pager.
12. How is a process created? Explain the role of fork & exec system calls used in process creation.[DEC-10]
13. Define a job. How is job control done in UNIX? [JUN-09/DEC-10]
14. What are three standard files used by UNIX commands? Explain. [JUN-10/JUN-11]
15. What is shell process? What are three different phases in the creation of process? [JUN-10]
16. Explain the variables, operators & expressions in Perl. [JUN-09/DEC-10/DEC-14]
17. Write a Perl script to convert a decimal number to binary. [JUN-10/DEC-10/DEC-14]
18. List and explain the various privileges of system administrator.
19. How is file managed in Perl? Explain with an example. [DEC-10]
20. Explain at, corn, nohup and nice commands. [Jan 2017]
21. Explain the list & array used in Perl. [DEC-10/JUN-11]



22. Explain string handling function in Perl. [DEC-10/JUN-11]
23. Write a Perl program to find the number of characters, words as well as to print the reverse of a given sentence.[JUN-11]
24. Using command line argument, write a Perl program to find whether a given year is leap. [DEC-10/DEC-14][Jan 2017]
25. Explain with example the following built in functions-split, substr, length, index & reverse.[DEC-09]

### 16.0 University Result

| Examination | S+ | S  | A  | B  | C  | D  | E  | %Passing |
|-------------|----|----|----|----|----|----|----|----------|
| JAN-2018    | 00 | 00 | 12 | 12 | 20 | 03 | 05 | 100      |
| JAN-2017    | 00 | 04 | 14 | 18 | 13 | 00 | 02 | 100      |

| Prepared by            | Checked by            |     |           |
|------------------------|-----------------------|-----|-----------|
|                        |                       |     |           |
| Prof. Mahesh G. Huddar | Prof. A. A. Daptardar | HOD | Principal |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                                    |   |                   |    |
|------------------------------------|---|-------------------|----|
| <b>Subject Title</b>               | <b>DISCRETE MATHEMATICAL STRUCTURES</b> |                   |    |
| <b>Subject Code</b>                | 17CS36                                  | <b>IA Marks</b>   | 40 |
| <b>Number of Lecture Hrs /</b>     | 04                                      | <b>Exam Marks</b> | 60 |
| <b>Total Number of Lecture Hrs</b> | 50                                      | <b>Exam Hours</b> | 03 |
| <b>CREDITS – 04</b>                |   |                   |    |

### FACULTY DETAILS:

|                                       |   |                               |
|---------------------------------------|---|-------------------------------|
| <b>Name:</b> Prof. Aruna A. Daptardar | <b>Designation:</b> Asst. Professor                   | <b>Experience:</b> 12.5 Years |
| <b>No. of times course taught:</b> 02 | <b>Specialization:</b> Computer Science & Engineering |                               |

### 1.0 Prerequisite Subjects:

| Sl. No | Branch      | Semester | Subject    |
|--------|-------------|----------|------------|
| 01     | Mathematics | I/II     | M-I & M-II |

### 2.0 Course Objectives

1. Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.
2. Understand and apply logic, relations, functions, basic set theory, countability and counting arguments, proof techniques.
3. Understand and apply mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory
4. Understand and apply graph theory and mathematical proof techniques.

### 3.0 Course Outcomes

Having successfully completed this course, the student will be able to draw and use modeling software's to generate

| CO                                | Course Outcome  | Cognitive Level | POs                     |
|-----------------------------------|---|-----------------|-------------------------|
| C206.1                            | Demonstrate the correctness of an argument using propositional and predicate logic, and truth tables. | L2              | PO1,PO2,PO4,PO5,PO6,PO7 |
| C206.2                            | Demonstrate the properties of Integers & fundamental principles of Counting.                          | L2              | PO1,PO2,PO4,PO5,PO6,PO7 |
| C206.3                            | Make use of Relation and Function's properties to solve logical problems.                             | L3              | PO1,PO2,PO4,PO5,PO6,PO7 |
| C206.4                            | Solve problems involving principle of Inclusion & Exclusion, and recurrence relations.                | L3              | PO1,PO2,PO4,PO5,PO6,PO7 |
| C206.5                            | Explain the fundamentals of Graphs and Trees.   | L2              | PO1,PO2,PO4,PO5,PO6,PO7 |
| <b>Total Hours of instruction</b> |   |                 | <b>50</b>               |

### 4.0 Course Content



**MODULE -1**

**10 Hours**

**Fundamentals of Logic:** Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.  
**Textbook 1: Ch 2**

**MODULE-2**

**10 Hours**

**Properties of the Integers:** Mathematical Induction, The Well Ordering Principle -Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.  
**Textbook 1: Ch 4: 4.1, 4.2 Ch 1.**

**MODULE-3**

**10 Hours**

**Relations and Functions:** Cartesian Products and Relations, Functions – Plain and One-to- One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.  
**Textbook 1: Ch 5:5.1 to 5.3, 5.5, 5.6, Ch 7:7.1 to 7.4**

**MODULE-4**

**10 Hours**

**The Principle of Inclusion and Exclusion:** The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials. Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.  
**Textbook 1: Ch 8: 8.1 to 8.4, Ch 10:10.1 to 10.2**

**MODULE-5**

**10 Hours**

**Introduction to Graph Theory:** Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits , Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.  
**Textbook 1: Ch 11: 11.1 to 11.3, Ch 12: 12.1 to 12.4**

**5.0 Relevance to future subjects**

| Sl. No | Semester | Subject                         | Topics |
|--------|----------|---------------------------------|--------|
| 01     | V        | Automata Theory & Computability | --     |

**6.0 Relevance to Real World**

| Sl. No | Real World Mapping                |
|--------|-----------------------------------|
| 01     | Logic Oriented Real Time Problems |

**7.0 Gap Analysis and Mitigation**



| Sl. No | Delivery Type | Details                     |
|--------|---------------|-----------------------------|
| 01     | Tutorial      | Topic: Module-1 to Module-5 |
| 02     | NPTEL         | Videos                      |

## 8.0 Books Used and Recommended to Students

| Text Books  |
|---|
| 1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5 <sup>th</sup> Edition, Pearson Education. 2004.       |
| Reference Books   |
| 1. Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016 |
| 2. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007.                         |
| 3. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.                              |
| 4. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.                   |
| Additional Study material & e-Books   |
| 1. Dr. D. S. C: Discrete Mathematical Structures 2 <sup>nd</sup> Edition.   |

## 9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References              |
|---|
| 1. <a href="http://www.google.com">www.google.com</a> |

## 10.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals                              | Website   |
|--------|---|---|
| 1      | Advances & applications in Discrete Mathematics | <a href="http://www.pphmj.com/journals/aadm.htm">www.pphmj.com/journals/aadm.htm</a>        |
| 2      | International Scholarly Research Notices        | <a href="https://www.hindawi.com/journals/isrn/">https://www.hindawi.com/journals/isrn/</a> |

## 11.0 Examination Note

### Internal Assessment: 30+10=40 Marks

30 marks –from three internal assessment test

10 marks- from the assignments

### Scheme of Evaluation for Internal Assessment (30 Marks)

- Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.
- Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

### Question Paper Pattern (IA):

- Two main questions to be set from syllabus covered up to IA tests.
- Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
  - Q.No I or Q.No II = 15 Marks
  - Q.No III or Q.No IV = 15 Marks

**Total = 30 Marks**

### Question Paper Pattern and instructions (Main Exam):

- The question paper will have TEN questions.
- There will be TWO questions from each module.



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3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.  
Max. Marks: 100 and each question carries 20 marks.  
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

**12.0 Course Delivery Plan**

| Module No. | Lecture No.                           | Content of Lecture  | % of Portion |
|------------|---------------------------------------|---|--------------|
| 1          | 1                                     | Propositions  | 20           |
|            | 2                                     | Basic Connectives and Truth Tables  |              |
|            | 3                                     | Logical equivalence: Laws of logic  |              |
|            | 4                                     | Continued...  |              |
|            | 5                                     | Logical Implications: Rules of inference  |              |
|            | 6                                     | Continued...  |              |
|            | 7                                     | Open statements   |              |
|            | 8                                     | The use of Quantifiers  |              |
|            | 9                                     | Quantifiers, definitions and proofs of theorems                                     |              |
|            | 10                                    | Continued...  |              |
| 2          | 1                                     | Mathematical Induction  | 20           |
|            | 2                                     | Continued...  |              |
|            | 3                                     | The Well-Ordering Principle: Mathematical Induction                                 |              |
|            | 4                                     | Continued...  |              |
| 3          | 5                                     | Recursive Definitions   | 20           |
|            | 6                                     | The Rules of Sum and Product  |              |
|            | 7                                     | Permutations  |              |
|            | 8                                     | Combinations: The Binomial Theorem  |              |
|            | 9                                     | Combinations with Repetition  |              |
|            | 10                                    | Continued...  |              |
|            | 1                                     | Cartesian Products and Relations  |              |
|            | 2                                     | Functions – Plain and One-to-One, Onto Functions                                    |              |
|            | 3                                     | The Pigeon-hole Principle   |              |
|            | 4                                     | Function Composition and Inverse Functions  |              |
|            | 5                                     | Continued...  |              |
|            | 6                                     | Properties of Relations   |              |
|            | 7                                     | Computer Recognition – Zero-One Matrices and Directed Graphs                        |              |
|            | 8                                     | Continued...  |              |
| 9          | Partial Orders – Hasse Diagrams       |   |              |
| 10         | Equivalence Relations and Partitions. |   |              |
| 4          | 1                                     | The Principle of Inclusion and Exclusion  | 20           |
|            | 2                                     | Continued...  |              |
|            | 3                                     | Generalizations of the Principle  |              |
|            | 4                                     | Derangements – Nothing is in its Right Place  |              |
|            | 5                                     | Rook Polynomials  |              |
|            | 6                                     | Recurrence Relations: First Order Linear Recurrence Relation                        |              |
|            | 7                                     | Continued...  |              |
|            | 8                                     | The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. |              |



