

# University of Mumbai



AAMS\_UGS /ICC/2024-25/169

## CIRCULAR:-

**Sub :- B.Voc (Cyber Security and Digital Forensics).**

All the Principals of the Affiliated Colleges, the Heads of the University Departments and Directors of the recognized Institutions in Faculty of **Science & Technology** are hereby informed that the recommendations passed by the Board of Deans at its meeting held on **27<sup>th</sup> October, 2023** vide item No. **6.14 (N)** have been accepted by the Academic Council at its meeting held on **1<sup>st</sup> November, 2023**, vide item No. **6.14 (N)** and subsequently approved by the Management Council at its meeting held on **20<sup>th</sup> November, 2023** vide item No. **7** and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the Ordinance **6884 & 6885** Regulations **9715 & 9716** and the syllabus of **B.Voc (Cyber Security and Digital Forensics) (Sem I to II) (CBCS)** has been introduced and the same have been brought into force with effect from the academic year **2023-24**, accordingly.

(The circular is available on the University's website [www.mu.ac.in](http://www.mu.ac.in)).

MUMBAI – 400 032  
30<sup>th</sup> September, 2024

  
(Dr. Prasad Karande)  
REGISTRAR

A.C/6.14 (N)/1/11/2023.  
M.C/7/20/11/2023.

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Copy forwarded with Compliments for information to:-

- 1) The Chairman, Board of Deans
- 2) The Dean, Faculty of Science & Technology,
- 3) The Chairman, Board of Studies,
- 4) The Director, Board of Examinations and Evaluation,
- 5) The Director, Board of Students Development,
- 6) The Director, Department of Information & Communication Technology,
- 7) The Co-ordinator, MKCL.

| <b>Copy forwarded for information and necessary action :-</b> |                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                             | The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Dept)(AEM),<br><a href="mailto:dr@eligi.mu.ac.in">dr@eligi.mu.ac.in</a>                                                                                                                                    |
| 2                                                             | The Deputy Registrar, Result unit, Vidyanagari<br><a href="mailto:drresults@exam.mu.ac.in">drresults@exam.mu.ac.in</a>                                                                                                                                                             |
| 3                                                             | The Deputy Registrar, Marks and Certificate Unit,. Vidyanagari<br><a href="mailto:dr.verification@mu.ac.in">dr.verification@mu.ac.in</a>                                                                                                                                           |
| 4                                                             | The Deputy Registrar, Appointment Unit, Vidyanagari<br><a href="mailto:dr.appointment@exam.mu.ac.in">dr.appointment@exam.mu.ac.in</a>                                                                                                                                              |
| 5                                                             | The Deputy Registrar, CAP Unit, Vidyanagari<br><a href="mailto:cap.exam@mu.ac.in">cap.exam@mu.ac.in</a>                                                                                                                                                                            |
| 6                                                             | The Deputy Registrar, College Affiliations & Development Department (CAD),<br><a href="mailto:deputyregistrar.uni@gmail.com">deputyregistrar.uni@gmail.com</a>                                                                                                                     |
| 7                                                             | The Deputy Registrar, PRO, Fort, (Publication Section),<br><a href="mailto:Pro@mu.ac.in">Pro@mu.ac.in</a>                                                                                                                                                                          |
| 8                                                             | The Deputy Registrar, Executive Authorities Section (EA)<br><a href="mailto:eau120@fort.mu.ac.in">eau120@fort.mu.ac.in</a><br><br>He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular. |
| 9                                                             | The Deputy Registrar, Research Administration & Promotion Cell (RAPC),<br><a href="mailto:rapc@mu.ac.in">rapc@mu.ac.in</a>                                                                                                                                                         |
| 10                                                            | The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA)<br>dy.registrar.tau.fort.mu.ac.in<br><a href="mailto:ar.tau@fort.mu.ac.in">ar.tau@fort.mu.ac.in</a>                                                                                                         |
| 11                                                            | The Deputy Registrar, College Teachers Approval Unit (CTA),<br><a href="mailto:concolsection@gmail.com">concolsection@gmail.com</a>                                                                                                                                                |
| 12                                                            | The Deputy Registrars, Finance & Accounts Section, fort<br><a href="mailto:draccounts@fort.mu.ac.in">draccounts@fort.mu.ac.in</a>                                                                                                                                                  |
| 13                                                            | The Deputy Registrar, Election Section, Fort<br><a href="mailto:drelection@election.mu.ac.in">drelection@election.mu.ac.in</a>                                                                                                                                                     |
| 14                                                            | The Assistant Registrar, Administrative Sub-Campus Thane,<br><a href="mailto:thanesubcampus@mu.ac.in">thanesubcampus@mu.ac.in</a>                                                                                                                                                  |
| 15                                                            | The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,<br><a href="mailto:ar.seask@mu.ac.in">ar.seask@mu.ac.in</a>                                                                                                                                                   |
| 16                                                            | The Assistant Registrar, Ratnagiri Sub-centre, Ratnagiri,<br><a href="mailto:ratnagirisubcenter@gmail.com">ratnagirisubcenter@gmail.com</a>                                                                                                                                        |
| 17                                                            | The Director, Centre for Distance and Online Education (CDOE),<br>Vidyanagari,<br><a href="mailto:director@idol.mu.ac.in">director@idol.mu.ac.in</a>                                                                                                                               |
| 18                                                            | Director, Innovation, Incubation and Linkages,<br>Dr. Sachin Laddha<br><a href="mailto:pinkumanno@gmail.com">pinkumanno@gmail.com</a>                                                                                                                                              |
| 19                                                            | Director, Department of Lifelong Learning and Extension (DLLE),<br><a href="mailto:dlleuniversityofmumbai@gmail.com">dlleuniversityofmumbai@gmail.com</a>                                                                                                                          |

| Copy for information :- |                                                                                                                     |
|-------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1                       | P.A to Hon'ble Vice-Chancellor,<br><a href="mailto:vice-chancellor@mu.ac.in">vice-chancellor@mu.ac.in</a>           |
| 2                       | P.A to Pro-Vice-Chancellor<br><a href="mailto:pvc@fort.mu.ac.in">pvc@fort.mu.ac.in</a>                              |
| 3                       | P.A to Registrar,<br><a href="mailto:registrar@fort.mu.ac.in">registrar@fort.mu.ac.in</a>                           |
| 4                       | P.A to all Deans of all Faculties                                                                                   |
| 5                       | P.A to Finance & Account Officers, (F & A.O),<br><a href="mailto:camu@accounts.mu.ac.in">camu@accounts.mu.ac.in</a> |

To,

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | The Chairman, Board of Deans<br><a href="mailto:pvc@fort.mu.ac.in">pvc@fort.mu.ac.in</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2 | <p><b>Faculty of Humanities,</b></p> <p><b>Dean</b></p> <p>1. Prof.Anil Singh<br/><a href="mailto:Dranilsingh129@gmail.com">Dranilsingh129@gmail.com</a></p> <p><b>Associate Dean</b></p> <p>2. Dr.Suchitra Naik<br/><a href="mailto:Naiksuchitra27@gmail.com">Naiksuchitra27@gmail.com</a></p> <p>3.Prof.Manisha Karne<br/><a href="mailto:mkarne@economics.mu.ac.in">mkarne@economics.mu.ac.in</a></p> <p><b>Faculty of Commerce &amp; Management,</b></p> <p><b>Dean</b></p> <p>1. Dr.Kavita Laghate<br/><a href="mailto:kavitalaghate@jbims.mu.ac.in">kavitalaghate@jbims.mu.ac.in</a></p> <p><b>Associate Dean</b></p> <p>2. Dr.Ravikant Balkrishna Sangurde<br/><a href="mailto:Ravikant.s.@somaiya.edu">Ravikant.s.@somaiya.edu</a></p> <p>3. Prin.Kishori Bhagat<br/><a href="mailto:kishoribhagat@rediffmail.com">kishoribhagat@rediffmail.com</a></p> |

|   |                                                                                                                                                                                                                                                                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>Faculty of Science &amp; Technology</b><br><b>Dean</b><br>1. Prof. Shivram Garje<br><a href="mailto:ssgarje@chem.mu.ac.in">ssgarje@chem.mu.ac.in</a><br><b>Associate Dean</b><br>2. Dr. Madhav R. Rajwade<br><a href="mailto:Madhavr64@gmail.com">Madhavr64@gmail.com</a><br>3. Prin. Deven Shah<br><a href="mailto:sir.deven@gmail.com">sir.deven@gmail.com</a> |
|   | <b>Faculty of Inter-Disciplinary Studies,</b><br><b>Dean</b><br>1. Dr. Anil K. Singh<br><a href="mailto:aksingh@trcl.org.in">aksingh@trcl.org.in</a><br><b>Associate Dean</b><br>2. Prin. Chadrashekhhar Ashok Chakradeo<br><a href="mailto:cachakradeo@gmail.com">cachakradeo@gmail.com</a>                                                                        |
| 3 | Chairman, Board of Studies,                                                                                                                                                                                                                                                                                                                                         |
| 4 | The Director, Board of Examinations and Evaluation,<br><a href="mailto:dboee@exam.mu.ac.in">dboee@exam.mu.ac.in</a>                                                                                                                                                                                                                                                 |
| 5 | The Director, Board of Students Development,<br><a href="mailto:dsd@mu.ac.in@gmail.com">dsd@mu.ac.in@gmail.com</a> <b>DSW</b> <a href="mailto:directr@dsw.mu.ac.in">directr@dsw.mu.ac.in</a>                                                                                                                                                                        |
| 6 | The Director, Department of Information & Communication Technology,<br><a href="mailto:director.dict@mu.ac.in">director.dict@mu.ac.in</a>                                                                                                                                                                                                                           |

# University of Mumbai



## **Syllabus for B. Voc. (Cyber Security and Digital Forensics)**

**Semester – I & II**

**Choice Based Credit System**

**(With effect from the academic year 2023–2024)  
Progressively)**



## University of Mumbai



### Syllabus for Approval

| Sr. No. | Heading                              | Particulars                                                                                                                            |
|---------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Title of Course O.6884               | B. Voc.<br>(Cyber Security and Digital Forensics)                                                                                      |
| 2       | Eligibility for Admission O.6885     | HSC or equivalent from any recognized board (Science, Commerce and Arts Stream) There is no age bar for admission in B.Voc. under NSQF |
| 3       | Standards of Passing R.9715          | 40%                                                                                                                                    |
| 4       | Ordinance / Regulations (if any)     |                                                                                                                                        |
| 5       | No. of years/Semesters R.9716        | 3 years / 6 semesters                                                                                                                  |
| 6       | Level                                | Under Graduation                                                                                                                       |
| 7       | Pattern                              | Semester                                                                                                                               |
| 8       | Status                               | New                                                                                                                                    |
| 9       | To be implemented from Academic Year | With effect from Academic Year: 2023-2024                                                                                              |

Dr. Deven Shah  
Offg. Associate Dean  
Faculty of Science and Technology

Dr. Shivram Garje  
Offg. Dean  
Faculty of Science and Technology

## Preamble

As per AICTE, Vocational Education can be defined as the education based on occupation and employment. It involves various practical trainings. It may be referred as technical education because the trainee directly develops expertise in a particular group of skills and techniques. Vocational Education prepares individuals for job, makes them perform better by honouring their skills, thus specializing them at their own Level. Vocational education provides an intensive training and certification Programme and support the youth in gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

The National Skills Qualifications Framework (NSQF) is a competency-based framework that organizes all qualifications according to a series of Levels of knowledge, skills and aptitude. These Levels, graded from one to ten, are defined in terms of learning outcomes which the learners must possess regardless of whether they are obtained through formal, Non-Formal or informal learning.

The curriculum in each of the years of the Program would be a suitable mix of general education and skill development components. The General Education Component shall have 40% of the total credits and balance 60% credits will be of Skill Component or as amended by the MoE/ Ministry from time to time.

Dr. Deven Shah  
Associate Dean  
Faculty of Science and Technology  
University of Mumbai

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Faculty of Science and Technology  
University of Mum

**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester I**

| Course Code                 | Course Name                                   | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |                         |              |       |     |
|-----------------------------|-----------------------------------------------|---------------------------------|--------|------|------------------|-------------------------|--------------|-------|-----|
|                             |                                               | Theory                          | Pract. | Tut. | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                               |                                 |        |      |                  |                         |              |       |     |
| BVCDFG101                   | Professional Skill-I (Soft Skill Development) | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG102                   | Applied Mathematics                           | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG103                   | Programming principles with C                 | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
|                             | Total                                         | 9                               | 2      | 2    | 9                | 1                       | 2            | 12    |     |
| Skill Component             |                                               |                                 |        |      |                  |                         |              |       |     |
| BVCDFS101                   | Computer Networks                             | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS102                   | Cybersecurity Fundamentals                    | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS103                   | Operating System and Network Security         | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS104                   | On Job Training/ Skill based Internship       | -                               | 12     | -    | --               | 6#                      | --           | 6     |     |
|                             | Total                                         | 9                               | 18     | --   | 9                | 9                       | --           | 18    |     |
| Grand Total                 |                                               | 18                              | 20     | 2    | 18               | 10                      | 2            | 30    |     |
| Course Code                 | Course Name                                   | Examination Scheme              |        |      |                  |                         |              |       |     |
|                             |                                               | Theory                          |        |      |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                               | Internal Assessment             |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                               | Test 1                          | Test2  | Avg  |                  |                         |              |       |     |
| General Education Component |                                               |                                 |        |      |                  |                         |              |       |     |
| BVCDFG101                   | Professional Skill-I (Soft Skill Development) | 10                              | 10     | 10   | 40               | 2                       |              | 50    |     |
| BVCDFG102                   | Applied Mathematics                           | 20                              | 20     | 20   | 80               | 3                       | 25           | --    | 125 |
| BVCDFG103                   | Programming principles with C                 | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| Skill Component             |                                               |                                 |        |      |                  |                         |              |       |     |
| BVCDFS101                   | Computer Networks                             | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS102                   | Cybersecurity Fundamentals                    | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS103                   | Operating System and Network Security         | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS104                   | On Job Training/ Skill based Internship       | --                              | --     | --   | --               | --                      | 50#          | --    | 50  |
| Total                       |                                               | --                              | --     | 110  | 440              | --                      | 175          | 100   | 825 |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.