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|   |    |  |    |
|---|----|--|----|
|   | 9  | Continued...   |    |
|   | 10 | Continued...   |    |
| 5 | 1  | Introduction to Graph Theory: Definitions and Examples | 20 |
|   | 2  | Sub graphs, Complements and Graph Isomorphism          |    |
|   | 3  | Continued...   |    |
|   | 4  | Vertex Degree, Euler Trails and Circuits               |    |
|   | 5  | Continued...   |    |
|   | 6  | Trees: Definitions, Properties, and Examples           |    |
|   | 7  | Continued...   |    |
|   | 8  | Routed Trees   |    |
|   | 9  | Trees and Sorting                                      |    |
|   | 10 | Weighted Trees and Prefix Codes                        |    |

### 13.0 Assignments, Pop Quiz, Mini Project, Seminars

| Sl. No. | Title  | Outcome expected   | Allied study               | Week No. | Individual / Group activity                     | Reference: book/website /Paper                              |
|---------|--|--|----------------------------|----------|---|---|
| 1       | Assignment 1: Fundamentals of Logic                  | Students study the Topics and write the Answers. Get practice to solve university questions. | Module I of the syllabus   | 2        | Individual Activity. Printed solution expected. | Book 1 of the reference list. Website of the Reference list |
| 2       | Assignment 2: Properties of the Integers             | Students study the Topics and write the Answers. Get practice to solve university questions. | Module II of the syllabus  | 4        | Individual Activity. Printed solution expected. | Book 1 of the reference list. Website of the Reference list |
| 3       | Assignment 3: Relations & Functions                  | Students study the Topics and write the Answers. Get practice to solve university questions. | Module III of the syllabus | 6        | Individual Activity. Printed solution expected. | Book 1 of the reference list. Website of the Reference list |
| 4       | Assignment 4: The Principle of Inclusion & Exclusion | Students study the Topics and write the Answers. Get practice to solve university questions. | Module IV of the syllabus  | 8        | Individual Activity. Printed solution expected. | Book 1 of the reference list. Website of the Reference list |
| 5       | Assignment 5: Introduction to Graph Theory           | Students study the Topics and write the Answers. Get practice to solve university questions. | Module V of the syllabus   | 10       | Individual Activity. Printed solution expected. | Book 1 of the reference list. Website of the Reference list |

### 14.0 QUESTION BANK

#### MODULE-1

- Define with an example Proposition, Compound proposition, Tautology, Contradiction, Logical equivalence and Logical Implication.
- Define Inverse, converse and contra positive of a conditional statement.
- Find the following in symbolic form and establish if the argument is valid: If A gets the supervisor's position and works hard, then he will get a raise. If he gets a raise, then he will buy a new car. He has not bought a new car. Therefore A did not get supervisor's position or he did not work hard.
- Find p, q and r if  $p \rightarrow (q \vee r)$  is FALSE and  $p \wedge (q \rightarrow r)$  is TRUE.
- Prove the following logical equivalences without using truth tables.
  - $p \vee [p \wedge (p \vee q)] \equiv p$
  - $[(\neg p \vee \neg q) \rightarrow (p \wedge q \wedge r)] \equiv p \wedge q$
- What do you mean by 'equivalence relation' and 'equivalence classes'? Give an example for each.



7. Verify the following without using truth table,
  - a.  $[(p \rightarrow q) \wedge (\neg r \vee s) \wedge (p \vee r)]$  therefore  $\neg q \rightarrow s$ .
8. Let p, q, r denote primitive statements. Use truth table to verify the following logical equivalence. (Dec-2017)
  - a.  $[p \rightarrow (q \wedge r)] \Leftrightarrow [(p \rightarrow q) \wedge (p \rightarrow r)]$
  - b.  $[(p \vee q) \rightarrow r] \Leftrightarrow [(p \rightarrow r) \wedge (q \rightarrow r)]$
  - c.  $[p \rightarrow (q \vee r)] \Leftrightarrow [\neg r \rightarrow r \wedge (p \rightarrow q)]$
9. What is tautology? Verify if the following statements are tautology.
  - a. i)  $p \rightarrow [q \rightarrow (p \wedge q)]$  ii)  $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$  iii)  $(p \vee q) \rightarrow [q \rightarrow (p \wedge q)]$
10. Define tautology. Prove that for any three prepositions p, q and r the compound proposition  $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$  is a tautology using truth table.
11. Prove the following logical equivalence without using truth table:  $[(p \rightarrow q) \wedge (\neg q \wedge (r \vee \neg q))] \Leftrightarrow (\neg q \vee p)$ .
12. State identity and absorption laws. Prove them using truth tables.
13. State and DE Morgan's laws of set theory.
14. Let p, q, r denote a primitive statements. Use truth table to verify the following logical equivalence.
  - a.  $p \rightarrow (q \wedge r) \Leftrightarrow (p \rightarrow q) \wedge (p \rightarrow r)$
  - b.  $[(p \rightarrow (q \vee r))] \Leftrightarrow [\neg r \rightarrow r(p \rightarrow q)]$
  - c.  $[(p \vee q) \rightarrow r] \Leftrightarrow [(p \rightarrow r) \wedge (q \rightarrow r)]$
15. Negate the following statements  $(p \vee q) \rightarrow r$
16. If x is not a real number then it is not a rational number and not an irrational number.
17. Prove that for any propositions p, q, r the compound proposition  $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$  is tautology.
18. Write dual, negation, converse, inverse and contrapositive of the given statement:
  - a. "If kabir wears brown pant, then he will wear white shirt"
19. Define Dual of a logical statement. Write dual of  $(p \vee T_0) \wedge (q \vee F_0) \vee (r \wedge s \wedge T_0)$ .
20. Write the truth-values for NAND & NOR.
21. Define Dual of a logical statement. Verify the principal of duality for the following logical Equivalence:  $[\neg(p \wedge q) \rightarrow \neg p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$
22. Define Universal quantifier, Existential quantifier, Open statement and Quantified statement Write down the following propositions in symbolic form and find its negation.
  - a. If all triangles are right angled, then no triangle is equiangular.
  - b. For all integers n, if n is not divisible by 2, then n is odd and
  - c. All integers are rational numbers and some rational numbers are not integers.
23. Prove that the following argument is valid,
 
$$\begin{aligned} &\forall x [p(x) \rightarrow q(x)] \\ &\forall x [q(x) \rightarrow r(x)] \\ &\sim r(c) \\ \therefore &\sim p(c) \end{aligned}$$
24. For given statements  $p(x): x > 3$ ,  $q(x): x < 3$ , the universe consists of all real numbers. Express in statement and symbolic form of converse, inverse and contra positive of the statement  $\forall x [p(x) \rightarrow q(x)]$ . State an example if the truth value is false.
25. Give direct and indirect proof of the following statement: "If n is an Odd integer, then (n+9) is an even number" (Dec-2016)
26. Give R(x, y): x+y is even where the variables x and y represent integers write down the following in words:
  - a.  $\forall x \exists y p(x, y)$
  - b.  $\exists x \forall y p(x, y)$
27. Negate and simplify each of the following:
  - a.  $\exists x, [p(x) \vee q(x)]$
  - b.  $\forall x, [p(x) \wedge \neg q(x)]$
  - c.  $\forall x, [p(x) \rightarrow q(x)]$
28. Establish the validity of the following argument:
 
$$\begin{aligned} &\forall x, [p(x) \vee q(x)] \\ &\forall x, [\{\neg p(x) \wedge q(x)\} \rightarrow r(x)] \\ \hline \therefore &\forall x, [\neg r(x) \rightarrow p(x)] \end{aligned}$$
29. Let p(x) be the open statement " $x^2 = 2x$ ", where the universe comprises all integers. Determine whether each of the following statements is true/ false. i) P(0) ii) P(1) iii) P(2) iv) P(-2) v)  $\exists x P(x)$
30. Negate and simplify, i)  $\forall x [p(x) \wedge \sim q(x)]$  ii)  $\exists x [(P(x) \vee q(x)) \rightarrow r(x)]$ .