**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester II**

| Course Code                 | Course Name                                              | Teaching Scheme<br>(Contact hours) |        |      | Credits Assigned |                         |              |       |     |
|-----------------------------|----------------------------------------------------------|------------------------------------|--------|------|------------------|-------------------------|--------------|-------|-----|
|                             |                                                          | Theory                             | Pract. | Tut. | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                                          |                                    |        |      |                  |                         |              |       |     |
| BVCDFG201                   | Professional Skill-II<br>(Business communication Ethics) | 3                                  | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG202                   | Statistics for Data Science                              | 3                                  | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG203                   | Digital Logic & Computer Architecture                    | 3                                  | 2      | -    | 3                | 1                       | --           | 4     |     |
|                             | Total                                                    | 9                                  | 2      | 2    | 9                | 1                       | 2            | 12    |     |
| Skill Component             |                                                          |                                    |        |      |                  |                         |              |       |     |
| BVCDFS201                   | Python Programming                                       | 3                                  | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS202                   | Web Application Security                                 | 3                                  | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS203                   | Database Management and Security                         | 3                                  | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS204                   | On Job Training/ Skill based Internship                  | -                                  | 12     | -    | --               | 6#                      | --           | 6     |     |
|                             | Total                                                    | 9                                  | 18     | --   | 9                | 9                       | --           | 18    |     |
| Grand Total                 |                                                          | 18                                 | 20     | 2    | 18               | 10                      | 2            | 30    |     |
| Course Code                 | Course Name                                              | Examination Scheme                 |        |      |                  |                         |              |       |     |
|                             |                                                          | Theory                             |        |      |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                                          | Internal Assessment                |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                                          | Test 1                             | Test2  | Avg  |                  |                         |              |       |     |
| General Education Component |                                                          |                                    |        |      |                  |                         |              |       |     |
| BVCDFG201                   | Professional Skill-II<br>(Business Communication Ethics) | 10                                 | 10     | 10   | 40               | 2                       |              |       | 50  |
| BVCDFG202                   | Statistics for Data Science                              | 20                                 | 20     | 20   | 80               | 3                       | 25           | --    | 125 |
| BVCDFG 203                  | Digital Logic & Computer Architecture                    | 20                                 | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| Skill Component             |                                                          |                                    |        |      |                  |                         |              |       |     |
| BVCDFS201                   | Python Programming                                       | 20                                 | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS202                   | Web Application Security                                 | 20                                 | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS203                   | Database Management and Security                         | 20                                 | 20     | 20   | 80               | --                      | 25           | 25    | 150 |
| BVCDFS204                   | On Job Training/ Skill based Internship                  | --                                 | --     | --   | --               | --                      | 50#          | --    | 50  |
| Total                       |                                                          | --                                 | --     | 110  | 440              | --                      | 175          | 100   | 825 |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.

**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester III**

| Course Code                 | Course Name                                | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |                         |              |       |     |
|-----------------------------|--------------------------------------------|---------------------------------|--------|------|------------------|-------------------------|--------------|-------|-----|
|                             |                                            | Theory                          | Pract. | Tut. | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 301                  | Professional Skill-III (Entrepreneurship)  | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 302                  | Ethical Hacking                            | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 303                  | Machine Learning I                         | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
|                             | Total                                      | 9                               | 2      | 2    | 9                | 1                       | 2            | 12    |     |
| Skill Component             |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 301                  | Cybersecurity Risk Management and Auditing | 3                               | 2      |      | 3                | 1                       | --           | 4     |     |
| BVCDFS 302                  | Malware Analysis and Reverse Engineering   | 3                               | 2      | —    | 3                | 1                       | --           | 4     |     |
| BVCDFS 303                  | Cyber Threat Intelligence                  | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS 304                  | On Job Training/ Skill based Internship    | -                               | 12     | -    | --               | 6#                      | --           | 6     |     |
|                             | Total                                      | 9                               | 18     | --   | 9                | 9                       | --           | 18    |     |
| Grand Total                 |                                            | 18                              | 20     | 2    | 18               | 10                      | 2            | 30    |     |
| Course Code                 | Course Name                                | Examination Scheme              |        |      |                  |                         |              |       |     |
|                             |                                            | Theory                          |        |      |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                            | Internal Assessment             |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                            | Test 1                          | Test2  | Avg  |                  |                         |              |       |     |
| General Education Component |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 301                  | Professional Skill-III (Entrepreneurship)  | 10                              | 10     | 10   | 40               | 2                       |              |       | 50  |
| BVCDFG 302                  | Ethical Hacking                            | 20                              | 20     | 20   | 80               | 3                       | 25           | --    | 125 |
| BVCDFG 303                  | Machine Learning I                         | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| Skill Component             |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 301                  | Cybersecurity Risk Management and Auditing | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 302                  | Malware Analysis and Reverse Engineering   | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 303                  | Cyber Threat Intelligence                  | 20                              | 20     | 20   | 80               | --                      | 25           | 25    | 150 |
| BVCDFS 304                  | On Job Training/ Skill based Internship    | --                              | --     | --   | --               | --                      | 50#          | --    | 50  |
| Total                       |                                            | --                              | --     | 110  | 440              | --                      | 175          | 100   | 825 |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.

**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester IV**

| Course Code                 | Course Name                                         | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |                         |              |       |     |
|-----------------------------|-----------------------------------------------------|---------------------------------|--------|------|------------------|-------------------------|--------------|-------|-----|
|                             |                                                     | Theory                          | Pract. | Tut. | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                                     |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 401                  | Professional Skill-IV (Aptitude and Logic Building) | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 402                  | Security Architecture and Engineering               | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 403                  | Digital Forensics                                   | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
|                             | Total                                               | 9                               | 2      | 2    | 12               | 1                       | 2            | 12    |     |
| Skill Component             |                                                     |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 401                  | Penetration Testing and Vulnerability Assessment    | 3                               | 2      |      | 3                | 1                       | --           | 4     |     |
| BVCDFS 402                  | Cybercrime Investigation Techniques                 | 3                               | 2      | --   | 3                | 1                       | --           | 4     |     |
| BVCDFS 403                  | Network Forensics                                   | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS 404                  | On Job Training/ Skill based Internship             | -                               | 12     | -    | --               | 6#                      | --           | 6     |     |
|                             | Total                                               | 9                               | 18     | --   | 9                | 9                       | --           | 18    |     |
| Grand Total                 |                                                     | 18                              | 20     | 2    | 21               | 10                      | 2            | 30    |     |
| Course Code                 | Course Name                                         | Examination Scheme              |        |      |                  |                         |              |       |     |
|                             |                                                     | Theory                          |        |      |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                                     | Internal Assessment             |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                                     | Test 1                          | Test2  | Avg  |                  |                         |              |       |     |
| General Education Component |                                                     |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 401                  | Professional Skill-IV (Aptitude and Logic Building) | 10                              | 10     | 10   | 40               | 2                       |              |       | 50  |
| BVCDFG 402                  | Security Architecture and Engineering               | 20                              | 20     | 20   | 80               | 3                       | 25           | --    | 125 |
| BVCDFG 403                  | Digital Forensics                                   | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| Skill Component             |                                                     |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 401                  | Penetration Testing and Vulnerability Assessment    | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 402                  | Cybercrime Investigation Techniques                 | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 403                  | Network Forensics                                   | 20                              | 20     | 20   | 80               | --                      | 25           | 25    | 150 |
| BVCDFS 404                  | On Job Training/ Skill based Internship             | --                              | --     | --   | --               | --                      | 50#          | --    | 50  |
| Total                       |                                                     | --                              | --     | 110  | 440              | --                      | 175          | 100   | 825 |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.

**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester V**

| Course Code                 | Course Name                                            | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |                         |           |              |       |
|-----------------------------|--------------------------------------------------------|---------------------------------|--------|------|------------------|-------------------------|-----------|--------------|-------|
|                             |                                                        | Theory                          | Pract. | Tut. | Theory           | Pract.                  | Tut.      | Total        |       |
| General Education Component |                                                        |                                 |        |      |                  |                         |           |              |       |
| BVCDFG 501                  | Professional Skill-IV (Cloud Forensics)                | 3                               | -      | 1*   | 3                | --                      | 1         | 4            |       |
| BVCDFG 502                  | Environmental Management                               | 3                               | -      | 1*   | 3                | --                      | 1         | 4            |       |
| BVCDFG 503                  | Cyber Security Laws                                    | 3                               | 2      | -    | 3                | 1                       | --        | 4            |       |
|                             | Total                                                  | 9                               | 2      | 2    | 12               | 1                       | 2         | 12           |       |
| Skill Component             |                                                        |                                 |        |      |                  |                         |           |              |       |
| BVCDFS 501                  | Blockchain Forensics and Crypto-currency Investigation | 3                               | 2      |      | 3                | 1                       | --        | 4            |       |
| BVCDFS 502                  | Ransomware Investigation                               | 3                               | 2      | —    | 3                | 1                       | --        | 4            |       |
| BVCDFS 503                  | Mobile Security and Forensics                          | 3                               | 2      | -    | 3                | 1                       | --        | 4            |       |
| BVCDFS 504                  | Major Project I                                        | -                               | 12     | -    | --               | 6#                      | --        | 6            |       |
|                             | Total                                                  | 9                               | 18     | --   | 9                | 9                       | --        | 18           |       |
| Grand Total                 |                                                        | 18                              | 20     | 2    | 21               | 10                      | 2         | 30           |       |
| Course Code                 | Course Name                                            | Examination Scheme              |        |      |                  |                         |           |              |       |
|                             |                                                        | Theory                          |        |      |                  |                         | Term Work | Pract. &oral | Total |
|                             |                                                        | Internal Assessment             |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |           |              |       |
|                             |                                                        | Test 1                          | Test2  | Avg  |                  |                         |           |              |       |
| General Education Component |                                                        |                                 |        |      |                  |                         |           |              |       |
| BVCDFG 501                  | Professional Skill-IV (Cloud Forensics)                | 10                              | 10     | 10   | 40               | 2                       |           |              | 50    |
| BVCDFG 502                  | Environmental Management                               | 20                              | 20     | 20   | 80               | 3                       | 25        | --           | 125   |
| BVCDFG 503                  | Cyber Security Laws                                    | 20                              | 20     | 20   | 80               | 3                       | 25        | 25           | 150   |
| Skill Component             |                                                        |                                 |        |      |                  |                         |           |              |       |
| BVCDFS 501                  | Blockchain Forensics and Crypto-currency Investigation | 20                              | 20     | 20   | 80               | 3                       | 25        | 25           | 150   |
| BVCDFS 502                  | Ransomware Investigation                               | 20                              | 20     | 20   | 80               | 3                       | 25        | 25           | 150   |
| BVCDFS 503                  | Mobile Security and Forensics                          | 20                              | 20     | 20   | 80               | --                      | 25        | 25           | 150   |
| BVCDFS 504                  | Major Project I                                        | --                              | --     | --   | --               | --                      | 50#       | --           | 50    |
| Total                       |                                                        | --                              | --     | 110  | 440              | --                      | 175       | 100          | 825   |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.