31. Prove that for every integer  $n$ ,  $n^2$  is even iff  $n$  is even.
32. Let  $p$ ,  $q$  and  $r$  be propositions having truth values 0, 0 and 1 respectively. Find the truth values of the following compound proposition. i)  $(p \wedge q) \rightarrow r$  ii)  $p \rightarrow (q \wedge r)$  iii)  $p \wedge (r \rightarrow q)$  iv)  $p \rightarrow (q \rightarrow (\neg r))$   
**(Dec-2016)**
33. Define tautology. Prove that for any propositions  $p$ ,  $q$ ,  $r$  the compound proposition  $[(p \vee q) \wedge \{(p \rightarrow r) \wedge (q \rightarrow r)\}]$  is tautology. **(Dec-2016)**
34. Prove the following logical equivalences without using truth tables.
  - a. i.  $p \vee [p \wedge (p \vee q)] \equiv p$  ii.  $[(\neg p \vee \neg q) \rightarrow (p \wedge q \wedge r)] \equiv p \wedge q$
35. What is tautology? Verify if the following statements are tautology.
  - a. i)  $p \rightarrow [q \rightarrow (p \wedge q)]$  ii)  $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$
36. Define Dual of a logical statement. Verify the principal of duality for the following
  - a. logical Equivalence:  $[\neg (p \wedge q) \rightarrow \neg p \vee (\neg p \vee q)] \Leftrightarrow (\neg p \vee q)$
37. Negate and simplify each of the following:
  - a. i)  $\exists x, [p(x) \vee q(x)]$  ii)  $\forall x, [p(x) \wedge \neg q(x)]$  iii)  $\forall x, [p(x) \rightarrow q(x)]$
38. Establish the validity of the following argument. **(Dec-2016)**

$$\forall x, [p(x) \vee q(x)]$$

$$\exists x, \neg p(x)$$

$$\forall x, [\neg q(x) \vee r(x)]$$

$$\forall x, [s(x) \rightarrow \neg r(x)]$$

-----

$$\therefore \exists x, \neg s(x)$$
39. Prove that for all integers 'k' and 'l' are both odd, then  $k+l$  is even and  $kl$  is odd by Direct Proof.  
**(Dec-2017)**

## MODULE-2

1. State and briefly explain mathematical induction and well ordering principle.
2. Prove by mathematical induction  $1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2 = n(n+1)(2n+1)/6$ .
3. Prove by mathematical induction  $1 + 2 + 3 + 4 + \dots + n = n(n+1)/2$ .
4. The Fibonacci numbers are defined recursively by  $F_0=0$ ,  $F_1=1$  and  $F_n=F_{n-1}+F_{n-2}$  for  $n \geq 2$ . Evaluate  $F_2$  to  $F_{10}$ .
5. Provide an 'Indirect Proof' for the following. "For any integer 'n', if  $n^2$  is odd then  $n$  is odd"
6. Prove that  $4n < (n^2-7)$ , for all integers  $n \geq 6$ .
7. Prove that every positive integers  $n \geq 24$  can be written as a sum of sum of 5's and 7's.
8. Obtain a recursive definitions for the sequence  $\{a_n\}$  in each of the following:
  - i)  $a_n = 5n$  ii)  $a_n = 2(-1)^n$
9. State the pigeonhole principle. If 5 colors are used to paint 26 doors, show that at least six doors will have the same color.
10. For all positive integers  $n$ , prove that if  $n \geq 24$ , then  $n$  can be written as a sum of 5's and / or 7's.
11. Prove the following, i) If  $m$  is an even integer, then prove  $m+7$  is odd ii) if  $k$  &  $l$  are odd integers, prove  $k+l$  is even.
12. Give a direct proof for each of the following
  - i) For all integers  $K$  and  $l$ , if  $k, l$  are both even, then  $k+l$  is even.
  - ii) For all integers'  $k$  and  $l$ , if  $k, l$  are even, then  $k.l$  is even
13. Solve the linear recurrence relation  $a_n = 4a_{n-1} + 5 a_{n-2}$  with  $a_1 = 2$ ,  $a^2 = 6$ .
14. Find unique solution for the recurrence  $4a_n - 5a_{n-1} = 0$  with  $n \geq 1$  and  $a_0 = 1$ .
15. Prove  $2^n < n!$   $n > 3$  and  $\forall n$  belongs to  $z^+$ .
16. Prove  $\sum_{i=1, n} 1/i(i+1) = n/(n+1)$   $\forall n$  belongs to  $z^+$ .
17. Solve  $a_n - 5a_{n-1} + 6a_{n-2} = 0$  with  $a_1 = 5$  by Characteristic root method.
18. A sequence  $\{a_n\}$  defined by  $a_1 = 4$ ,  $a_n = n + a_{n-1}$  for  $n \geq 2$ .
19. Show that explicit expression of  $a_n = a_{n-1} + n$ , for  $n \geq 2$ . Find  $a_n$  in explicit form.
20. If  $F_0, F_1, F_2, \dots$  are Fibonacci numbers, prove that  $\sum_{i=0}^n F_n \times F_{n+1}$ .
21. The Lucas numbers are defined recursively by  $L_0 = 2$ ,  $L_1 = 1$  and  $L_n = L_{n-1} + L_{n-2}$  for  $n \geq 2$ . Evaluate  $L_2$  to  $L_{10}$ .
22. A sequence  $\{a_n\}$  defined by  $a_1 = 4$ ,  $a_n = n + a_{n-1}$  for  $n \geq 2$ . Show that explicit expression of  $a_n = 3 + \frac{1}{2}(n^2 + n)$ .



23. How many permutations of size 3 can one produce with letters m, r, a, f and t?
24. A gym coach must select 11 seniors to play on a football team. If he can his selection in 12,376 ways, how many seniors are eligible to play? List all permutations for the letters a,c,t.
25. Evaluate each of the following:  
a.  $P(7,2)$       b.  $P(8,4)$       c.  $P(10,7)$       d.  $P(12,3)$
26. Determine the coefficient of: a.  $xyz^2$  in  $(x+y+z)^4$       b.  $xyz^2$  in  $(2x-y-z)^4$
27. Prove by mathematical induction  $1^2+2^2+3^2+4^2+\dots+n^2 = n(n+1)(2n+1)/6$ . (DEC-2016)
28. State the pigeonhole principle. If 5 colors are used to paint 26 doors, show that at least six doors will have the same color. (DEC-2016)
29. Prove that every positive integer  $n \geq 24$  can be written as a sum of 5's and/or 7's. (DEC-2016)
30. Find the coefficient of i)  $x^9y^3$  in the expansion of  $(2x-3y)^{12}$  ii)  $a^2b^3c^2d^5$  in the expansion of  $(a+2b-3c+2d+5)^{16}$ . (DEC-2016)
31. A certain question papers contains three parts A, B, C with four questions in part A, five questions in part B and six questions in part C. It is required to answer seven questions selecting atleast two questions in each part. In how many ways can a student select his seven questions for answering? (Dec-2017)
32. Prove by Mathematical Induction that, every positive integer n, 5 divides  $n^5-n$ . (Dec-2017)
33. Find the coefficient of i)  $x^9y^3$  in the expansion of  $(2x-3y)^{12}$  ii)  $x^{12}$  in the expansion of  $x^3(1-2x)^{10}$ . (Dec-2017)