**Program Structure for First Year B. Voc. Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester VI**

| Course Code                 | Course Name                                | Teaching Scheme (Contact Hours) |        |      | Credits Assigned |                         |              |       |     |
|-----------------------------|--------------------------------------------|---------------------------------|--------|------|------------------|-------------------------|--------------|-------|-----|
|                             |                                            | Theory                          | Pract. | Tut. | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 601                  | Professional Skill-IV (API Pentesting)     | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 602                  | Information Retrieval System               | 3                               | -      | 1*   | 3                | --                      | 1            | 4     |     |
| BVCDFG 603                  | Distributed Computing                      | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
|                             | Total                                      | 9                               | 2      | 2    | 12               | 1                       | 2            | 12    |     |
| Skill Component             |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 601                  | Cloud Computing Security                   | 3                               | 2      |      | 3                | 1                       | --           | 4     |     |
| BVCDFS 602                  | Machine Learning II                        | 3                               | 2      | –    | 3                | 1                       | --           | 4     |     |
| BVCDFS 603                  | Security information and Event Management. | 3                               | 2      | -    | 3                | 1                       | --           | 4     |     |
| BVCDFS 604                  | Major Project II                           | -                               | 12     | -    | --               | 6#                      | --           | 6     |     |
|                             | Total                                      | 9                               | 18     | --   | 9                | 9                       | --           | 18    |     |
| Grand Total                 |                                            | 18                              | 20     | 2    | 21               | 10                      | 2            | 30    |     |
| Course Code                 | Course Name                                | Examination Scheme              |        |      |                  |                         |              |       |     |
|                             |                                            | Theory                          |        |      |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                            | Internal Assessment             |        |      | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                            | Test 1                          | Test2  | Avg  |                  |                         |              |       |     |
| General Education Component |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFG 601                  | Professional Skill-IV (API Pentesting)     | 10                              | 10     | 10   | 40               | 2                       |              |       | 50  |
| BVCDFG 602                  | Information Retrieval System               | 20                              | 20     | 20   | 80               | 3                       | 25           | --    | 125 |
| BVCDFG 603                  | Distributed Computing                      | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| Skill Component             |                                            |                                 |        |      |                  |                         |              |       |     |
| BVCDFS 601                  | Cloud Computing Security                   | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 602                  | Machine Learning II                        | 20                              | 20     | 20   | 80               | 3                       | 25           | 25    | 150 |
| BVCDFS 603                  | Security Information and Event Management. | 20                              | 20     | 20   | 80               | --                      | 25           | 25    | 150 |
| BVCDFS 604                  | Major Project II                           | --                              | --     | --   | --               | --                      | 50#          | --    | 50  |
| Total                       |                                            | --                              | --     | 110  | 440              | --                      | 175          | 100   | 825 |

- \*Should be conducted batch wise.
- # Indicates Practical and Oral Marks includes report and presentation.

| Course Code:     | Course Title                                         | Credit   |
|------------------|------------------------------------------------------|----------|
| <b>BVCDFG101</b> | <b>Professional Skill-I (Soft Skill Development)</b> | <b>4</b> |

|                                      |                                                                                                                                                             |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: No Prerequisite</b> |                                                                                                                                                             |
| <b>Course Objectives:</b>            |                                                                                                                                                             |
| 1                                    | To develop effective communication skills (spoken and written).                                                                                             |
| 2                                    | To develop effective presentation skills.                                                                                                                   |
| 3                                    | To conduct effective business correspondence and prepare business reports which produce results.                                                            |
| 4                                    | To become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills                                       |
| <b>Course Outcomes:</b>              |                                                                                                                                                             |
| 1                                    | To understand effective communication skills (spoken and written).                                                                                          |
| 2                                    | To apply effective presentation skills.                                                                                                                     |
| 3                                    | To understand effective business correspondence and prepare business reports which produce results.                                                         |
| 4                                    | To implement soft skills for self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.                  |
| 5                                    | To develop all-round personalities with a mature outlook to function effectively in different circumstances.                                                |
| 6                                    | To develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets. |

| Module   |     | Content                                                                                                                                                                                                        | Hrs      |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>1</b> |     | <b>Mechanics of Communication</b>                                                                                                                                                                              | <b>8</b> |
|          | 1.1 | Concept and Meaning: Etymology, Definition and Process of Communication. Barriers: Linguistic, Semantic, Personal, Socio-Psychological, Physical, Environmental, Mechanical, Cross-Cultural                    |          |
|          | 1.2 | Methods of Communication: Verbal Non- Verbal Communication<br>Networks of communications: Understanding Organizational Communication.                                                                          |          |
| <b>2</b> |     | <b>Mastering Language Skills</b>                                                                                                                                                                               | <b>8</b> |
|          | 2.1 | Listening: Types of Listening; Process of Listening; Hearing and Listening; Exercises on Listening Skill (Video/ Audio)<br>Speaking: Art of Public Speaking; Activities on Speaking Skill.                     |          |
|          | 2.2 | Reading: Concept and Types of Reading, Reading Newspaper articles, Fiction and Non-fiction works; Activities on Reading<br>Writing: Principles; Business Correspondence: Elements, Types and Formats of Letter |          |
| <b>3</b> |     | <b>Presentation Skills</b>                                                                                                                                                                                     | <b>8</b> |
|          | 3.1 | Meaning, Importance and Structure of presentations.<br>Use of ICT tools in presentations. (Various applications like Excel, Word, Flipgrid, Nearpod etc.)                                                      |          |
|          | 3.2 | Effective presentation traits (Verbal-Nonverbal)<br>Types of presentations/ Prezi/MS PPT 1`<br>PDCA of presentation                                                                                            |          |

|          |     |                                                                                                                                                                                                |           |
|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>4</b> |     | <b>Written Communication</b>                                                                                                                                                                   | <b>7</b>  |
|          | 4.1 | Parts of Speech; Phrases and Clauses<br>Sentence Structures; Types of Sentences<br>Editing and Proofreading: Common Errors in English                                                          |           |
|          | 4.2 | Comprehension and Summarization Paraphrasing and Précis Writing: Exercises                                                                                                                     |           |
| <b>5</b> |     | <b>Technical Writing Skills</b>                                                                                                                                                                | <b>7</b>  |
|          | 5.1 | Introduction to Technical Writing: Definition, Importance and Types of Technical Writing Writing Instructions: Tips to Write Instructions; Writing User Manuals.                               |           |
|          | 5.2 | Describing: Describing Technical Object/Product/ Process; Digital Content Development Writing Research Paper: Structure of Writing standard technical research paper: Exercises Report Writing |           |
| <b>6</b> |     | <b>Communicative Competence</b>                                                                                                                                                                | <b>7</b>  |
|          | 6.1 | Phonetics, Situational English                                                                                                                                                                 |           |
|          | 6.2 | Compering, Hosting, Anchoring ,Presentation on Technical Research Paper (one technical topic)                                                                                                  |           |
|          |     | <b>Total</b>                                                                                                                                                                                   | <b>45</b> |

#### **Textbooks:**

|   |                                                                                                          |
|---|----------------------------------------------------------------------------------------------------------|
| 1 | Michael Swan, <i>“Practical English Usage, Principles and Practice”</i> , 4th Edition, OUP, 1995.        |
| 2 | F.T. Wood, <i>“Remedial English Grammar”</i> , Macmillan, 2007                                           |
| 3 | William Zinsser, <i>“On Writing Well”</i> Harper Resource Book 25 <sup>th</sup> Anniversary Edition 2001 |

#### **Referecebooks:**

|   |                                                                                                      |
|---|------------------------------------------------------------------------------------------------------|
| 1 | Liz Hamp- Lyons and Ben Heasly, <i>“Study Writing”</i> , Cambridge University Press 2nd Edition 2006 |
| 2 | Sanjay Kumar and Pushp Lata, <i>“Communication Skills”</i> , OUP 1st Edition 2011                    |
| 3 | CIEFL, <i>“Exercises in Spoken English Parts. I-III”</i> , 1997 Edition University Press,            |

#### **Assessment:**

##### **Internal Assessment:**

Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour.

##### **End Semester Theory Examination:**

|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Question paper will comprise of total six questions.                                                                                              |
| 2 | All question carries equal marks                                                                                                                  |
| 3 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4 | Only Four question need to be solved.                                                                                                             |
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.                 |

#### **Useful Links**



|   |                                                                                                                                           |
|---|-------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.coursera.org/learn/speak-english- professionally.">https://www.coursera.org/learn/speak-english- professionally.</a> |
| 2 | <a href="https://nptel.ac.in/courses/109/106/109106129/">https://nptel.ac.in/courses/109/106/109106129/</a>                               |

**List of Tutorial:**

| <b>Tutorial Number</b> | <b>Tutorial Topic</b>                      |
|------------------------|--------------------------------------------|
| 1                      | Introduction                               |
| 2                      | Public Speaking (Practice1) Social         |
| 3                      | Public Speaking (Practice 2) Technical     |
| 4                      | Public Speaking (Practice 3)<br>Extempore  |
| 5                      | Activities based on Basic Language Skills. |
| 6                      | Writing Skills                             |
| 7                      | Reading Skills                             |
| 8                      | Speaking Skills                            |
| 9                      | Listening Skills                           |
| 10                     | Presentation Practice-I                    |
| 11                     | Presentation Practice-II                   |
| 12                     | Presentation Practice-III                  |
| 13                     | Presentation Practice-IV                   |

|                     |                            |               |
|---------------------|----------------------------|---------------|
| <b>Course Code:</b> | <b>Course Title</b>        | <b>Credit</b> |
| <b>BVCDFG102</b>    | <b>Applied Mathematics</b> | <b>4</b>      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                                                     |
|---|-------------------------------------------------------------------------------------------------------------------------------------|
| 1 | To cultivate clear thinking and creative problem solving.                                                                           |
| 2 | To Thoroughly prepare for the mathematical aspects of other Computer Engineering courses                                            |
| 3 | To provide detailed of matrices which is applied for solving system of linear equations and useful in various fields of technology. |
| 4 | To understand Matrix algebra for solving engineering problems.                                                                      |
| 5 | To obtain knowledge of Linear and Non-linear programming problems of optimization.                                                  |

**Course Outcomes: On successful completion of course, learner will be able to**

|   |                                                                                                               |
|---|---------------------------------------------------------------------------------------------------------------|
| 1 | To Understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving.  |
| 2 | Apply his ability to reason logically.                                                                        |
| 3 | Apply the knowledge of matrices to solve the problems.                                                        |
| 4 | Define subspace of a vector space                                                                             |
| 5 | Discuss how those matrices change when the bases are changed and Define the kernel of a linear transformation |
| 6 | To find the optimal set of factors that best predict the outcome.                                             |

| <b>Module</b> |     | <b>Content</b>                                                                                                                                                                                            | <b>Hrs</b> |
|---------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>1</b>      |     | <b>Set Theory and Proofing Techniques</b>                                                                                                                                                                 | <b>8</b>   |
|               | 1.1 | Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and accountability (Countable and Uncountable sets)                                       |            |
|               | 1.2 | Laws of set theory, Power set and Products Partitions of sets, The Principle of Inclusion and Exclusion.                                                                                                  |            |
|               | 1.3 | Pigeonhole Principle.                                                                                                                                                                                     |            |
| <b>2</b>      |     | <b>Relation and Functions</b>                                                                                                                                                                             | <b>8</b>   |
|               | 2.1 | Relation: Definition, types of relation, composition of relations, pictorial representation of relation (Digraphs), properties of relation, partial ordering relation. Operations on relations, Closures. |            |
|               | 2.2 | Function: Definition and types of function, composition of functions, Recursive and recursively defined functions, Generating Functions.                                                                  |            |
| <b>3</b>      |     | <b>Matrices</b>                                                                                                                                                                                           | <b>7</b>   |

|          |     |                                                                                                                                                                              |           |
|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | 3.1 | Rank of a matrix, Row Echelon form, System of linear algebraic equations,                                                                                                    |           |
|          | 3.2 | Eigenvalues, eigenvectors, Caley Hamilton theorem,                                                                                                                           |           |
|          | 3.3 | Diagonalization of matrix, Orthogonal transformation, Gram- Schmidt orthogonalization.                                                                                       |           |
| <b>4</b> |     | <b>Linear algebra-I</b>                                                                                                                                                      | <b>8</b>  |
|          | 4.1 | Vector space- Examples and Properties, Subspaces-criterion for a subset to be a subspace, linear span of a set, linear combination, linear independent and dependent subsets |           |
| <b>5</b> |     | <b>Linear algebra-II</b>                                                                                                                                                     | <b>7</b>  |
|          | 5.1 | Basis and dimensions, Standard properties, Examples illustrating concepts and results                                                                                        |           |
|          | 5.2 | Linear transformations, properties, matrix of a linear transformation, change of basis, range and kernel                                                                     |           |
| <b>6</b> |     |                                                                                                                                                                              | <b>7</b>  |
|          | 6.1 | Singular Value Decomposition (SVD), The adjoint of a linear operator,                                                                                                        |           |
|          | 6.2 | Normal and Self adjoint operators, Orthogonal projections and Spectral theorem.                                                                                              |           |
|          |     | <b>Total</b>                                                                                                                                                                 | <b>45</b> |

|                                      |                                                                                                                                                                                                                                                         |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>                    |                                                                                                                                                                                                                                                         |
| 1                                    | C. L. Liu and D. P. Mohapatra: <i>Elements of Discrete Mathematics</i> , McGraw Hill, Revised Second Edition                                                                                                                                            |
| 2                                    | K. Hoffmann and R. A. Kunze: <i>Linear algebra</i> , PHI Learning, Second Edition.                                                                                                                                                                      |
| <b>References:</b>                   |                                                                                                                                                                                                                                                         |
| 1                                    | Stephen H Friedberg, <i>Linear Algebra</i> , O 'Eastern Economic Edition, fourth edition                                                                                                                                                                |
| 2                                    | B.S. Grewal, <i>Higher Engineering Mathematics</i> , Khanna Publishers, Thirty Sixth edition .                                                                                                                                                          |
| <b>Useful Links for E-resources:</b> |                                                                                                                                                                                                                                                         |
| 1                                    | <a href="https://nptel.ac.in/courses/111105123/">https://nptel.ac.in/courses/111105123/</a>                                                                                                                                                             |
| 2                                    | <a href="https://www.analyticsvidhya.com/blog/2017/02/lintr-oductory-guide-on-linear-programming-explained-in-simple-english/">https://www.analyticsvidhya.com/blog/2017/02/lintr-oductory-guide-on-linear-programming-explained-in-simple-english/</a> |
| 3                                    | <a href="https://www.u-aizu.ac.jp/~qf-zhao/TEACHING/AI/AI.html">https://www.u-aizu.ac.jp/~qf-zhao/TEACHING/AI/AI.html</a>                                                                                                                               |
| 4                                    | <a href="https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai">https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai</a> .                                                                       |

|                             |
|-----------------------------|
| <b><u>Assessment:</u></b>   |
| <b>Internal Assessment:</b> |

|                                                                                                                                                                                                                                                           |                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                                   |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                         | Question paper will comprise a total of six questions.                                                                                            |
| 2                                                                                                                                                                                                                                                         | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                         | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                         | Only Four questions need to be solved.                                                                                                            |
| 5                                                                                                                                                                                                                                                         | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