### MODULE-3

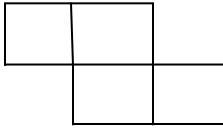
1. Define Cartesian product For  $D = \{1, 2, 3, 4, 5, 6, 7\}$ ,  $A = \{1, 2, 3, 4\}$ ,  $B = \{2, 5\}$ ,  $C = \{3, 4, 7\}$ . Find - i)  $A \times B$  ii)  $B^2$       iii)  $(A \times C) \cup (B \times C)$       iv)  $A \cup (B \times C)$ .
2. Let A and B be finite sets with  $|A|=m$ , and  $|B|=n$ . Find how many functions are possible from A to B. If  $|B|=3$  and 2187 functions from A to B then  $|A|=?$
3. Prove that a function  $f:A \rightarrow B$  is invertible iff it is one-to-one and onto.
4. Define function. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  is function defined by  $f(x) = 3x-5$  for  $x > 0$  &  $f(x) = -3x+1$  for  $x \leq 0$ . Determine  $f(0)$ ,  $f(-1)$ ,  $f(5/3)$ ,  $f^{-1}(-1)$ ,  $f^{-1}([-6, 5])$ ,  $f^{-1}([5, 5])$ .
5. Let  $A=B=C=\mathbb{R}$  and  $f: A \rightarrow B$  and  $g: B \rightarrow C$  be defined by  $f(a) = 2a+1$ ,  $g(b) = b/3$ , for all a and b belongs A and B. Compute  $g \circ f$  and show that is invertible. What is  $(g \circ f)^{-1}$ ?
6. Let  $A = \{1, 2, 3, 4, 5, 6, 7\}$ ,  $B = \{w, x, y, z\}$ . Find the numbers onto functions from A to B.
7. What is a 'relation'? What are its properties?
8. Define a matrix and digraph of a relation with an example.
9. Show that congruence module m is an equivalence relation.
10. Let  $R = \{(1,1), (1,2), (2,3), (3,3), (3,4)\}$  be a relation on  $A = \{1, 2, 3, 4\}$ ,  
i) Draw the graph of R.  
ii) Obtain  $R^2$  and draw graph of  $R^2$ .
11. What do you mean by 'equivalence relation' and 'equivalence classes'? Give an example for each.
12. Let  $A = \{1, 2, 3, 4, 6\}$  and 'R' be a relation on 'A' denoted by  $aRb$  iff 'a is multiple of b' Write down its relation matrix  $M(R)$  and draw its digraph. Is it connected?
13. Define the following terms with example Reflexive, Irreflexive, Anti symmetric, Transitive and Symmetry
14. Let  $A = \{1, 2, 3, 4\}$ . Let R by  $xRy$  iff  $x|y$ , and  $y=2x$ , write down:  
i) R is a relation of se of order pairs.  
ii) Draw digraph of R.  
iii) Determine in degrees and out degrees of a digraph.
15. Draw the hasse diagram represented by the positive divisor of 36.
16. In the following problem, Consider the partial order of divisibility on set A. Draw the hasse diagram of the poset and determine whether the poset is linearly ordered or not.  
i)  $A = \{1, 2, 3, 5, 6, 10, 15, 30\}$  ii)  $A = \{2, 4, 8, 16, 32\}$
17. Define relation and binary relation.
18. Let  $A = \{1, 2, 3, 4, 5, 6\}$  & R be a relation on A defined by  $aRb$  iff a is multiple of b i) write down R as set of ordered pairs. ii) Represent R as Matrix iii) Draw the digraph of R
19. If  $R = \{(x,y) | x \geq y\}$  is a relation on the set  $A = \{1, 2, 3, 4\}$  write down Matrix & digraph of R
20. Let  $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ . On this set define the relation R by (x, y) belongs to R iff (x-y) is a multiple of 5. Verify that R is an equivalence relation.
21. Let (A, R1) and (B, R2) be points. On  $A \times B$ , define the relation R by (a, b)R(x, y) if  $aR1x$  and  $bR2y$ . Prove that R is a partial order.



22. On the set  $A = \{1, 2, 3, 4, 5, 6\}$  the relation defined as follows.  $R = \{(1,2), (1,6), (2,3), (3,3), (3,4), (4,1), (4,3), (4,5), (6,4)\}$  list the paths of length of 3, list all cycles of length 4 and Find the length of the path from 6 to 2.
23. If  $A = \{1, 2, 3, 4\}$  &  $R, S$  are Relation on  $A$  defined by  $R = \{(1,2), (1,3), (2,4), (4,2)\}$   
 $S = \{(1,1), (1,2), (1,3), (1,4), (2,3), (2,4)\}$  find  $R \circ S, S \circ R, R^2, S^2$  and write down their matrix
24. On the set  $Z^+$  relation  $R$  is defined by  $aRb$  iff  $a$  divides  $b$  prove that  $R$  is Reflexive, asymmetric, Transitive but not Symmetric.
25. Define equivalence relation. Let  $A = \{1, 2, 3, 4, 5, 6, 7\}$  &  $R$  be equivalence relation on  $A$  that induces partition  $A = \{1, 2\} \cup \{3\} \cup \{4, 5, 7\} \cup \{6\}$  find  $R$ .
26. Define Poset. Draw the Hasse diagram representing the +ve divisor of 72.
27. If  $X \subseteq Y$ , show that this relation is a partial order on  $A$ . Draw its Hasse diagram.
28. Define the following: (i) Partial order (ii) Total order (iii) Poset (iv) Lattice.
29. Show that a total order is a Lattice. Is the converse true? Give reason.
30. For a given set  $A = \{1, 2, 3, 4\}$   $B = \{w, x, y, z\}$   $C = \{5, 6, 7\}$   $R_1 = \{(1,x), (2,x), (3,y), (3,z)\}$   $R_2 = \{(w,5), (x,6)\}$ . Compute  $M(R_1), M(R_2)$  and hence find  $M(R_1.R_2)$
31. Let  $A = \{1, 2, 3, 6, 9, 12, 18\}$  and define a relation  $R$  on  $A$  such that  $xRy$  iff  $x|y$ . Draw hasse diagram of Poset( $A$ )
32. Let  $A = \{1, 2, 3, 4\}$ ,  $B = \{w, x, y, z\}$  and  $C = \{5, 6, 7\}$ . Also, let  $R_1$  be a relation from  $A$  to  $B$ , defined by  $R_1 = \{(1, x), (2, x), (3, y), (3, z)\}$  and  $R_2$  and  $R_3$  be relations from  $B$  to  $C$ , defined by  $R_2 = \{(w, 5), (x, 6)\}$ ,  $R_3 = \{(w, 5), (w, 6)\}$ . Find  $R_1 \circ R_3$ .
33. Find the number of equivalence relations that can be defined on a finite set  $A$  with  $|A| = 6$ .
34.  $ABC$  is equilateral triangle whose sides are of length 1cm each. If we select 5 points inside the triangle, prove that at least two of these points are such that the distance between them is less than  $\frac{1}{2}$  cm. (DEC-2016)
35. Let  $A = \{1, 2, 3\}$  and  $B = \{2, 4, 5\}$ . Determine the
  - a. Number of binary relations on  $A$ .
  - b. Number of relations from  $A$  to  $B$  that contain  $(1,2)$  and  $(1,5)$ .
  - c. Number of relations from  $A, B$  that contain exactly five ordered pairs.
  - d. Number of binary relations on  $A$  that contains at least seven ordered pairs. (DEC-2016)
36. Define a relation  $R$  on  $A \times A$  by  $(x_1, y_1) R (x_2, y_2)$  iff  $x_1 + y_1 = x_2 + y_2$ , where  $A = \{1, 2, 3, 4, 5\}$ .
  - a. Verify that  $R$  is an equivalence relation on  $A \times A$ .
  - b. Determine the equivalence classes  $[(1,3)]$  and  $[(2,4)]$ . (DEC-2016)
37. Let a function  $f: R \rightarrow R$  be defined by  $f(x) = x_2 + 1$ . Find the images of  $A_1 = \{2, 3\}$ ,  $A_2 = \{-2, 0, 3\}$ ,  $A_3 = (0, 1)$  and  $A_4 = [6, -3]$ . (DEC-2016)
38. Let  $A = \{1, 2, 3, 4, 6, 12\}$ . On  $A$  define the relation  $R$  by  $aRb$  iff 'a divides b'
  - i) prove that  $R$  is a partial order on  $A$ .
  - ii) draw the Hasse diagram
  - iii) write down the matrix of relation. (Dec-2017)
39. Prove that if  $f: A \rightarrow B$  &  $g: B \rightarrow C$  are invertible functions then  $g \circ f: A \rightarrow C$  is invertible function &  $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$ . (Dec-2017)

#### MODULE-4

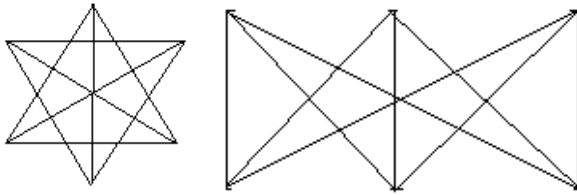
1. Establish the Principle of Inclusion and Exclusion by applying the principle of Mathematical Induction to the number  $t$  of conditions.
2. Determine the number of positive integers  $n$  where  $n \leq 100$  and  $n$  is not divisible by 2, 3 or 5.
  - i. Condition  $c_1$  if  $n$  is divisible by 2.
  - ii. Condition  $c_2$  if  $n$  is divisible by 3.
  - iii. Condition  $c_3$  if  $n$  is divisible by 5.
3. Determine the number of nonnegative integer solutions to the equation  $x_1 + x_2 + x_3 + x_4 = 18$  and  $x_i \leq 7$  for all  $i$ .
4. For finite sets  $A, B$ , where  $|A| = m \geq n = |B|$ , and function  $f: A \rightarrow B$ , determine the number of onto functions  $f$ .
5. In how many ways can the integers 1, 2, 3, ..., 10 be arranged in a line so that no even integer is in its natural position?
6. How many derangements are there for 1, 2, 3, 4, 5?
7. Construct or describe a smallest (least number of squares) chessboard for which  $r_{10} \neq 0$
8. Find the rook polynomials for the shaded chessboards in below figures:



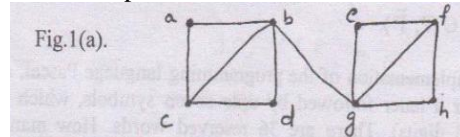
9. Find a recurrence relation with initial condition, that uniquely determines each of the following:
  - a. 2,10,50,250,..
  - b. 6, -18, 54, -162,..
  - c. 7, 14/5, 28/25, 56/125,..
10. Solve the recurrence relation  $a_k = 3a_{k-1}$  for  $k=1,2,3,\dots$  and initial condition  $a_0 = 2$ .
11. Find the generating functions for  $(1+x)^{-n}$  and  $(1-x)^{-n}$  where  $n \in \mathbf{Z}^+$
12. The number of bacteria in a culture is 1000 and this number increases 250% every two hours. Use a recurrence relation to determine the number of bacteria present after one day.
13. Solve:  $a_n = 5a_{n-1} + 6a_{n-2}$ ,  $n \geq 2$ ,  $a_0 = 1, a_1 = 3$ .
14. Determine the number of positive integers  $n$  such that  $1 \leq n \leq 100$  and  $n$  is not divisible by 2, 3, or 5. **(DEC-2016)**
15. The number of affected files in a system 1000 (to start with) and this increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day. **(DEC-2016)**
16. In how many ways can one arrange the letters in the word CORRESPONDENTS so that
  - a. There is no pair of consecutive identical letters.
  - b. There are exactly two pairs of consecutive identical letters. **(DEC-2016)**
17. Solve the recurrence relation  $a_n = 3a_{n-1} - 2a_{n-2}$  for  $n \geq 2$  given that  $a_1 = 5$  and  $a_2 = 3$ . **(DEC-2016)**
18. Find the number of permutations of English letters which contain exactly two of the pattern car, dog, pun, byte. **(Dec-2017)**
19. Solve recurrence relation  $a_n - 6a_{n-1} + 9a_{n-2} = 0$  from  $n \geq 2$ . **(Dec-2017)**
20. Five teachers  $T_1, T_2, T_3, T_4, T_5$  are to be made class teachers for five classes  $C_1, C_2, C_3, C_4, C_5$ , one teacher for each class.  $T_1$  or  $T_2$  do not wish to become class teacher of  $T_1$  or  $T_2, T_3$  and  $T_4$  for  $C_4$  or  $C_5$  and  $T_5$  for  $C_3$  or  $C_4$  or  $C_5$ . In how many ways can the teachers be assigned work without displeasing each teacher? **(Dec-2017)**

## MODULE-5

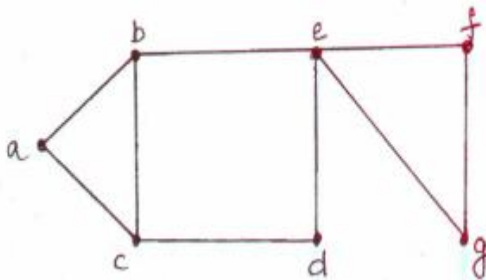
1. Define connected graph. Prove that a connected graph with a  $n$  vertex has at least  $(n-1)$  edges.
2. Let  $G$  be a simple graph of order  $n$ . If the size of  $G$  is 56 and size of  $G$  complement is 80, what is  $n$ ?
3. Define complement of a graph. Find an example of a self-complementary graph on four vertices and one on five vertices.
4. Define connected graph. Give an example of a connected graph  $G$  where removing any edge of  $G$  results in disconnected graph.
5. Define the complete bipartite graph. How many vertices and how many edges are there in  $K_{4,7}$  and  $K_{7,11}$ ?
6. Define following terms with an example i) Directed graph, ii) degree of a graph, iii) simple graph, iv) multi graph v) general graph.
7. Define and give an example for each 1) connected graph, 2) spanning sub-graph 3) complement of a graph.
8. Find all non-isomorphic undirected graphs with four vertices. How many of these graphs are connected?
9. In every graph  $G$ , the sum of out degree of all vertices is equal to the sum of in degree of all vertices, each sum being equal to the number of edges in  $G$ .
10. Define terms complete graph, bipartite graph regular graph. Give examples for each.
11. What is Handshaking property, explain.
12. Prove that the sum of degrees of all vertices in a graph is an even number, and this number is equal to twice the number of edges in the graph.
13. How many vertices the following graph will have, i) 16 edges and all vertices with degree 4? ii) 21 edges, 3 vertices of degree 3 and other vertices of degree 3?
14. Determine  $|V|$  for the following i)  $G$  is regular graph with 15 edges ii)  $G$  has 10 edges with 2 vertices of degree 10 and all other of degree 3.
15. Define Isomorphic of two graphs. Determine whether the two graphs are isomorphic
16. What are isomorphic graphs? Show that following graph are isomorphic. **(Dec-2017)**



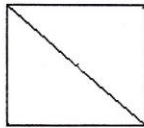
17. Show that the following graphs are isomorphic with each other.  
18. Find the number of paths from V1 to V8. How many length of path have length 5.



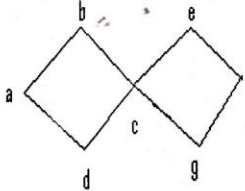
19. Define terms with an example i) sub graph, ii) spanning sub graph iii) induced sub graph iv) complement of a sub graph.  
20. Let  $G$  be a simple graph of order  $n$ . If the size of  $G$  is 56 and the size of  $G$  complement is 80.  
21. Define following terms with an example i) Walk ii) Trail iii) Circuit iv) Path v) Cycle.  
22. Prove the following i) A path  $n$  vertices is of length  $n-1$  ii) If a cycle has  $n$  vertices, it has  $n$  edges iii) The degree of every vertex in a cycle is two.  
23. A simple graph with  $n$  vertices and  $k$  components can have at most  $(n-k)(n-k+1)/2$  edges  
24. Show that the following graph contains an Euler trail.  
25. Define the complete graph. In the complete graph with  $n$  vertices, where  $n$  is an odd number  $\geq 3$ , there are  $(n-1)/2$  edge-disjoint Hamiltonian cycles.  
26. For the following graph determine  
a. A walk from  $b$  to  $d$  that is not trail  
b. A  $b$ - $d$  trail that is not a path  
c. A path from  $b$ - $d$   
d. A closed walk from  $b$ - $b$  that is not a circuit  
e. A circuit from  $b$ - $b$  that is not a cycle  
f. A cycle from  $b$ - $b$



27. Define Subgraph, Spanning subgraph, Induced subgraph and complete graph with examples  
28. Prove that the undirected graph  $G=(V,E)$  has an Euler circuit if and only if  $G$  is connected and every vertex in  $G$  has even degree.  
29. Define tree. Prove that a tree with  $n$  vertices has  $n-1$  edges. (Dec-2017)  
30. Prove that in every tree  $T=(V,E)$   $|V|=|E|+1$   
31. Prove that tree with two or more vertices contains at least two pendant vertices.  
32. In a tree with 14 pendent vertices, the degree of every non-pendent vertex is either 4 or 5. Find the number of vertices with degree 4 and 5.  
33. Define the following terms with an example rooted tree, binary tree, full binary tree and complete binary.  
34. For every tree  $T=(V,E)$ , if  $|V|\geq 2$ , show that tree has at least 2 pendant vertices.  
35. What is spanning tree. Find all possible spanning trees of the following graph.



36. Find i) DFS and ii) BFS spanning trees for the graph shown below.



37. Construct an optimal prefix code for the symbols a, b, c, d, e, f, g, h, i, j that occur with respective frequencies 78, 16, 30, 35, 125, 31, 20, 50, 80, 3.
38. Construct an optimal prefix code for the symbols a, o, q, u, y, z, j that occur with respective frequencies 20, 28, 4, 17, 12, 7
39. If  $T_1=(V_1,E_1)$  and  $T_2=(V_2,E_2)$  be two trees where  $|E_1|=17$  and  $|V_2|=2|V_1|$ , then find  $|V_1|$ ,  $|V_2|$  and  $|E_2|$
40. Let  $F_2=(V_2,E_2)$  is a forest with  $|V_2|=62$  and  $|E_2|=51$ , how many trees determine  $F_2$
41. Let  $F_1=(V_1,E_1)$  be a forest of 7 trees where  $|E_1|=40$ . What is  $|V_1|$ .
42. Obtain an optimal prefix code for the message ROAD IS GOOD. Indicate the code. **(DEC-2016)**
43. Discuss the solution of Konigsberg bridge problem. **(DEC-2016, Dec-2017)**
44. Define optimal tree and construct an optimal tree for a given set of weights {4, 15, 25, 5, 8, 16}. Hence find the weight of the optimal tree. **(DEC-2016)**
45. Prove that in a graph
  - a. The sum of the degrees of all the vertices is an even number and is equal to twice the number of edges in the graph.
  - b. The number of vertices of odd degrees is even. **(DEC-2016)**
46. Obtain an optimal prefix code for the message LETTER RECEIVED. Indicate the code & weight. **(DEC-2017)**
47. Merge Sort the list -1, 7, 4, 11, 5, -8, 15, -3, -2, 6, 10, 3. **(Dec-2017)**

**16.0 University Result**

| Examination | S+ | S  | A  | B  | C  | D  | E  | % Passing |
|-------------|----|----|----|----|----|----|----|-----------|
| JAN-2018    | 00 | 02 | 01 | 04 | 22 | 12 | 04 | 86.53     |
| JAN-2017    | 00 | 00 | 00 | 06 | 20 | 07 | 16 | 96.07     |

| Prepared by             | Checked by          |     |           |
|-------------------------|---------------------|-----|-----------|
|                         |                     |     |           |
| Prof. Aruna A Daptardar | Prof. S. G. Gollagi | HOD | Principal |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                           |   |                   |    |
|---------------------------|---|-------------------|----|
| <b>Subject Title</b>      | <b>ANALOG AND DIGITAL ELECTRONICS LAB</b> |                   |    |
| <b>Subject Code</b>       | 17CSL37                                   | <b>IA Marks</b>   | 40 |
| No. of Lecture hrs./Week: | 01I+02P                                   | <b>Exam Hours</b> | 03 |
| Total No. of Lecture Hrs: | 40  | <b>Exam Marks</b> | 60 |
| <b>CREDITS - 02</b>       |   |                   |    |