**List of Tutorials:**

| Sr. No | Topic                                                     |
|--------|-----------------------------------------------------------|
| 1      | Tutorial on Set theory                                    |
| 2      | Tutorial on Principle of Inclusion and Exclusion          |
| 3      | Tutorial on Pigeonhole Principle                          |
| 4      | Tutorial on Relation                                      |
| 5      | Tutorial on Functions                                     |
| 6      | Tutorial on system of linear algebraic equations          |
| 7      | Tutorial on Caley Hamilton theorem                        |
| 8      | Tutorial on diagonalization of matrix                     |
| 9      | Tutorial on Gram-Schmidt orthogonalization                |
| 10     | Tutorial on vector space and subspace                     |
| 11     | Tutorial on linear dependence and independence of vectors |
| 12     | Tutorial on basis and dimensions of vector space          |
| 13     | Tutorial on linear transformation and its matrix          |
| 14     | Tutorial on Singular Value Decomposition                  |
| 15     | Tutorial on normal, adjoint and self-adjoint operators    |

| Course Code: | Course Title                  | Credit |
|--------------|-------------------------------|--------|
| BVCDFG103    | Programming principles with C | 4      |

|                                                                                  |                                                                                                                                 |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: No Prerequisite</b>                                             |                                                                                                                                 |
| <b>Course Objectives:</b>                                                        |                                                                                                                                 |
| 1                                                                                | To explore Problem-solving by developing an algorithm, flowchart and implement the logic using C programming language.          |
| 2                                                                                | To understand data types in C                                                                                                   |
| 3                                                                                | To explore mathematical and logical operations.                                                                                 |
| 4                                                                                | To explore different statements using if statement and loops and understand arranging data in arrays and implementing pointers. |
| <b>Course Outcomes:</b> On successful completion of course, learner will be able |                                                                                                                                 |
| 1                                                                                | To formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language.                   |
| 2                                                                                | To ability to handle possible errors during program execution.                                                                  |
| 3                                                                                | To Implement, test and execute programs comprising of control structures.                                                       |
| 4                                                                                | To decompose a problem into functions and synthesize a complete program.                                                        |
| 5                                                                                | To demonstrate the use of arrays, strings and structures in C language.                                                         |
| 6                                                                                | To understand the concept of pointers                                                                                           |

| Module   |     | Content                                                                                                                                                                                                             | Hrs      |
|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>1</b> |     | <b>Introduction to C Programming</b>                                                                                                                                                                                | <b>8</b> |
|          | 1.1 | Introduction to components of a Computer System<br>Introduction to Algorithm and Flowchart.                                                                                                                         |          |
|          | 1.2 | Fundamentals of C Programming: Keywords, Identifiers, Constants and Variables , Data types in C , Operators in C , Basic Input and Output Operations , Expressions and Precedence of Operators , In-built Functions |          |
| <b>2</b> |     | <b>Control Structures</b>                                                                                                                                                                                           | <b>8</b> |
|          | 2.1 | Introduction to Control Structures.                                                                                                                                                                                 |          |
|          | 2.2 | Branching and looping structures: If statement, If-else statement, Nested if-else, else-if Ladder , Switch statement , For loop, While loop, Do while loop , break and continue                                     |          |
| <b>3</b> |     | <b>Functions</b>                                                                                                                                                                                                    | <b>6</b> |
|          | 3.1 | Introduction to functions Function prototype, Function definition, accessing a function and parameter passing.                                                                                                      |          |
|          | 3.2 | Recursion.                                                                                                                                                                                                          |          |
| <b>4</b> |     | <b>Arrays and Strings</b>                                                                                                                                                                                           | <b>8</b> |
|          | 4.1 | Introduction to Arrays, Declaration and initialization of one dimensional and two-dimensional arrays.                                                                                                               |          |
|          | 4.2 | Definition and initialization of String, String functions.                                                                                                                                                          |          |

|   |     |                                                                                        |           |
|---|-----|----------------------------------------------------------------------------------------|-----------|
| 5 |     | <b>Structure and Union</b>                                                             | 7         |
|   | 5.1 | Concept of Structure and Union ,Declaration and Initialization of structure and union. |           |
|   | 5.2 | Nested structures, Array of Structures, Passing structure to functions.                |           |
| 6 |     | <b>Pointers</b>                                                                        | 8         |
|   | 6.1 | Fundamentals of pointers, Declaration, initialization and dereferencing of pointers    |           |
|   | 6.2 | Operations on Pointers ,Concept of dynamic memory allocation.                          |           |
|   |     | <b>Total</b>                                                                           | <b>45</b> |

|                     |                                                                                                                             |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>   |                                                                                                                             |
| 1                   | E. Balaguruswamy, “ <b>Programming in ANSI C</b> ”, McGraw-Hill Third Edition 2014                                          |
| 2                   | Kernighan , Ritchie “ <b>The C programming Language</b> ”, Prentice Hall of India second Edition 2015                       |
| <b>References:</b>  |                                                                                                                             |
| 1                   | Byron Gottfried, “ <b>Programing with C</b> ”,McGraw Hill ( Schaum’s outline series) Third Edition 2009.                    |
| 2                   | KanetkarYashwant “ <b>Let Us C</b> ”, IEEE Press, Wiley Publication BPB Publication Third Edition, 2013.                    |
| <b>Useful Links</b> |                                                                                                                             |
| 1                   | <a href="https://www.coursera.org/specializations/c-programming">https://www.coursera.org/specializations/c-programming</a> |
| 2                   | <a href="https://onlinecourses.nptel.ac.in/noc20_cs91/preview">https://onlinecourses.nptel.ac.in/noc20_cs91/preview</a>     |

|                                                                                                                                                                                                                                                   |                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Assessment:</b>                                                                                                                                                                                                                                |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                       |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                           |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                 | Question paper will comprise of total six questions.                                                                                              |
| 2                                                                                                                                                                                                                                                 | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                 | Only Four question need to be solved.                                                                                                             |
| 5                                                                                                                                                                                                                                                 | In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.                 |

#### **List of Practical/ Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b>    |
|-------------------------|---------------------------------------|
| 1                       | Basic data types and I/O operations   |
| 2                       | Branching Statements                  |
| 3                       | Statements using conditional controls |

|    |                                                                     |
|----|---------------------------------------------------------------------|
| 4  | Problem statement for iterative loop structure                      |
| 5  | Problem statement for nested loop structure                         |
| 6  | Problem statement on Implementation of One D Array                  |
| 7  | Problem statement on Implementation of Two D Array                  |
| 8  | Implementation of Strings using header file and without header file |
| 9  | Study and Implementation of Functions.                              |
| 10 | Study and Implementation of Recursion.                              |
| 11 | Structure and Union                                                 |
| 12 | Array of Structure and Nested Structures.                           |
| 13 | Implementation of Pointers.                                         |

| Course Code: | Course Title      | Credit |
|--------------|-------------------|--------|
| BVCDFS101    | Computer Networks | 4      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                    |
|---|----------------------------------------------------------------------------------------------------|
| 1 | To introduce concepts and fundamentals of data communication and computer networks.                |
| 2 | To explore the inter-working of various layers of OSI.                                             |
| 3 | To explore the issues and challenges of protocols design while delving into TCP/IP protocol suite. |
| 4 | To assess the strengths and weaknesses of various routing algorithms.                              |
| 5 | To understand various transport layer and application layer protocols.                             |

**Course Outcomes: On successful completion of course, learner will be able to**

|   |                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------|
| 1 | Demonstrate the concepts of data communication at physical layer and compare ISO – OSI model with TCP/IP model. |
| 2 | Introduction to Physical layer Transmission media.                                                              |
| 3 | Explore different design issues at data link layer.                                                             |
| 4 | Design the network using IP addressing and sub netting / super netting schemes.                                 |
| 5 | Analyze transport layer protocols and congestion control algorithms.                                            |
| 6 | Explore protocols at application layer.                                                                         |

| Module   |     | Content                                                                                                                                                                                                                                                      | Hrs      |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>1</b> |     | <b>Introduction to Networking</b>                                                                                                                                                                                                                            | <b>6</b> |
|          | 1.1 | Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services. |          |
|          | 1.2 | Reference models: Layer details of OSI, TCP/IP models. Communication between layers.                                                                                                                                                                         |          |
| <b>2</b> |     | <b>Physical Layer</b>                                                                                                                                                                                                                                        | <b>6</b> |
|          | 2.1 | Introduction to Communication Electromagnetic Spectrum.                                                                                                                                                                                                      |          |
|          | 2.2 | Guided Transmission Media: Twisted pair, Coaxial, Fiber optics.                                                                                                                                                                                              |          |
| <b>3</b> |     | <b>Data Link Layer</b>                                                                                                                                                                                                                                       | <b>8</b> |



|          |     |                                                                                                                                                                                                                                       |           |
|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | 3.1 | DLL Design Issues (Services, Framing, Error Control, Flow Control), Error Detection and Correction (Hamming Code, CRC, Checksum), Elementary Data Link protocols, Stop and Wait, Sliding Window (Go Back N, Selective Repeat)         |           |
|          | 3.2 | Medium Access Control sub layer Channel Allocation problem, Multiple access Protocol( Aloha, Carrier Sense Multiple Access (CSMA/CD)                                                                                                  |           |
| <b>4</b> |     | <b>Network layer</b>                                                                                                                                                                                                                  | <b>10</b> |
|          | 4.1 | Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (class full and classless), Sub netting, Super-netting design problems ,IPv4 Protocol, Network Address Translation (NAT), IPv6. |           |
|          | 4.2 | Routing algorithms: Shortest Path (Dijkstra's), Link state routing, Distance Vector Routing.                                                                                                                                          |           |
|          | 4.3 | Protocols - ARP, RARP, ICMP, IGMP                                                                                                                                                                                                     |           |
|          | 4.4 | Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, Token & Leaky bucket algorithms.                                                                                         |           |
| <b>5</b> |     | <b>Transport Layer</b>                                                                                                                                                                                                                | <b>8</b>  |
|          | 5.1 | The Transport Service: Transport service primitives, Berkeley Sockets, Connection management (Handshake), UDP, TCP, TCP state transition, TCP timers.                                                                                 |           |
|          | 5.2 | TCP Flow control (sliding Window), TCP Congestion Control: Slow Start.                                                                                                                                                                |           |
| <b>6</b> |     | <b>Application Layer</b>                                                                                                                                                                                                              | <b>7</b>  |
|          | 6.1 | DNS: Name Space, Resource Record and Types of Name Server. HTTP, SMTP, Telnet, FTP, DHCP                                                                                                                                              |           |
|          |     | <b>Total</b>                                                                                                                                                                                                                          | <b>45</b> |

### **Assessment:**

#### **Internal Assessment:**

Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour.

#### **End Semester Theory Examination:**

1 Question paper will comprise a total of six questions.

2 All question carries equal marks

|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4 | Only Four questions need to be solved.                                                                                                            |
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

**Textbooks:**

- |   |                                                                                 |
|---|---------------------------------------------------------------------------------|
| 1 | A.S. Tanenbaum: Computer Networks, Pearson Education, 4 <sup>th</sup> Edition.  |
| 2 | B.A. Forouzan: Data Communication and Networking, TMH, 5 <sup>th</sup> Edition. |

**References:**

- |   |                                                                                                                               |
|---|-------------------------------------------------------------------------------------------------------------------------------|
| 1 | James F. Kurose, Keith W. Ross: Computer Networking, A Top-Down Approach Featuring the Internet, Addison Wesley, 6th edition. |
|---|-------------------------------------------------------------------------------------------------------------------------------|

**Useful Links for E-resources:**

- |   |                                                                                                                                                                               |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.udemy.com/course/mta-networking-fundamentals-exam-microsoft-98-366/">https://www.udemy.com/course/mta-networking-fundamentals-exam-microsoft-98-366/</a> |
| 2 | <a href="https://onlinecourses.nptel.ac.in/noc21_cs18/preview">https://onlinecourses.nptel.ac.in/noc21_cs18/preview</a>                                                       |

**List of Practical/ Experiments:**

| Practical Number | Practical/ Experiment Topic                                                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                | Study of RJ45 and CAT6 Cabling and connection using crimping tool.                                                                                                  |
| 2                | Use basic networking commands in Linux (ping, tracer, nslookup, netstat, ARP,                                                                                       |
| 3                | Build a simple network topology and configure it for static routing protocol using packet tracer. Setup a network and configure IP addressing, subnetting, masking. |
| 4                | Design VPN and Configure RIP/OSPF using Packet tracer.                                                                                                              |
| 5                | Socket programming using TCP or UDP                                                                                                                                 |

|    |                                                                                                                                                                                                                                                                                                                                                                        |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | Perform Remote login using Telnet server                                                                                                                                                                                                                                                                                                                               |
| 7  | Perform File Transfer and Access using FTP                                                                                                                                                                                                                                                                                                                             |
| 8  | Use simulator (Eg. NS2) to understand functioning of ALOHA, CSMA/CD                                                                                                                                                                                                                                                                                                    |
| 9  | Study and Installation of Network Simulator (NS3)                                                                                                                                                                                                                                                                                                                      |
| 10 | <p>a. Set up multiple IP addresses on a single LAN.</p> <p>b. Using netstat and route commands of Linux, do the following:</p> <ul style="list-style-type: none"> <li>● View current routing table</li> <li>● Add and delete routes</li> <li>● Change default gateway</li> </ul> <p>c. Perform packet filtering by enabling IP forwarding using IPtables in Linux.</p> |

| Course Code: | Course Title                | Credit |
|--------------|-----------------------------|--------|
| BVCDFS102    | Cyber Security Fundamentals | 4      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                                                                                              |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | To introduce classical encryption techniques and concepts of modular arithmetic and number theory.                                                                           |
| 2 | To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms |
| 3 | To understand various cryptographic techniques.                                                                                                                              |
| 4 | To understand various security management issues                                                                                                                             |

**Course Outcomes: On successful completion of course, learner will be able to**

|   |                                                                                                                                                                          |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory |
| 2 | Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication                             |
| 3 | To understand security threats and vulnerabilities present in the system.                                                                                                |
| 4 | Apply different message digest and digital signature algorithms to verify integrity and achieve authentication and design secure applications                            |
| 5 | Analyze and apply system security concept to recognize malicious code.                                                                                                   |
| 6 | Understand and analyze various security management issues.                                                                                                               |

| Module   |     | Content                                                                                                                                                                              | Hrs       |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          |     | <b>Security Fundamentals</b>                                                                                                                                                         | <b>5</b>  |
|          | 1.1 | An Overview of Information Security: The Basic Components, Threats, Policy and Mechanism, Assumptions and Trust, Assurance, Operational Issues, Human Issues, Security nomenclature. |           |
|          | 1.2 | Access Control Matrix, Security Policies: Confidentiality, Integrity, Availability Policies and Hybrid Policies, OS Security                                                         |           |
| <b>2</b> |     | <b>Modular Arithmetic and Cryptography Basics</b>                                                                                                                                    | <b>10</b> |
|          | 2.1 | Modular Arithmetic: Modular Arithmetic Notations, Modular Arithmetic Operations, Euclid's method of finding GCD, The extended Euclid's algorithm.                                    |           |
|          | 2.2 | Cryptography : Classical encryption techniques, Block and Chain ciphers, Data Encryption Standard, Advanced Encryption Standard, RC5                                                 |           |

|          |     |                                                                                                                                                            |           |
|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>3</b> |     | <b>Security Threats and Vulnerabilities</b>                                                                                                                | <b>8</b>  |
|          | 3.1 | Overview of Security threats<br>Weak / Strong Passwords and Password Cracking<br>Insecure Network connections                                              |           |
|          | 3.2 | Malicious Code<br>Programming Bugs<br>Cybercrime and Cyber terrorism<br>Information Warfare and Surveillance                                               |           |
| <b>4</b> |     | <b>Cryptography / Encryption</b>                                                                                                                           | <b>8</b>  |
|          | 4.1 | Introduction to Cryptography/ Encryption Digital Signatures Public Key Infrastructure                                                                      |           |
|          | 4.2 | Applications of Cryptography Tools and techniques of Cryptography.                                                                                         |           |
| <b>5</b> |     | <b>Attacks, Malicious Logic and Countermeasures</b>                                                                                                        | <b>8</b>  |
|          | 5.1 | Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, DoS and DDoS, SQL injection, Buffer Overflow, Spyware, Adware and Ransomware |           |
|          | 5.2 | Antivirus and other security measures Intrusion Detection System: IDS fundamentals, Different types of IDS. Intrusion Prevention.                          |           |
| <b>6</b> |     | <b>Issues in Security Management</b>                                                                                                                       | <b>6</b>  |
|          | 6.1 | Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices.                              |           |
|          | 6.2 | Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.                                                   |           |
|          |     | <b>Total</b>                                                                                                                                               | <b>45</b> |

|                                      |                                                                                                                                                         |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>                    |                                                                                                                                                         |
| 1                                    | William Stallings: Computer Security: Principles and Practices, Pearson Publication, 6 <sup>th</sup> Edition.                                           |
| <b>References:</b>                   |                                                                                                                                                         |
| 1                                    | Nina Godbole: Cyber Security- Understanding Cyber Crimes, Wiley India Pvt. Ltd, Third Edition.                                                          |
| <b>Useful Links for E-resources:</b> |                                                                                                                                                         |
| 1                                    | <a href="https://www.udemy.com/course/complete-introduction-to-cybersecurity/">https://www.udemy.com/course/complete-introduction-to-cybersecurity/</a> |
| 2                                    | <a href="https://www.coursera.org/learn/cyber-security-fundamentals">https://www.coursera.org/learn/cyber-security-fundamentals</a>                     |
| 3                                    | <a href="https://onlinecourses.nptel.ac.in/noc23_cs127/preview">https://onlinecourses.nptel.ac.in/noc23_cs127/preview</a>                               |

|                             |
|-----------------------------|
| <b><u>Assessment:</u></b>   |
| <b>Internal Assessment:</b> |

Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour.

**End Semester Theory Examination:**

|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Question paper will comprise a total of six questions.                                                                                            |
| 2 | All question carries equal marks                                                                                                                  |
| 3 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4 | Only Four questions need to be solved.                                                                                                            |
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

**List of Practicals:**

| Serial No | Name of Practical                                                                                                                                                    |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | To implement Text Encryption Using Cryptographic Algorithms.                                                                                                         |
| 2         | To implement Key logger Software.                                                                                                                                    |
| 3         | To implement Image Encryption.                                                                                                                                       |
| 4         | To implement Password Strength Tester.                                                                                                                               |
| 5         | To implement Web-Based Facial Authentication System                                                                                                                  |
| 6         | Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, xmas scan etc. |
| 7         | Detect ARP spoofing using nmap and/or open-source tool ARPWATCH and wireshark. Use arping tool to generate gratuitous arps and monitor using wireshark.              |
| 8         | Simulate DOS attack using Hping, hping3 and other tools.                                                                                                             |
| 9         | Simulate buffer overflow attack using Ollydbg, Splint, Cpp check etc.                                                                                                |
| 10        | Setting up personal Firewall using iptables.                                                                                                                         |

| Course Code: | Course Title                          | Credit |
|--------------|---------------------------------------|--------|
| BVCDFS103    | Operating System and Network Security | 4      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                       |
|---|-----------------------------------------------------------------------|
| 1 | To introduce basic concepts and functions of operating systems.       |
| 2 | To understand the concept of process, thread and resource management. |
| 3 | To understand the concepts of process synchronization and deadlock.   |
| 4 | To understand various Memory, I/O and File management techniques.     |
| 5 | To Understand security concepts and terminologies in computer network |

**Course Outcomes: On successful completion of course, learner will be able to**

|   |                                                                                                      |
|---|------------------------------------------------------------------------------------------------------|
| 1 | Understand the objectives, functions and structure of OS                                             |
| 2 | Analyze the concept of process management and evaluate performance of process scheduling algorithms. |
| 3 | Understand and apply the concepts of synchronization and deadlocks                                   |
| 4 | Evaluate performance of Memory allocation and replacement policies                                   |
| 5 | Understand the concepts of file management                                                           |
| 6 | Understand security concepts and terminologies in computer network                                   |

| Module   |     | Content                                                                                                            | Hrs       |
|----------|-----|--------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> |     | <b>Operating system Overview</b>                                                                                   | <b>7</b>  |
|          | 1.1 | Introduction, Objectives, Functions and Evolution of Operating System.                                             |           |
|          | 1.2 | Operating system structures: Layered, Monolithic and Microkernel.                                                  |           |
|          | 1.3 | Linux Kernel, Shell and System Calls.                                                                              |           |
| <b>2</b> |     | <b>Process and Process Scheduling</b>                                                                              | <b>10</b> |
|          | 2.1 | Concept of a Process, Process States, Process Description, Process Control Block.                                  |           |
|          | 2.2 | Uniprocessor Scheduling-Types: Preemptive and Non-preemptive scheduling algorithms (FCFS, SJF, SRTN, Priority, RR) |           |
|          | 2.3 | Threads: Definition and Types, Concept of Multithreading                                                           |           |
| <b>3</b> |     | <b>Process Synchronization and Deadlocks</b>                                                                       | <b>10</b> |

|          |     |                                                                                                                                                                                               |           |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | 3.1 | Concurrency: Principles of Concurrency, Inter-Process Communication, Process Synchronization                                                                                                  |           |
|          | 3.2 | Mutual Exclusion: Requirements, Hardware Support (TSL), Operating System Support (Semaphores), Producer and Consumer problem                                                                  |           |
|          | 3.3 | Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem |           |
| <b>4</b> |     | <b>Memory Management</b>                                                                                                                                                                      | <b>7</b>  |
|          | 4.1 | Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation, TLB.   |           |
|          | 4.2 | Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing.                                                                                                    |           |
| <b>5</b> |     | <b>File Management</b>                                                                                                                                                                        | <b>5</b>  |
|          | 5.1 | Overview, File Organization and Access, File Directories, File Sharing                                                                                                                        |           |
| <b>6</b> |     | <b>Network security</b>                                                                                                                                                                       | <b>6</b>  |
|          | 6.1 | Security Concepts and Terminology.<br>TCP/IP and OSI Network Security.<br>Access Control Issues (Packet Filters, Firewalls).                                                                  |           |
|          |     | <b>Total</b>                                                                                                                                                                                  | <b>45</b> |

#### **Textbooks:**

- |   |                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------|
| 1 | William Stallings: Operating System: Internals and Design Principles, Prentice Hall, 2014 8 <sup>th</sup> Edition |
|---|-------------------------------------------------------------------------------------------------------------------|

#### **References:**

- |   |                                                                                                 |
|---|-------------------------------------------------------------------------------------------------|
| 1 | Abraham Silberschatz: Operating System Concept, John Wiley & Son, 2016 9 <sup>th</sup> Edition. |
|---|-------------------------------------------------------------------------------------------------|

#### **Useful Links for E-resources:**

- |   |                                                                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.udemy.com/course/operating-systems-from-scratch-part1/">https://www.udemy.com/course/operating-systems-from-scratch-part1/</a> |
| 2 | <a href="https://www.coursera.org/learn/-network-security">https://www.coursera.org/learn/-network-security</a>                                     |
| 3 | <a href="https://onlinecourses.nptel.ac.in/noc21_cs88/preview">https://onlinecourses.nptel.ac.in/noc21_cs88/preview</a>                             |

#### **Assessment:**

##### **Internal Assessment:**

Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour.

##### **End Semester Theory Examination:**

- |   |                                                        |
|---|--------------------------------------------------------|
| 1 | Question paper will comprise a total of six questions. |
|---|--------------------------------------------------------|



|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | All question carries equal marks                                                                                                                  |
| 3 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4 | Only Four questions need to be solved.                                                                                                            |
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

### **List of Practical/ Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b>                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                       | Explore usage of basic Linux Commands and system calls for file, directory and process management.<br>For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc.<br>system calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid. sort, grep, awk, etc.)                                                                                                             |
| 2                       | Linux shell script Write shell scripts to do the following:<br>a. Display OS version, release number, kernel version<br>b. Display top 10 processes in descending order<br>c. Display processes with highest memory usage.<br>d. Display current logged in user and log name.<br>Display current shell, home directory, operating system type, current path setting,<br>current working directory. |
| 3                       | a. Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system call.<br>b. Explore wait and waitpid before termination of process.                                                                                                                                                        |
| 4                       | a. Write a program to demonstrate the concept of non-preemptive scheduling algorithms.<br>b. Write a program to demonstrate the concept of preemptive scheduling algorithms.                                                                                                                                                                                                                       |
| 5                       | a. Write a C program to implement solution of Producer consumer problem through Semaphore                                                                                                                                                                                                                                                                                                          |
| 6                       | Implement IP Table Security                                                                                                                                                                                                                                                                                                                                                                        |
| 7                       | Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm                                                                                                                                                                                                                                                                                                        |
| 8                       | Write a program demonstrate the concept of Dining Philosopher's Problem                                                                                                                                                                                                                                                                                                                            |
| 9                       | Write a program to demonstrate the concept of MVT and MFT memory management techniques                                                                                                                                                                                                                                                                                                             |
| 10                      | Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc                                                                                                                                                                                                                                                                    |