### FACULTY DETAILS:

|                                       |                                     |  |
|---------------------------------------|-------------------------------------|--|
| <b>Name:</b> Mr. Y. M. Naik           | <b>Designation:</b> Asst. Professor | <b>Experience:</b> 15 Years                  |
| <b>No. of times course taught:</b> 06 |                                     | <b>Specialization:</b> Digital Communication |

### 1.0 Prerequisite Subjects:

| Sl. No. | Branch                         | Semester | Subject                            |
|---------|--------------------------------|----------|------------------------------------|
| 01      | Computer Science & Engineering | I/II     | Fundamentals of Basic Electronics. |

### 2.0 Course Objectives

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

1. Analog component and circuits including operational Amplifier, timer, etc
2. combination logic circuits
3. Flip Flop and their operation
4. Counters and Registers using Flip Flop
5. Synchronous and Asynchronous Sequential circuits
6. A/D and D/A converters.

### 3.0 Course Outcomes

The student, after successful completion of the course, will be able to

| CO                                | Course Outcome  | Cognitive Level | POs       |
|-----------------------------------|---|-----------------|-----------|
| <b>C207.1</b>                     | Make Use of various Electronic devices like cathode ray oscilloscope, signal generators, digital trainer kit, millimeter and components like resistor, capacitor, opamp and integrated circuit. | <b>U</b>        | 1,2,3,4,7 |
| <b>C207.2</b>                     | Design and demonstrate various combinational logic circuits   | <b>U</b>        | 1,2,3,4,7 |
| <b>C207.3</b>                     | Design and demonstrate various types of counters and Registers using Flip-flops   | <b>U</b>        | 1,2,3,4,7 |
| <b>C207.4</b>                     | Make Use of simulation package to design circuits.  | <b>U</b>        | 1,2,3,4,7 |
| <b>Total Hours of instruction</b> |   | <b>40</b>       |           |



## **4.0 Course Content**

### **Laboratory Experiments**

1. a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.  
b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.
2. a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.  
b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled.
3. Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.
4. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
5. a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.  
b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working
6. Design and implement code converter I) Binary to Gray II) Gray to Binary Code using basic gates.
7. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.
8. a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.  
b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
9. a) Design and implement a mod-n ( $n < 8$ ) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.  
b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.
10. Design and implement an asynchronous counter using decade counter IC to count up from 0 to  $n (n \leq 9)$  and demonstrate on 7-segment display (using IC-7447).
11. Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).

### **Study experiment**

12. To study 4-bit ALU using IC-74181.

## **5.0 Relevance to future subjects**

| Sl. No | Semester | Subject                   | Topics / Relevance         |
|--------|----------|---------------------------|----------------------------|
| 01     | VII      | Embedded Computing system | Memory Optimization        |
| 02     | VIII     | Project                   | IOT any Embedded Projects. |

## **6.0 Relevance to Real World**

| Sl. No | Real World Mapping   |
|--------|--|
| 01     | Apply the knowledge to design and develop the software and hardware applications |

## **7.0 Books Used and Recommended to Students**

| <b>Text Books</b>  |
|--|
| 1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.   |
| 2. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8 <sup>th</sup> Edition, Tata McGraw Hill, 2015 |
| <b>Reference Books</b>   |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

1. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008.

### Additional Study material & e-Books

1. CSE Department ADE lab manual.

## 8.0

### Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

#### Website and Internet Contents References

1. [www.iitg.ac.in/apvajpeyi/ph218/PH-218%20-%20Introduction.pdf](http://www.iitg.ac.in/apvajpeyi/ph218/PH-218%20-%20Introduction.pdf)
2. [electronics-course.com/](http://electronics-course.com/)

## 9.0

### Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals                             | Website   |
|--------|--|---|
| 1      | ACM journals                                   | <a href="http://www.dl.acm.org/pubs.cfm">www.dl.acm.org/pubs.cfm</a>  |
| 2      | IBM journal of Research and Development        | <a href="https://link.springer.com/journal/453">https://link.springer.com/journal/453</a>   |
| 3      | Research papers/Analog and Digital electronics | <a href="https://wiki.haskell.org/Research_papers/Analog_and_Digital_electronics">https://wiki.haskell.org/Research_papers/Analog_and_Digital_electronics</a> |

## 10.0

### Examination Note

#### Internal Assessment: 40 Marks

- Continuous evaluation of each lab experiment will be done for 30 marks and its average marks will be considered.

#### Lab experiment conduction procedure

- A student has to perform one experiment every week.

#### Scheme of Evaluation for Continuous Assessment (30 Marks)

| Description          | Max. marks |
|----------------------|------------|
| Write-up             | 10         |
| Conduction & Outcome | 15         |
| Viva-Voce            | 05         |
| Total                | 30         |

#### Scheme of Evaluation for Internal Assessment (10 Marks)

- Lab IA will be conducted for 10 marks.

| Description           | Max. marks |
|-----------------------|------------|
| Write-up & Conduction | 05         |
| Outcome & Conclusion  | 03         |
| Viva-Voce             | 02         |
| Total                 | 10         |



**Conduction of Practical Examination for Network Lab:**

1. All laboratory experiments (TWELVE nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva:15 + 70 +15 (100).
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

**11.0 Course Delivery Plan**

| Expt. No. | Lab No. | Content of Experiment  | % of Portion |
|-----------|---------|--|--------------|
| 1         | 1       | a) Design and construct a Schmitt trigger using Op-Amp for given UTP and LTP values and demonstrate its working.<br>b) Design and implement a Schmitt trigger using Op-Amp using a simulation package for two sets of UTP and LTP values and demonstrate its working.  | 83.33        |
| 2         | 2       | a) Design and construct a rectangular waveform generator (Op-Amp relaxation oscillator) for given frequency and demonstrate its working.<br>b) Design and implement a rectangular waveform generator (Op-Amp relaxation oscillator) using a simulation package and demonstrate the change in frequency when all resistor values are doubled. | 83.33        |
| 3         | 3       | Design and implement an Astable multivibrator circuit using 555 timer for a given frequency and duty cycle.  | 83.33        |
| 4         | 4       | Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.   | 83.33        |
| 5         | 5       | a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.<br>b) Design and develop the Verilog /VHDL code for an 8:1 multiplexer. Simulate and verify its working.  | 83.33        |
| 6         | 6       | Design and implement code converter I) Binary to Gray II) Gray to Binary Code using basic gates.   | 83.33        |
| 7         | 7       | Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic Logic Gates with an even parity bit.  | 83.33        |
| 8         | 8       | a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.<br>b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.  | 83.33        |
| 9         | 9       | a) Design and implement a mod-n ( $n < 8$ ) synchronous up counter using J- K Flip-Flop ICs and demonstrate its working.<br>b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify its working.   | 83.33        |
| 10        | 10      | Design and implement an asynchronous counter using decade counter IC to count up from 0 to $n (n \leq 9)$ and demonstrate on 7-segment display (using IC-7447).  | 83.33        |
| 11        | 11      | Generate a Ramp output waveform using DAC0800 (Inputs are given to DAC through IC74393 dual 4-bit binary counter).   | 83.33        |
| 12        | 12      | To study 4-bit ALU using IC-74181  | 83.33        |

**12.0 QUESTION BANK**

1. Give the expression of contact difference of potential?
2. What is the static resistance of a diode?
3. Define dynamic resistance.
4. What is an amplifier?



5. Why do we choose q point at the center of the load line?
6. When does a transistor act as a switch?
7. What is biasing?
8. What is operating point?
9. What is dc load line?
10. What is the necessary of the coupling capacitor?
11. Why is the operating point selected at the Centre of the active region?
12. Define an operational amplifier.
13. Mention the characteristics of an ideal op-amp.
14. What happens when the common terminal of V+ and V- sources is not grounded?
15. Define input offset voltage.
16. What is Logic Gate? Explain truth table
17. Define MUX and explain its applications
18. Differentiate between Odd and Even parity
19. Define flip flop and explain the excitation table of flip flop
20. Differentiate between Synchronous and Asynchronous counter
21. How we can convert a Digital signal into analog
22. Define accuracy, resolution with respect to D/A conversion techniques
23. Define accuracy, resolution with respect to A/D Techniques
24. Define ALU and explain the working of 74181 IC
25. What is Ramp output and explain it.