**Program Structure for First Year B. Voc Cyber Security and Digital Forensics**  
**UNIVERSITY OF MUMBAI (With Effect from 2023-2024)**  
**Semester II**

| <b>Course Code:</b> | <b>Course Title</b>                  | <b>Credit</b> |
|---------------------|--------------------------------------|---------------|
| <b>BVCDFG201</b>    | <b>Business communication Ethics</b> | <b>4</b>      |

|                                                                                |                                                                                                                     |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: Professional Skill-I</b>                                      |                                                                                                                     |
| <b>Course Objectives:</b>                                                      |                                                                                                                     |
| 1                                                                              | To enhance effective communication and interpersonal skills.                                                        |
| 2                                                                              | To explain / defend his/her ideas to a single person or panel.                                                      |
| 3                                                                              | To develop creative and impactful presentation skills..                                                             |
| 4                                                                              | To understand the dynamics of business communication through group communication. required for career enhancement . |
| 5                                                                              | To develop analytical and logical skills for problem-solving.                                                       |
| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                     |
| 1                                                                              | 1. Prepare effective business/ technical documents apt for managerial roles in social and professional situations.  |
| 2                                                                              | Deliver effective business and technical presentations.                                                             |
| 3                                                                              | Develop life skills/interpersonal skills to build a confident personality.                                          |
| 4                                                                              | Develop creative thinking and problem solving attitude through group communication.                                 |
| 5                                                                              | Organize personal and professional skills to build an impressive professional image for internal or external        |
| 6                                                                              | Apply the trait of a successful professional with a charismatic personality.                                        |

| <b>Module</b> |     | <b>Content</b>                                                                                                                                                                                                                                                                                  | <b>Hrs</b> |
|---------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>1</b>      |     | <b>Writing Skills ( Part -II) A Report &amp; Proposal Writing</b>                                                                                                                                                                                                                               | <b>12</b>  |
|               | 1.1 | Report Writing: Objectives of Report Writing (on General Topics) Language and Style in a report Types: Informative and Interpretative (Analytical, Survey and Feasibility) and Formats of reports( Short Report) Proposal Writing :Short Proposal Writing : Objectives, formats, language style |            |
| <b>2</b>      |     | <b>Writing Skills ( Part -II) B Business/ Trade Letters</b>                                                                                                                                                                                                                                     | <b>6</b>   |
|               | 2.1 | Order credit and status Enquiry<br>Letters of inquiry, letter of complaints, Claim & adjustment letter<br>Sales Letter, promotional leaflets and fliers                                                                                                                                         |            |
| <b>3</b>      |     | <b>Presentation Skills</b>                                                                                                                                                                                                                                                                      | <b>6</b>   |
|               | 3.1 | Technical Presentation<br>Business Presentation.                                                                                                                                                                                                                                                |            |
| <b>4</b>      |     | <b>Introduction to Interpersonal Skills</b>                                                                                                                                                                                                                                                     | <b>8</b>   |

|  |     |                                                                                                                                                            |  |
|--|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | 4.1 | Emotional Intelligence,Leadership and Motivation,Team Building,Assertiveness<br>Conflict Resolution and Negotiation Skills,Time Management,Decision Making |  |
|--|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|   |     |                                                                                                                                                                      |           |
|---|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 5 |     | <b>Meetings and Documentation</b>                                                                                                                                    | 8         |
|   | 5.1 | Need & Importance of meeting , Conduct of meeting ,Strategies for conducting effective meetings,Notice, Agenda and Minutes of a meeting, Business meeting etiquettes |           |
| 6 |     | <b>Introduction to Business Ethics</b>                                                                                                                               | 5         |
|   |     | Concept & meaning, Importance of Business Ethics, Business Ethics & Media Computer Ethics, personal integrity at public place                                        |           |
|   |     | <b>Total</b>                                                                                                                                                         | <b>45</b> |

|                    |                                                                                                                               |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>  |                                                                                                                               |
| 1                  | Bové, C. L.& Thill, J. V, " <i>Business communication today</i> NJ: Pearson                                                   |
| 2                  | Ram Archana, " <i>Place Mentor, Tests of Aptitude for Placement Readiness</i> ", Oxford University Press                      |
| <b>References:</b> |                                                                                                                               |
| 1                  | Raman Meenakshi, Sharma Sangeeta. Technical Communication, Principles and Practice., Oxford University Press.                 |
| 2                  | Masters, L. A., Wallace, H. R., & Harwood, L., Personal development for life and work, Mason: South-Western Cengage Learning. |

|                                                                                                                                                                                                                                                          |                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>Assessment:</u></b>                                                                                                                                                                                                                                |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                              |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                                  |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                        | Question paper will comprise a total of six questions.                                                                                            |
| 2                                                                                                                                                                                                                                                        | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                        | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                        | Only Four questions need to be solved.                                                                                                            |
| 5                                                                                                                                                                                                                                                        | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

|                     |                                                                                                                                                                 |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Useful Links</b> |                                                                                                                                                                 |
| 1                   | <a href="https://www.ese.iitb.ac.in/sites/default/files/downloads/repot_guide.pdf">https://www.ese.iitb.ac.in/sites/default/files/downloads/repot_guide.pdf</a> |
| 2                   | <a href="https://www.spe.org/en/authors/resources/prepare-presentation">https://www.spe.org/en/authors/resources/prepare-presentation</a> .                     |
| 3                   | <a href="https://india.oup.com/productPage/5591038/7421214/9780198066217">https://india.oup.com/productPage/5591038/7421214/9780198066217</a>                   |
| 4                   | <a href="https://www.geektonight.com/business-meeting/">https://www.geektonight.com/business-meeting/</a>                                                       |

**Suggested List of Tutorials:**

| Sr. No | Topic                                                                 |
|--------|-----------------------------------------------------------------------|
| 1      | Report writing Or Proposal Writing ( Brief reports on general topics) |

|   |                                                          |
|---|----------------------------------------------------------|
| 2 | Letter writing                                           |
| 3 | Business Or Technical presentation                       |
| 4 | Public Speaking Activity                                 |
| 5 | Role Play & Model Building                               |
| 6 | Meetings Documentation ( Notice agenda & minutes writing |
| 7 | Case study on business/ corporate ethics                 |
| 8 | Group discussion & Debate                                |

| Course Code: | Course Title                | Credit |
|--------------|-----------------------------|--------|
| BVCDFG202    | Statistics for Data Science | 4      |

**Prerequisite: Applied Mathematics.**

**Course Objectives:**

- |   |                                                                                                                  |
|---|------------------------------------------------------------------------------------------------------------------|
| 1 | To build the fundamentals of data science.                                                                       |
| 2 | To build a classification model and interpret results.                                                           |
| 3 | To learn the intricacies of logistic regression, evaluate its outputs, and comprehend how a link function works. |
| 4 | To handle a data set to produce a specified set of results.                                                      |

**Course Outcomes: On the completion of the course, learners will be able to:**

- |   |                                                                                     |
|---|-------------------------------------------------------------------------------------|
| 1 | To be able to calculate probabilities for continuous and discrete random variables. |
| 2 | To understand the basics of statistics.                                             |
| 3 | To understand Bivariate statistics                                                  |
| 4 | To understand theory of sampling                                                    |
| 5 | To understand Test of significance                                                  |
| 6 | To understand Paired test, chi-square test for goodness of fit.                     |

| Module   |     | Content                                                                                                                                                                                                                                                         | Hrs       |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> |     | <b>Basic Probability</b>                                                                                                                                                                                                                                        | <b>8</b>  |
|          | 1.1 | Measures of Central tendency, Moments, skewness and Kurtosis,                                                                                                                                                                                                   |           |
|          | 1.2 | Binomial, Poisson and Normal distribution and evaluation of statistical parameters for these three distributions (Distribution functions, Mean and Variance).                                                                                                   |           |
| <b>2</b> |     | <b>Basic Statistics</b>                                                                                                                                                                                                                                         | <b>8</b>  |
|          | 2.1 | Measures of Central tendency, Moments, skewness and Kurtosis, Binomial, Poisson and Normal distribution and evaluation of statistical parameters for these three distributions (Distribution functions, Mean and Variance).                                     |           |
| <b>3</b> |     | <b>Bivariate Statistics</b>                                                                                                                                                                                                                                     | <b>10</b> |
|          | 3.1 | Correlation and Regression – Concepts of Correlation, Coefficient of Correlation, Rank correlation, Regression Analysis - linear & multivariable regression, Curve fitting by the method of least squares-fitting of straight lines, second degree polynomials. |           |
|          | 3.2 | Correlation and Regression – Concepts of Correlation, Coefficient of Correlation, Rank correlation, Regression Analysis - linear & multivariable regression, Curve fitting by the method of least squares-fitting of straight lines, second degree polynomials. |           |

|   |     |                                                                                                                                                                              |           |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 4 |     | <b>Sampling Theory</b>                                                                                                                                                       | 7         |
|   | 4.1 | Introduction to sampling distributions, Standard Normal Variate, Central Limit Theorem, standard error, Type-I and Type-II errors, estimation, confidence intervals.         |           |
| 5 |     | <b>Applied Statistics -I</b>                                                                                                                                                 | 7         |
|   | 5.1 | Test of significance: Large sample test for single mean, difference of means, and difference of standard deviations, Small samples test for single mean, difference of means |           |
| 6 |     | <b>Applied Statistics – II</b>                                                                                                                                               | 5         |
|   | 6.1 | Paired t-test, Chi-square test for goodness of fit and independence of attributes, Test for ratio of variances                                                               |           |
|   |     | <b>Total</b>                                                                                                                                                                 | <b>45</b> |

#### **Textbooks:**

|   |                                                                                                          |
|---|----------------------------------------------------------------------------------------------------------|
| 1 | S.C. Gupta & V.K. Kapoor, <i>“Fundamentals of Mathematical Statistics”</i> , Sultan Chand & Co.          |
| 2 | P. G. Hoel, S. C. Port and C. J. Ston, <i>“Introduction to Probability Theory”</i> , Universal BookStall |

#### **References:**

|   |                                                                                                                                   |
|---|-----------------------------------------------------------------------------------------------------------------------------------|
| 1 | Gareth James, Daniela Witten, Trevor Hastie, <i>“An Introduction to Statistical Learning: with Applications in R”</i> , Springer. |
| 2 | Ross, <i>“A First Course in Probability”</i> , Pearson Education India.                                                           |

#### **Useful Links**

|   |                                                                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.statisticssolutions.com/continuous-probability-distribution/">https://www.statisticssolutions.com/continuous-probability-distribution/</a> |
| 2 | <a href="https://nptel.ac.in/courses/111/106/111106112/">https://nptel.ac.in/courses/111/106/111106112/</a>                                                     |
| 3 | <a href="https://nptel.ac.in/courses/111/105/111105124/">https://nptel.ac.in/courses/111/105/111105124/</a>                                                     |
| 4 | <a href="https://www.youtube.com/watch?v=L-pQtGm3VS8">https://www.youtube.com/watch?v=L-pQtGm3VS8</a>                                                           |
| 5 | <a href="https://www.youtube.com/watch?v=vN5cNN2-HWE">https://www.youtube.com/watch?v=vN5cNN2-HWE</a>                                                           |

#### **Assessment:**

##### **Internal Assessment:**

Assessment consists of two class tests of 20 marks each. The first-class test is to be conducted when approx. 40% syllabus is completed and second-class test when additional 40% syllabus is completed. Duration of each test shall be one hour.

##### **End Semester Theory Examination:**

|   |                                                                                                                                                   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Question paper will comprise of total six questions.                                                                                              |
| 2 | All question carries equal marks                                                                                                                  |
| 3 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4 | Only Four question need to be solved.                                                                                                             |
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.                 |

#### **Suggested List of Practical/ Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b> |
|-------------------------|------------------------------------|
|-------------------------|------------------------------------|

|   |                                                                                      |
|---|--------------------------------------------------------------------------------------|
| 1 | Implement conditional probability and Bayes theorem                                  |
| 2 | Perform experiment to plot probabilities for continuous and discrete random variable |

|    |                                                                                                            |
|----|------------------------------------------------------------------------------------------------------------|
| 3  | Perform experiment to measure central tendency of a dataset                                                |
| 4  | Perform experiment to measure dispersion of a dataset                                                      |
| 5  | Perform experiment to calculate correlation between variables                                              |
| 6  | Implement Regression                                                                                       |
| 7  | Implement curve fitting optimization using SciPy package                                                   |
| 8  | Implement Sampling distributions                                                                           |
| 9  | Implement Statistical Significance tests                                                                   |
| 10 | Regression analysis on hours spent on internet and time spent to study on academic performance of students |



| Course Code: | Course Title                          | Credit |
|--------------|---------------------------------------|--------|
| BVCDFG203    | Digital Logic & Computer Architecture | 4      |

|                                                                                  |                                                                                                                      |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: No Prerequisite</b>                                             |                                                                                                                      |
| <b>Course Objectives:</b>                                                        |                                                                                                                      |
| 1                                                                                | To have the rough understanding of the basic structure and operation of basic digital circuits and digital computer. |
| 2                                                                                | To discuss in detail arithmetic operations in digital system.                                                        |
| 3                                                                                | To discuss generation of control signals and different ways of communication with I/O devices.                       |
| 4                                                                                | To study the hierarchical memory and principles of advanced computing.                                               |
| <b>Course Outcomes:</b> On successful completion of course, learner will be able |                                                                                                                      |
| 1                                                                                | To learn different number systems and basic structure of computer system.                                            |
| 2                                                                                | To demonstrate the arithmetic algorithms.                                                                            |
| 3                                                                                | To understand the basic concepts of digital components and processor organization.                                   |
| 4                                                                                | To understand the generation of control signals of computer.                                                         |
| 5                                                                                | To demonstrate the memory organization.                                                                              |
| 6                                                                                | To describe the concepts of parallel processing and different Buses                                                  |

| Module   |     | Content                                                                                                                                                                                   | Hrs      |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>1</b> |     | <b>Computer Fundamentals</b>                                                                                                                                                              | <b>8</b> |
|          | 1.1 | Introduction to Number System and Codes<br>Number Systems: Binary, Octal, Decimal, Hexadecimal,<br>Codes: Grey, BCD, Excess-3, ASCII, Boolean Algebra.                                    |          |
|          | 1.2 | Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR<br>Overview of computer organization and architecture.<br>Basic Organization of Computer and Block Level functional Units, Von-Neumann Model. |          |
| <b>2</b> |     | <b>Data Representation and Arithmetic algorithms</b>                                                                                                                                      | <b>6</b> |
|          | 2.1 | Binary Arithmetic: Addition, Subtraction, Multiplication, Division using Sign Magnitude, 1's and 2's compliment, BCD and Hex Arithmetic Operation.                                        |          |
|          | 2.2 | Booths Multiplication Algorithm, Restoring and Non-Restoring Division Algorithm.<br>IEEE-754 Floating point Representation.                                                               |          |

|          |     |                                                                                                                                      |           |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>3</b> |     | <b>Processor Organization and Architecture</b>                                                                                       | <b>10</b> |
|          | 3.1 | Introduction: Half adder, Full adder, MUX, DMUX, Encoder, Decoder (IC level). Introduction to Flip Flop: SR, JK, D, T (Truth table). |           |
|          | 3.2 | Register Organization, Instruction Formats, Addressing modes, Instruction Cycle, Interpretation and sequencing.                      |           |
| <b>4</b> |     | <b>Control Unit Design</b>                                                                                                           | <b>6</b>  |
|          | 4.1 | 4.1 Hardwired Control Unit: State Table Method, Delay Element Methods.                                                               |           |
|          | 4.2 | 4.2 Microprogrammed Control Unit: Micro Instruction-Format, Sequencing and execution, Micro operations, Examples of microprograms..  |           |

|   |     |                                                                                                                                                                                                         |           |
|---|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 5 |     | <b>Memory Organization</b>                                                                                                                                                                              | 7         |
|   | 5.1 | Introduction and characteristics of memory, Types of RAM and ROM, Memory Hierarchy, 2-level Memory Characteristic.                                                                                      |           |
|   | 5.2 | Cache Memory: Concept, locality of reference, Design problems based on mapping techniques, Cache coherence and write policies. Interleaved and Associative Memory.                                      |           |
| 6 |     | <b>Principles of Advanced Processor and Buses</b>                                                                                                                                                       | 8         |
|   | 6.1 | Basic Pipelined Data path and control, data dependencies, data hazards, branch hazards, delayed branch, and branch prediction, Performance measures-CPI, Speedup, Efficiency, throughput, Amdahl's law. |           |
|   | 6.2 | Flynn's Classification, Introduction to multicore architecture.<br>Introduction to buses: ISA, PCI, USB. Bus Contention and Arbitration.                                                                |           |
|   |     | <b>Total</b>                                                                                                                                                                                            | <b>45</b> |

|                     |                                                                                                                                                                                                                                         |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>   |                                                                                                                                                                                                                                         |
| 1                   | R. P. Jain, " <b>Modern Digital Electronic</b> ", McGraw-Hill Publication , Second Edition.                                                                                                                                             |
| 2                   | Andrew S. Tanenbaum " <b>Structured Computer Organization</b> ", Pearson Publication, 2nd Edition.                                                                                                                                      |
| <b>References:</b>  |                                                                                                                                                                                                                                         |
| 1                   | John P Hayes, " <b>Computer Architecture and Organization</b> ", McGraw-hill Publication Third Edition.                                                                                                                                 |
| 2                   | Malvino " <b>Digital computer Electronics</b> ", McGraw-Hill Publication, Third Edition, 2013.                                                                                                                                          |
| <b>Useful Links</b> |                                                                                                                                                                                                                                         |
| 1                   | <a href="https://www.coursera.org/learn/comparch">https://www.coursera.org/learn/comparch</a> .                                                                                                                                         |
| 2                   | <a href="https://nptel.ac.in/courses/106/103/106103068/">https://nptel.ac.in/courses/106/103/106103068/</a> .                                                                                                                           |
| 3                   | <a href="https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824">https://www.classcentral.com/course/swayam-computer-organization-and-architecture-a-pedagogical-aspect-9824</a> . |
| 4                   | <a href="https://www.edx.org/learn/computer-architecture">https://www.edx.org/learn/computer-architecture</a> .                                                                                                                         |

|                                                                                                                                                                                                                                                   |                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>Assessment:</u></b>                                                                                                                                                                                                                         |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                       |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                           |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                 | Question paper will comprise of total six questions.                                                                                              |
| 2                                                                                                                                                                                                                                                 | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                 | Only Four question need to be solved.                                                                                                             |
| 5                                                                                                                                                                                                                                                 | In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.                 |

**List of Practical/ Experiments:**

| Sr. No | Topic                                                       |
|--------|-------------------------------------------------------------|
| 1      | To verify the truth table of various logic gates using ICs. |
| 2      | To realize the gates using universal gates                  |
| 3      | Code conversion.                                            |
| 4      | To realize half adder and full adder.                       |
| 5      | To implement logic operation using MUX IC.                  |
| 6      | To implement logic operation decoder IC.                    |
| 7      | Study of flip flop IC.                                      |
| 8      | To implement ripple carry adder.                            |
| 9      | To implement carry look ahead adder.                        |
| 10.    | To implement Booth's algorithm.                             |
| 11     | To implement restoring division algorithm.                  |
| 12     | To implement non restoring division algorithm.              |
| 13     | To implement ALU design.                                    |

|                     |                           |               |
|---------------------|---------------------------|---------------|
| <b>Course Code:</b> | <b>Course Title</b>       | <b>Credit</b> |
| <b>BVCDFS201</b>    | <b>Python Programming</b> | <b>4</b>      |

**Prerequisite: Programming principles with C**

**Course Objectives:**

- |   |                                                           |
|---|-----------------------------------------------------------|
| 1 | Implementing data types, statement, operators and strings |
| 2 | Implementing OOPs concept in Python                       |
| 3 | To learn exception & file handling in Python.             |
| 4 | Connecting with databases                                 |

**Course Outcomes: On successful completion of course, learner will be able to**

- |   |                                                                                                   |
|---|---------------------------------------------------------------------------------------------------|
| 1 | Apply the concept of Program structure, Interactive Shell.                                        |
| 2 | To understand Data Structures and Program control flow,                                           |
| 3 | Apply the concept Functions and Modules & Packages for list manipulation and string manipulation. |
| 4 | Understand Classes & Objects for User Defined Data Type, Objects as Instances of Classes.         |
| 5 | Test Exception Handling & File Operations for Default Exception and Errors.                       |
| 6 | Apply the concept of Database, GUI & Turtle Programming.                                          |

| Module   |     | Content                                                                                                                                                                                                                                                                                                                        | Hrs       |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> |     | <b>Introduction to Python</b>                                                                                                                                                                                                                                                                                                  | <b>4</b>  |
|          | 1.1 | History & need of Python, Application of Python, Advantages of Python, Disadvantages of Python,                                                                                                                                                                                                                                |           |
|          | 1.2 | Installing Python, Program structure, Interactive Shell, Executable or script files, 1.3 User Interface or IDE Working with Interactive mode, Working with Script mode, 1.4 Python Character Set, Python Tokens, Keywords, Identifiers, Literals, Operators, Variables and Assignments, Input and Output in Python, DataTypes. |           |
| <b>2</b> |     | <b>Data Structures and Program control flow</b>                                                                                                                                                                                                                                                                                | <b>12</b> |
|          | 2.1 | Data Structures: String Manipulation, List Manipulation, Tuples and Dictionaries, Set and Frozenset.                                                                                                                                                                                                                           |           |
|          | 2.2 | Program Control Flow:                                                                                                                                                                                                                                                                                                          |           |
|          | 2.3 | Conditional Statements: if Statement, if-else Statement, if-elif Statement, Nested if Statements, Python Indentation.                                                                                                                                                                                                          |           |
|          | 2.4 | Looping and Iteration: For Loop, While Loop, Loop else Statement, Nested Loops, Break and Continue.                                                                                                                                                                                                                            |           |
|          | 2.5 | Range Function: Introduction to range(), Types of range() function, Use of range() function.                                                                                                                                                                                                                                   |           |
| <b>3</b> |     | <b>Functions and Modules &amp; Packages</b>                                                                                                                                                                                                                                                                                    | <b>6</b>  |

|  |     |                                                                                                                                                                                         |  |
|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | 3.1 | Built-In Functions: Introduction to Functions, Python Function Types, Structure of Python Functions, E.g. - map, zip, reduce, filter, any, chr, ord, sorted, globals, locals, all, etc. |  |
|--|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|          |     |                                                                                                                                                                                                                          |           |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | 3.2 | User Defined Functions: Structure of a Python Program w.r.t. UDF, Types of Functions, Invoking UDF, Flow of Execution, Arguments and Parameters, Default Arguments, Named Arguments, Scope of Variables, Lambda function |           |
|          | 3.3 | Recursion Function: Use of recursion function                                                                                                                                                                            |           |
|          | 3.4 | Modules & Packages: Importing Modules in Python Programs, Working with Random Modules, E.g. - builtins, os, time, datetime, calendar, sys, etc                                                                           |           |
| <b>4</b> |     | <b>Classes &amp; Objects</b>                                                                                                                                                                                             | <b>8</b>  |
|          | 4.1 | Introduction to OOP's: Procedural Vs Modular Programming, Object Oriented Programming, Data Abstraction, Data Hiding, Encapsulation, Modularity, Inheritance, Polymorphism                                               |           |
|          | 4.2 | Classes & Objects: Classes as User Defined Data Type, Objects as Instances of Classes, Creating Class and Objects, Creating Objects By Passing Values, Variables & Methods in a Class                                    |           |
| <b>5</b> |     | <b>Exception Handling &amp; File Operations</b>                                                                                                                                                                          | <b>8</b>  |
|          | 5.1 | Exception Handling: Default Exception and Errors, Catching Exceptions, Raise an exception, Try-except statement, Raise, Assert, Finally blocks, User defined exception.                                                  |           |
|          | 5.2 | File Operations: opening a file, Reading and Writing Files, Other file tools, Regular Expressions.                                                                                                                       |           |
| <b>6</b> |     | <b>Database, GUI &amp; Turtle Programming</b>                                                                                                                                                                            | <b>7</b>  |
|          | 6.1 | Database, GUI & Turtle Programming.                                                                                                                                                                                      |           |
|          | 6.2 | Database: Introduction to MySQL, PYMYSQL Connections, Executing queries, Transactions, Handling error.                                                                                                                   |           |
|          | 6.3 | GUI Programming: Introduction, Tkinter programming, Tkinter widgets, Frame, Button, Label, Entry<br>Turtle <b>Programming</b> : Introduction to Turtle, Controlling Turtle, Animation Programming                        |           |
|          |     | <b>Total</b>                                                                                                                                                                                                             | <b>45</b> |

| <b>Textbooks:</b>  |                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------|
| 1                  | Dr. R. Nageswara Rao: Core Python Programming, Dreamtech Press Wiley Publication, 2018 2 <sup>nd</sup> Edition. |
| 2                  | Zed A. Shaw: Learn Python 3 The Hard Way, Pearson Education, 2017 1 <sup>st</sup> Edition.                      |
| <b>References:</b> |                                                                                                                 |
| 1                  | Paul Barry: Head First Python: A Brain-Friendly Guide, Shroff/ O. Reilly, 2016 2 <sup>nd</sup> Edition.         |
| 2                  | Charles Dierbach: Introduction to Computer Science Using Python: A Computational                                |

|                                      |                                                                                                                                                                                                       |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | Problem-Solving Focus, Wiley Publication, 2012 1 <sup>st</sup> Edition.                                                                                                                               |
| <b>Useful Links for E-resources:</b> |                                                                                                                                                                                                       |
| 1                                    | <a href="https://www.tutorialspoint.com/python/python_basi_c_syntax.html">https://www.tutorialspoint.com/python/python_basi_c_syntax.html</a>                                                         |
| 2                                    | <a href="https://machinelearningmastery.com/machine-learning-in-python-step-by-step/">https://machinelearningmastery.com/machine-learning-in-python-step-by-step/</a>                                 |
| 3                                    | <a href="https://towardsdatascience.com/beginners-guide-to-machine-learning-with-python-b9ff35bc9c51">https://towardsdatascience.com/beginners-guide-to-machine-learning-with-python-b9ff35bc9c51</a> |

|                                                                                                                                                                                                                                                   |                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>Assessment:</u></b>                                                                                                                                                                                                                         |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                       |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                           |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                 | Question paper will comprise of total six questions.                                                                                              |
| 2                                                                                                                                                                                                                                                 | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                 | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                 | Only Four question need to be solved.                                                                                                             |
| 5                                                                                                                                                                                                                                                 | In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.                 |