### 13.0 University Result

| Examination | S+ | S  | A  | B  | C  | D  | E  | % Passing |
|-------------|----|----|----|----|----|----|----|-----------|
| JAN 2017    | 05 | 31 | 11 | 04 | 00 | 00 | 00 | 100       |
| JAN 2018    | 30 | 17 | 02 | 02 | 01 | 00 | 00 | 100       |

| Prepared by    | Checked by     |     |           |
|----------------|----------------|-----|-----------|
|                |                |     |           |
| Prof. Y M Naik | Prof. Y M Naik | HOD | Principal |



## Course Plan 2018-19 ODD – Semester - III Computer Science and Engineering

|                           |                                   |            |    |
|---------------------------|-----------------------------------|------------|----|
| Subject Title             | <b>DATA STRUCTURES LABORATORY</b> |            |    |
| Subject Code              | 17CSL38                           | IA Marks   | 20 |
| No. of Lecture hrs./Week: | 01I+02P                           | Exam Marks | 80 |
| Total No. of Lecture Hrs: | 40                                | Exam Hours | 03 |
| <b>CREDITS - 02</b>       |                                   |            |    |

### FACULTY DETAILS:

|                                |  |                        |
|--------------------------------|--|------------------------|
| Name: Prof. A. A. Daptardar    | Designation: Asst. Professor                     | Experience: 12.5 Years |
| No. of times course taught: 01 | Specialization: Computer Science and Engineering |                        |

### 1.0 Prerequisite Subjects:

| Sl. No | Branch                         | Semester | Subject                             |
|--------|--------------------------------|----------|-------------------------------------|
| 01     | Computer Science & Engineering | I/II     | Fundamentals C Programming Language |

### 2.0 Course Objectives

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

1. Asymptotic performance of algorithms.
2. Linear data structures and their applications such as Stacks, Queues and Lists.
3. Non-Linear Data Structures and their Applications such as Trees and Graphs
4. Sorting and Searching Algorithms

### 3.0 Course Outcomes

The student, after successful completion of the course, will be able to

| CO                                | Course Outcome   | Cognitive Level | POs            |
|-----------------------------------|--|-----------------|----------------|
| C208.1                            | Implement various linear and non-linear data structures.                                     | U               | 1,3,4,5,7,9,11 |
| C208.2                            | Demonstrate the working nature of different types of data structures and their applications. | U               | 1,3,4,5,7,9,11 |
| C208.3                            | Implement the searching and sorting algorithms.  | U               | 1,3,4,5,7,9,11 |
| C208.4                            | Select the appropriate data structures for solving computing problems.                       | U               | 1,3,4,5,7,9,11 |
| <b>Total Hours of instruction</b> |  |                 | <b>40</b>      |

### 4.0 Course Content

#### Laboratory Experiments:

1. Design, Develop and Implement a menu driven Program in C for the following Array operations
  - a. Creating an Array of N Integer Elements
  - b. Display of Array Elements with Suitable Headings
  - c. Inserting an Element (**ELEM**) at a given valid Position (**POS**)
  - d. Deleting an Element at a given valid Position(**POS**)
  - e. Exit.
 Support the program with functions for each of the above operations.
2. Design, Develop and Implement a Program in C for the following operations on **Strings**



- a. Read a main String (**STR**), a Pattern String (**PAT**) and a Replace String (**REP**)
- b. Perform Pattern Matching Operation: Find and Replace all occurrences of **PAT** in **STR** with **REP** if **PAT** exists in **STR**. Report suitable messages in case **PAT** does not exist in **STR**  
Support the program with functions for each of the above operations. Don't use Built-in functions
3. Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**)
  - a. **Push** an Element on to Stack
  - b. **Pop** an Element from Stack
  - c. Demonstrate how Stack can be used to check **Palindrome**
  - d. Demonstrate **Overflow** and **Underflow** situations on Stack
  - e. Display the status of Stack
  - f. ExitSupport the program with appropriate functions for each of the above operations.
4. Design, develop and implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, \*, /, %(**Remainder**), ^(Power) and alphanumeric operands.
5. Design, Develop and Implement a Program in C for the following Stack Applications
  - a. Evaluation of **Suffix expression** with single digit operands and operators: +, -, \*, /, %, ^
  - b. Solving **Tower of Hanoi** problem with **n** disks
6. Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters (Array Implementation of Queue with maximum size **MAX**)
  - a. Insert an Element on to Circular QUEUE
  - b. Delete an Element from Circular QUEUE
  - c. Demonstrate **Overflow** and **Underflow** situations on Circular QUEUE
  - d. Display the status of Circular QUEUE
  - e. ExitSupport the program with appropriate functions for each of the above operations.
7. Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** of Student Data with the fields: USN, Name, Branch, Sem, PhNo.
  - a. Create a **SLL** of **N** Students Data by using **front insertion**
  - b. Display the status of **SLL** and count the number of nodes in it
  - c. Perform Insertion and Deletion at End of **SLL**
  - d. Perform Insertion and Deletion at Front of **SLL**
  - e. Demonstrate how this **SLL** can be used as **STACK** and **QUEUE**
  - f. Exit
8. Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo
  - a. Create a **DLL** of **N** Employees Data by using **end insertion**.
  - b. Display the status of **DLL** and count the number of nodes in it
  - c. Perform Insertion and Deletion at End of **DLL**
  - d. Perform Insertion and Deletion at Front of **DLL**
  - e. Demonstrate how this **DLL** can be used as **Double Ended Queue**
  - f. Exit
9. Design, Develop and Implement a Program in C for the following operations on **Singly Circular Linked List (SCLL)** with header nodes
  - a. Represent and Evaluate a Polynomial  $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$
  - b. Find the sum of two polynomials **POLY1(x,y,z)** and **POLY2(x,y,z)** and store the result in **POLYSUM(x,y,z)**Support the program with appropriate functions for each of the above operations



10. Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers
  - a. Create a BST of **N** Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
  - b. Traverse the BST in Inorder, Preorder and Post Order
  - c. Search the BST for a given element (**KEY**) and report the appropriate message
  - d. Delete an element(**ELEM**) from BST
  - e. Exit
  
11. Design, Develop and Implement a Program in C for the following operations on **Graph(G)** of Cities
  - a. Create a Graph of **N** cities using Adjacency Matrix
  - b. Print all the nodes **reachable** from a given starting node in a digraph using **DFS/BFS** method
  
12. Given a File of **N** employee records with a set **K** of Keys(4-digit) which uniquely determine the records in file **F**. Assume that file **F** is maintained in memory by a Hash Table(HT) of **m** memory locations with **L** as the set of memory addresses (2-digit) of locations in HT. Let the keys in **K** and addresses in **L** are Integers. Design and develop a Program in C that uses Hash function **H: K->L** as  $H(K)=K \bmod m$  (**remainder** method), and implement hashing technique to map a given key **K** to the address space **L**. Resolve the collision (if any) using **linear probing**.

### 5.0 Relevance to future subjects

| Sl. No. | Semester | Subject                           | Topics / Relevance              |
|---------|----------|-----------------------------------|---------------------------------|
| 01      | IV       | Design and Analysis of Algorithms | Design and develop the programs |

### 6.0 Relevance to Real World

| Sl. No. | Real World Mapping  |
|---------|---|
| 01      | Apply the knowledge to design and develop the software applications |

### 7.0 Books Used and Recommended to Students

| Text Books   |
|--|
| 1. Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities Press, 2014                   |
| 2. Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition, McGraw Hill, 2014                                  |
| Reference Books  |
| 1. Data Structures using C, , Reema Thareja, 3rd edition Oxford press, 2012  |
| 2. An Introduction to Data Structures with Applications- Jean-Paul Tremblay & Paul G. Sorenson, 2ndEdition, McGraw Hill, 2013.     |
| 3. Data Structures using C - A M Tenenbaum, PHI, 1989.   |
| Additional Study material & e-Books  |
| 1. <a href="https://wiki.haskell.org/Research_papers/Data_structures">https://wiki.haskell.org/Research_papers/Data_structures</a> |

### 8.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

| Website and Internet Contents References                               |
|--|
| 1. <a href="http://apps.topcoder.com/">http://apps.topcoder.com/</a>   |
| 2. <a href="http://www.ideserve.co.in/">http://www.ideserve.co.in/</a> |



## 9.0 Magazines/Journals Used and Recommended to Students

| Sl. No | Magazines/Journals                      | website   |
|--------|---|---|
| 1      | ACM journals                            | <a href="http://www.dl.acm.org/pubs.cfm">www.dl.acm.org/pubs.cfm</a>  |
| 2      | IBM journal of Research and Development | <a href="https://link.springer.com/journal/453">https://link.springer.com/journal/453</a>                                       |
| 3      | Research papers/Data structures         | <a href="https://wiki.haskell.org/Research_papers/Data_structures">https://wiki.haskell.org/Research_papers/Data_structures</a> |

## 10.0 Examination Note

### Internal Assessment: 40 Marks

- Continuous evaluation of each lab experiment will be done for 30 marks and its average marks will be considered.

### Lab experiment conduction procedure

- A student has to perform one experiment every week.