**List of Practical/ Experiments:**

| Sr. No | Topic                                                                                           |
|--------|-------------------------------------------------------------------------------------------------|
| 1      | To implement Python program to check whether the given number is even or not.                   |
| 2      | To implement Python program to convert the temperature in degree centigrade to Fahrenheit       |
| 3      | Python program to find the area of a triangle whose sides are given                             |
| 4      | To Python program to find out the average of a set of integers                                  |
| 5      | Python program to find the product of a set of real numbers                                     |
| 6      | To implement Python program to find the circumference and area of a circle with a given radius. |
| 7      | Python program to check whether the given integer is a multiple of 5                            |
| 8      | To implement Python program to check whether the given integer is a multiple of both 5 and 7.   |
| 9      | To implement Python program to find the average of 10 numbers using while loop.                 |
| 10.    | To implement Python program to display the given integer in a reverse manner.                   |

|    |                                                                                             |
|----|---------------------------------------------------------------------------------------------|
| 11 | To implement Python program to find the geometric mean of n numbers.                        |
| 12 | To implement Python program to find the sum of the digits of an integer using a while loop. |
| 13 | To implement Python program to display all the multiples of 3 within the range 10 to 50.    |



| Course Code: | Course Title             | Credit |
|--------------|--------------------------|--------|
| BVCDFS202    | Web Application Security | 4      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                |
|---|------------------------------------------------------------------------------------------------|
| 1 | To reveal the underlying in web application.                                                   |
| 2 | To understand SSDLC for secure coding                                                          |
| 3 | To identify and aid in fixing any security vulnerabilities during the web development process. |
| 4 | To understand the security principles in developing a reliable web application.                |

**Course Outcomes: On successful completion of course, learner will be able to**

|   |                                                                                    |
|---|------------------------------------------------------------------------------------|
| 1 | Identify the vulnerabilities in the web applications.                              |
| 2 | Identify the various types of threats and mitigation measures of web applications. |
| 3 | Apply the security principles in developing a reliable web application.            |
| 4 | Use industry standard tools for web application security.                          |
| 5 | Apply penetration testing to improve the security of web applications.             |
| 6 | Detecting and responding to web application security incidents.                    |

| Module   |     | Content                                                           | Hrs       |
|----------|-----|-------------------------------------------------------------------|-----------|
| <b>1</b> |     | <b>Introduction to Web Application Security</b>                   | <b>6</b>  |
|          | 1.1 | Understanding the importance of web application security          |           |
|          | 1.2 | Overview of common web application vulnerabilities                |           |
|          | 1.3 | Introduction to secure coding practices                           |           |
| <b>2</b> |     | <b>Web Application Architecture and Technologies</b>              | <b>10</b> |
|          | 2.1 | Client-server architecture and web application components         |           |
|          | 2.2 | HTTP protocol and web application communication                   |           |
|          | 2.3 | Common web application technologies (HTML, CSS, JavaScript, etc.) |           |

|          |     |                                                                |           |
|----------|-----|----------------------------------------------------------------|-----------|
| <b>3</b> |     | <b>Secure Software Development Lifecycle (SDLC)</b>            | <b>7</b>  |
|          | 3.1 | Overview of the software development process.                  |           |
|          | 3.2 | Integrating security into the SDLC                             |           |
|          | 3.3 | Secure coding guidelines and best practices.                   |           |
| <b>4</b> |     | <b>Web Application Threats and Attacks</b>                     | <b>8</b>  |
|          | 4.1 | Injection attacks (SQL injection, OS command injection)        |           |
|          | 4.2 | Cross-Site Scripting (XSS) attacks                             |           |
|          | 4.3 | Cross-Site Request Forgery (CSRF) attacks                      |           |
|          | 4.4 | Session hijacking and session management vulnerabilities       |           |
| <b>5</b> |     | <b>Web Application Security Testing</b>                        | <b>8</b>  |
|          | 5.1 | Manual and automated security testing techniques               |           |
|          | 5.2 | Vulnerability scanning and penetration testing                 |           |
|          | 5.3 | Fuzzing and input validation techniques                        |           |
|          | 5.4 | Web application security assessment tools                      |           |
| <b>6</b> |     | <b>Web Application Security Incident Response</b>              | <b>6</b>  |
|          | 6.1 | Detecting and responding to web application security incidents |           |
|          | 6.2 | Incident handling and forensics                                |           |
|          | 6.3 | Incident response planning and coordination                    |           |
|          |     | <b>Total</b>                                                   | <b>45</b> |

|                                      |                                                                                                                                                                                                                               |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>                    |                                                                                                                                                                                                                               |
| 1                                    | Bryan Sullivan and Vincent Liu: Web Application Security: A Beginner's Guide, McGraw Hill LLC, 2011 1 <sup>st</sup> Edition                                                                                                   |
|                                      | Prakhar Prasad: Mastering Modern Web Penetration Testing, Packt Publishing, 2016 1 <sup>st</sup> Edition.                                                                                                                     |
| <b>References:</b>                   |                                                                                                                                                                                                                               |
| 1                                    | Mark Dowd: The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities, Addison-Wesley Professional, 2006 1 <sup>st</sup> Edition.                                                           |
| <b>Useful Links for E-resources:</b> |                                                                                                                                                                                                                               |
| 1                                    | <a href="https://onlinecourses.nptel.ac.in/noc23_cs32/preview">https://onlinecourses.nptel.ac.in/noc23_cs32/preview</a>                                                                                                       |
| 2                                    | <a href="https://www.coursera.org/projects/googlecloud-securing-web-applications-with-web-security-scanner-uqqj1">https://www.coursera.org/projects/googlecloud-securing-web-applications-with-web-security-scanner-uqqj1</a> |

|   |                                                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | <a href="https://www.coursera.org/learn/codio-data-security-for-web-developers">https://www.coursera.org/learn/codio-data-security-for-web-developers</a> |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                           |                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><u>Assessment:</u></b>                                                                                                                                                                                                                                 |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                               |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                                   |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                         | Question paper will comprise a total of six questions.                                                                                            |
| 2                                                                                                                                                                                                                                                         | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                         | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                         | Only Four questions need to be solved.                                                                                                            |
| 5                                                                                                                                                                                                                                                         | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

### **List of Practical/ Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b>                         |
|-------------------------|------------------------------------------------------------|
| 1                       | Recon for bug hunting                                      |
| 2                       | Advanced SQL Injection                                     |
| 3                       | Command Injection                                          |
| 4                       | Session Management and Broken Authentication Vulnerability |
| 5                       | CSRF - Cross-Site Request Forgery                          |
| 6                       | SSRF - Server Site Request Forgery                         |
| 7                       | XSS - Cross-Site Scripting                                 |
| 8                       | IDOR - Insecure Direct Object Reference                    |
| 9                       | Sensitive Data Exposure and Information Disclose           |

|    |                                       |
|----|---------------------------------------|
| 10 | SSTI - Server Site Template Injection |
| 11 | Case Studies                          |

| Course Code: | Course Title                     | Credit |
|--------------|----------------------------------|--------|
| BVCDFS203    | Database Management and Security | 4      |

|                                                                                     |                                                                                                                       |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Prerequisite: No Prerequisite</b>                                                |                                                                                                                       |
| <b>Course Objectives:</b>                                                           |                                                                                                                       |
| 1                                                                                   | The role of security in the design and implementation of databases                                                    |
| 2                                                                                   | Use best practices for data input, output, and encryptions                                                            |
| 3                                                                                   | Maintain database management systems, including conducting security audits and keeping software updated.              |
| <b>Course Outcomes: On successful completion of course, learner will be able to</b> |                                                                                                                       |
| 1                                                                                   | Master the basic concepts and appreciate the applications of database systems.                                        |
| 2                                                                                   | Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.     |
| 3                                                                                   | Master sound design principles for logical design of databases, including the E- R method and normalization approach. |
| 4                                                                                   | To understand Database Security Fundamentals.                                                                         |
| 5                                                                                   | To understand Database Access Control and Privileges.                                                                 |
| 6                                                                                   | To understand Emerging Trends in Database Security.                                                                   |

| Module   |     | Content                                                   | Hrs      |
|----------|-----|-----------------------------------------------------------|----------|
| <b>1</b> |     | <b>Introduction to Database Management Systems (DBMS)</b> | <b>6</b> |
|          | 1.1 | Overview of DBMS concepts and architecture                |          |
|          | 1.2 | Relational database model and relational algebra          |          |
|          | 1.3 | Data models and database design principles                |          |
| <b>2</b> |     | <b>SQL and Database Querying</b>                          | <b>8</b> |
|          | 2.1 | Structured Query Language (SQL) fundamentals              |          |
|          | 2.2 | Data definition and manipulation using SQL                |          |
|          | 2.3 | Query optimization and performance tuning                 |          |

|          |     |                                                  |           |
|----------|-----|--------------------------------------------------|-----------|
| <b>3</b> |     | <b>Database Design and Normalization</b>         | <b>8</b>  |
|          | 3.1 | Entity-Relationship (ER) modeling                |           |
|          | 3.2 | Functional dependencies and normalization        |           |
|          | 3.3 | De normalization and trade-offs                  |           |
| <b>4</b> |     | <b>Database Security Fundamentals</b>            | <b>6</b>  |
|          | 4.1 | Security models and access control mechanisms    |           |
|          | 4.2 | Security models and access control mechanism     |           |
|          | 4.3 | User authentication and authorization            |           |
| <b>5</b> |     | <b>Database Access Control and Privileges</b>    | <b>12</b> |
|          | 5.1 | Granting and revoking user privileges            |           |
|          | 5.2 | Role-based access control (RBAC)                 |           |
|          | 5.3 | Fine-grained access control                      |           |
| <b>6</b> |     | <b>Emerging Trends in Database Security</b>      | <b>5</b>  |
|          | 6.1 | Cloud databases and security considerations      |           |
|          | 6.2 | Big Data and NoSQL databases security challenges |           |
|          | 6.3 | Privacy and data protection in databases         |           |
|          |     | <b>Total</b>                                     | <b>45</b> |

|                                      |                                                                                                                                               |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Textbooks:</b>                    |                                                                                                                                               |
| 1                                    | Avi Silberschatz , Henry F. Korth , and S. Sudarshan: Database System Concepts, McGraw-Hill, 2019 Seventh Edition.                            |
| 2                                    | Raghu Ramakrishnan: Database Management Systems, McGraw- Hill, 2014 3 <sup>rd</sup> Edition.                                                  |
| <b>References:</b>                   |                                                                                                                                               |
| 1                                    | Thomas Connolly and Carolyn Begg: Database Systems: Design, Implementation, and Management, Pearson Publication, 2019 6 <sup>th</sup> Edition |
| <b>Useful Links for E-resources:</b> |                                                                                                                                               |
| 1                                    | <a href="https://onlinecourses.nptel.ac.in/noc21_cs04/preview">https://onlinecourses.nptel.ac.in/noc21_cs04/preview</a>                       |
| 2                                    | <a href="https://www.coursera.org/learn/database-management">https://www.coursera.org/learn/database-management</a>                           |

|                                                                                                                                                                                                                                                           |                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Assessment:</b>                                                                                                                                                                                                                                        |                                                                                                                                                   |
| <b>Internal Assessment:</b>                                                                                                                                                                                                                               |                                                                                                                                                   |
| Assessment consists of two class tests of 20 marks each. The first -class test is to be conducted when approx. 40% syllabus is completed and the second-class test when an additional 40% syllabus is completed. Duration of each test shall be one hour. |                                                                                                                                                   |
| <b>End Semester Theory Examination:</b>                                                                                                                                                                                                                   |                                                                                                                                                   |
| 1                                                                                                                                                                                                                                                         | Question paper will comprise a total of six questions.                                                                                            |
| 2                                                                                                                                                                                                                                                         | All question carries equal marks                                                                                                                  |
| 3                                                                                                                                                                                                                                                         | Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3) |
| 4                                                                                                                                                                                                                                                         | Only Four questions need to be solved.                                                                                                            |
| 5                                                                                                                                                                                                                                                         | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.               |

**List of Practical/ Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b>                                              |
|-------------------------|---------------------------------------------------------------------------------|
| 1                       | To study and execute the DDL commands in RDBMS.                                 |
| 2                       | To study DML commands in RDBMS.                                                 |
| 3                       | To implement PL/SQL program using control structures, procedures and functions. |
| 4                       | To study and execute Triggers in RDBMS.                                         |
| 5                       | Implementation of views                                                         |
| 6                       | To create queries using Procedures.                                             |
| 7                       | To implement RDBMS using JDBC connectivity.                                     |
| 8                       | Granting and revoking user privileges                                           |

|    |                                               |
|----|-----------------------------------------------|
| 9  | To implement Role-based access control (RBAC) |
| 10 | To Demonstrate Fine-grained access control    |
| 11 | Course Case Study/Project                     |



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G-14(N)

## Appendix B

**Justification for  
B. Voc. (Cyber Security and Digital Forensics)**

|    |                                                                                                                                  |                                                                                                                           |
|----|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 1. | Necessity for starting the course:                                                                                               | As per government mandate skill based course need to be promoted.                                                         |
| 2. | Whether the UGC has recommended the course:                                                                                      | AICTE has recommended skill based course to be promoted on higher and technical institute to support vikshit bharat 2047, |
| 3. | Whether all the courses have commenced from the academic year 2023-24                                                            | yes                                                                                                                       |
| 4. | The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?: | Course start by Affiliated college.                                                                                       |
| 5. | To give details regarding the duration of the Course and is it possible to compress the course?:                                 | 3 years no compress is not possible.                                                                                      |
| 6. | The intake capacity of each course and no. of admissions given in the current academic year:                                     | Intake 30, no. of admission 14                                                                                            |
| 7. | Opportunities of Employability / Employment available after undertaking these courses:                                           | The skill based course on ICT infrastructure and hence opportunity of employability is very high.                         |



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