### Scheme of Evaluation for Continuous Assessment (30 Marks)

| Description          | Max. marks |
|----------------------|------------|
| Write-up             | 10         |
| Conduction & Outcome | 15         |
| Viva-Voce            | 05         |
| Total                | 30         |

### Scheme of Evaluation for Internal Assessment (10 Marks)

- Lab IA will be conducted for 10 marks.

| Description           | Max. marks |
|-----------------------|------------|
| Write-up & Conduction | 05         |
| Outcome & Conclusion  | 03         |
| Viva-Voce             | 02         |
| Total                 | 10         |

### Conduction of Practical Examination for Network Lab:

6. All laboratory experiments (TWELVE nos) are to be included for practical examination.
7. Students are allowed to pick one experiment from the lot.
8. Strictly follow the instructions as printed on the cover page of answer script
9. Marks distribution: Procedure + Conduction + Viva:15 + 70 +15 (100).
10. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

## 11.0 Course Delivery Plan



**Course Plan 2018-19 ODD – Semester - III**  
**Computer Science and Engineering**

| Expt. No. | Lab No. | Content of Experiment   | % of Portion |
|-----------|---------|---|--------------|
| 1         | 1       | <p>Design, Develop and Implement a menu driven Program in C for the following Array operations</p> <ol style="list-style-type: none"> <li>a. Creating an Array of <b>N</b> Integer Elements</li> <li>b. Display of Array Elements with Suitable Headings</li> <li>c. Inserting an Element (<b>ELEM</b>) at a given valid Position (<b>POS</b>)</li> <li>d. Deleting an Element at a given valid Position(<b>POS</b>)</li> <li>e. Exit.</li> </ol> <p>Support the program with functions for each of the above operations.</p>   | 3.33         |
| 2         | 2       | <p>Design, Develop and Implement a Program in C for the following operations on <b>Strings</b></p> <ol style="list-style-type: none"> <li>a) Read a main String (<b>STR</b>), a Pattern String (<b>PAT</b>) and a Replace String (<b>REP</b>)</li> <li>b) Perform Pattern Matching Operation: Find and Replace all occurrences of <b>PAT</b> in <b>STR</b> with <b>REP</b> if <b>PAT</b> exists in <b>STR</b>. Report suitable messages in case <b>PAT</b> does not exist in <b>STR</b></li> </ol> <p>Support the program with functions for each of the above operations. Don't use Built-in functions</p>   | 3.33         |
| 3         | 3       | <p>Design, Develop and Implement a menu driven Program in C for the following operations on <b>STACK</b> of Integers (Array Implementation of Stack with maximum size <b>MAX</b>)</p> <ol style="list-style-type: none"> <li>a) <b>Push</b> an Element on to Stack</li> <li>b) <b>Pop</b> an Element from Stack</li> <li>c) Demonstrate how Stack can be used to check <b>Palindrome</b></li> <li>d) Demonstrate <b>Overflow</b> and <b>Underflow</b> situations on Stack</li> <li>e) Display the status of Stack</li> <li>f) Exit</li> </ol> <p>Support the program with appropriate functions for each of the above operations.</p>                                 | 3.33         |
| 4         | 4       | <p>Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and <b>alphanumeric</b> operands.</p>   | 3.33         |
| 5         | 5       | <p>Design, Develop and Implement a Program in C for the following Stack Applications</p> <ol style="list-style-type: none"> <li>a) Evaluation of <b>Suffix expression</b> with single digit operands and operators: +, -, *, /, %, ^</li> <li>b) Solving <b>Tower of Hanoi</b> problem with <b>n</b> disks</li> </ol>   | 3.33         |
| 6         | 6       | <p>Design, Develop and Implement a menu driven Program in C for the following operations on <b>Circular QUEUE</b> of Characters (Array Implementation of Queue with maximum size <b>MAX</b>)</p> <ol style="list-style-type: none"> <li>a) Insert an Element on to Circular QUEUE</li> <li>b) Delete an Element from Circular QUEUE</li> <li>c) Demonstrate <b>Overflow</b> and <b>Underflow</b> situations on Circular QUEUE</li> <li>d) Display the status of Circular QUEUE</li> <li>e) Exit</li> </ol> <p>Support the program with appropriate functions for each of the above operations.</p>  | 3.33         |
| 7         | 7       | <p>Design, Develop and Implement a menu driven Program in C for the following operations on <b>Singly Linked List (SLL)</b> of Student Data with the fields: <b>USN, Name, Branch, Sem, PhNo.</b></p> <ol style="list-style-type: none"> <li>a) Create a <b>SLL</b> of <b>N</b> Students Data by using <b>front insertion</b></li> <li>b) Display the status of <b>SLL</b> and count the number of nodes in it</li> <li>c) Perform Insertion and Deletion at End of <b>SLL</b></li> <li>d) Perform Insertion and Deletion at Front of <b>SLL</b></li> <li>e) Demonstrate how this <b>SLL</b> can be used as <b>STACK</b> and <b>QUEUE</b></li> <li>f) Exit</li> </ol> | 3.33         |



|    |    |   |      |
|----|----|---|------|
| 8  | 8  | Design, Develop and Implement a menu driven Program in C for the following operations on <b>Doubly Linked List (DLL)</b> of Employee Data with the fields: <b>SSN, Name, Dept, Designation, Sal, PhNo</b><br>a) Create a <b>DLL</b> of <b>N</b> Employees Data by using <b>end insertion</b> .<br>b) Display the status of <b>DLL</b> and count the number of nodes in it<br>c) Perform Insertion and Deletion at End of <b>DLL</b><br>d) Perform Insertion and Deletion at Front of <b>DLL</b><br>e) Demonstrate how this <b>DLL</b> can be used as <b>Double Ended Queue</b><br>f) Exit   | 3.33 |
| 9  | 9  | Design, Develop and Implement a Program in C for the following operations on <b>Singly Circular Linked List (SCLL)</b> with header nodes<br>a) Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$<br>b) Find the sum of two polynomials <b>POLY1(x,y,z)</b> and <b>POLY2(x,y,z)</b> and store the result in <b>POLYSUM(x,y,z)</b><br>Support the program with appropriate functions for each of the above operations  | 3.33 |
| 10 | 10 | Design, Develop and Implement a menu driven Program in C for the following operations on <b>Binary Search Tree (BST)</b> of Integers<br>a) Create a BST of <b>N</b> Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2<br>b) Traverse the BST in Inorder, Preorder and Post Order<br>c) Search the BST for a given element ( <b>KEY</b> ) and report the appropriate message<br>d) Delete an element( <b>ELEM</b> ) from BST<br>e) Exit  | 3.33 |
| 11 | 11 | Design, Develop and Implement a Program in C for the following operations on <b>Graph(G)</b> of Cities<br>a) Create a Graph of <b>N</b> cities using Adjacency Matrix<br>b) Print all the nodes <b>reachable</b> from a given starting node in a digraph using <b>DFS/BFS</b> method  | 3.33 |
| 12 | 12 | Given a File of <b>N</b> employee records with a set <b>K</b> of Keys(4-digit) which uniquely determine the records in file <b>F</b> . Assume that file <b>F</b> is maintained in memory by a Hash Table(HT) of <b>m</b> memory locations with <b>L</b> as the set of memory addresses (2-digit) of locations in HT. Let the keys in <b>K</b> and addresses in <b>L</b> are Integers. Design and develop a Program in C that uses Hash function <b>H: K-&gt;L</b> as $H(K)=K \text{ mod } m$ ( <b>remainder</b> method), and implement hashing technique to map a given key <b>K</b> to the address space <b>L</b> . Resolve the collision (if any) using <b>linear probing</b> . | 3.33 |

## 12.0 QUESTION BANK

7. What is data structure?
8. What is a sequential file and how to create it?
9. What are the functions used for handling files?
10. What are the string handlings functions?
11. Differentiate structure and union.
12. What is stack and how to implement it?
13. Differentiate infix, postfix and prefix expressions.
14. How to evaluate postfix expression using stack.
15. What is queue and how to implement it?
16. What is circular queue?
17. What are pointer and pointer to pointer?
18. What is dynamic memory allocation?



19. What is singly linked list and how to construct it?
20. What is doubly linked list and how to implement it?
21. What is binary search tree and how to traverse inorder, preorder and postorder?
22. What is recursion?
23. Explain the working of binary search technique.
24. What is tree?
25. What is min heap?
26. Illustrate max heap with an example.
27. What is graph?
28. What is an array?
29. What is priority queue?
30. What is advantage of priority queue over simple queue?
31. What are the applications of stack?
32. What are the applications of queue?
33. What is thread?
34. What is sparse matrix?
35. Explain the advantages and disadvantages of sparse matrix.
36. What is meant by hashing in data structure?

### 13.0 University Result

| Examination | S+ | S  | A  | B  | C  | D  | E  | % Passing |
|-------------|----|----|----|----|----|----|----|-----------|
| JAN-2018    | 13 | 08 | 07 | 07 | 13 | 04 | 00 | 100       |
| JAN-2017    | 10 | 16 | 10 | 06 | 04 | 01 | 00 | 92.15     |

| Prepared by              | Checked by            |     |           |
|--------------------------|-----------------------|-----|-----------|
|                          |                       |     |           |
| Prof. Aruna A. Daptardar | Dr. Parashuram Baraki | HOD | Principal |