

# University of Mumbai



क्र. एएएमएस\_मुजीएस/आयसीसी/२०२४-२५/१७२

परिपत्रक :-

सर्व प्राचार्य/संचालक, संलग्नीत महाविद्यालये/संस्था, विद्यापीठ शैक्षणिक विभागाचे संचालक/विभाग प्रमुख यांना कळविण्यात येते की, राष्ट्रीय शैक्षणिक धोरण, २०२० च्या अमलबजावणीच्या अनुषंगाने शैक्षणिक वर्ष २०२४-२५ पासून एक्झिट पर्याय सह पदवी व पदव्युत्तर अभ्यासक्रमासाठी तयार करण्यात आलेले अभ्यासक्रम खालीलप्रमाणे :-

| बाब क्र. | अभ्यासक्रमाचे नाव                                   |
|----------|-----------------------------------------------------|
| 5.9 (N)  | M.A. (Marathi) for University Department of Marathi |
| 6.19 (N) | Master of Computer Application                      |
| 6.24 (N) | B.Voc. (Cyber Security and Digital Forensics)       |

सदर अभ्यासक्रम मुंबई विद्यापीठाच्या [www.mu.ac.in](http://www.mu.ac.in) या संकेतस्थळावर NEP 2020 या टॅब वर उपलब्ध करण्यात आलेले आहेत.

मुंबई - ४०० ०३२  
०१ ऑक्टोबर, २०२४

  
डॉ. प्रसाद कारंडे  
कुलसचिव

प्रत माहिती व उचित कार्यवाहीकरीता रवाना :-

१. मा. कुलगुरू यांचे स्वीय सहायक, मुंबई विद्यापीठ, फोर्ट, मुंबई.
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४. संचालक, विद्यापीठ विकास मंडळ,
५. संचालक, परीक्षा व मुल्यमापन मंडळ,
६. संचालक, माहिती आणि संप्रेषण तंत्रज्ञान विभाग,
७. उपकुलसचिव, महाविद्यालय संलग्नता आणि विकास विभाग,
८. उपकुलसचिव, निवडणुक विभाग,
९. उपकुलसचिव, पात्रता व स्थलांतर प्रमाणपत्र विभाग.
१०. उपकुलसचिव, निकाल कक्ष.

| <b>Copy forwarded for information and necessary action to :-</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>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>                                                                                                     |
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| 12                                                               | The Deputy Registrars, Finance & Accounts Section, fort<br><a href="mailto:draccounts@fort.mu.ac.in">draccounts@fort.mu.ac.in</a>                                                                                                                                              |
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| 14                                                               | The Assistant Registrar, Administrative Sub-Campus Thane,<br><a href="mailto:thanesubcampus@mu.ac.in">thanesubcampus@mu.ac.in</a>                                                                                                                                              |
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| 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 | <b>Faculty of Humanities,</b><br><b>Offg. Dean</b><br>1. Prof.Anil Singh<br><a href="mailto:Dranilsingh129@gmail.com">Dranilsingh129@gmail.com</a><br><b>Offg. Associate Dean</b><br>2. Prof.Manisha Karne<br><a href="mailto:mkarne@economics.mu.ac.in">mkarne@economics.mu.ac.in</a><br>3. Dr.Suchitra Naik<br><a href="mailto:Naiksuchitra27@gmail.com">Naiksuchitra27@gmail.com</a>                                                                                                                                                                    |
|   | <b>Faculty of Commerce &amp; Management,</b><br><b>Offg. Dean,</b><br>1 Prin.Ravindra Bambardekar<br><a href="mailto:principal@model-college.edu.in">principal@model-college.edu.in</a><br><b>Offg. Associate Dean</b><br>2. Dr.Kavita Laghate<br><a href="mailto:kavitalaghate@jbims.mu.ac.in">kavitalaghate@jbims.mu.ac.in</a><br>3. Dr.Ravikant Balkrishna Sangurde<br><a href="mailto:Ravikant.s.@somaiya.edu">Ravikant.s.@somaiya.edu</a><br>4. Prin.Kishori Bhagat<br><a href="mailto:kishoribhagat@rediffmail.com">kishoribhagat@rediffmail.com</a> |

|   |                                                                                                                                                                                                                                                                                                                                                                                                      |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>Faculty of Science &amp; Technology</b><br><b>Offg. Dean</b><br>1. Prof. Shivram Garje<br><a href="mailto:ssgarje@chem.mu.ac.in">ssgarje@chem.mu.ac.in</a><br><b>Offg. 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>Offg. Dean</b><br>1. Dr. Anil K. Singh<br><a href="mailto:aksingh@trcl.org.in">aksingh@trcl.org.in</a><br><b>Offg. Associate Dean</b><br>2. Prin. Chadrashekhhar Ashok Chakradeo<br><a href="mailto:cachakradeo@gmail.com">cachakradeo@gmail.com</a><br>3. Dr. Kunal Ingle<br><a href="mailto:drkunalingle@gmail.com">drkunalingle@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>                                                                                                                                                                                                                                                                                  |
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| 6 | The Director, Department of Information & Communication Technology,<br><a href="mailto:director.dict@mu.ac.in">director.dict@mu.ac.in</a>                                                                                                                                                                                                                                                            |

# As Per NEP 2020

## University of Mumbai



### Title of the program

- A- U.G. Certificate in Cyber Security and Digital Forensics
- B- U.G. Diploma in Cyber Security and Digital Forensics
- C- B.Voc. (Cyber Security and Digital Forensics)
- D- B.Voc. ( Hons.) in Cyber Security and Digital Forensics

### Syllabus for

### Semester – Sem I & II

Ref: GR dated 04<sup>th</sup> July, 2023 for Credit Structure of UG

(with effect from the academic year 2024-25 Progressively)  
(As per AICTE & NEP 2020 Guidelines)

# University of Mumbai



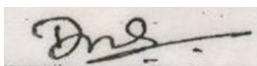
(As per NEP 2020)

| Sr. No. | Heading                                             | Particulars                                                                                                              |                                                                                                                                                   |
|---------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>Title of program</b><br>O: <u>TVU – 501 A</u>    | <b>A</b>                                                                                                                 | U.G. Certificate in Cyber Security and Digital Forensics                                                                                          |
|         | O: <u>TVU – 501 B</u>                               | <b>B</b>                                                                                                                 | U.G. Diploma in Cyber Security and Digital Forensics                                                                                              |
|         | O: <u>TVU – 501 C</u>                               | <b>C</b>                                                                                                                 | B.Voc. (Cyber Security and Digital Forensics)                                                                                                     |
|         | O: <u>TVU – 501 D</u>                               | <b>D</b>                                                                                                                 | B.Voc. (Hons.) in Cyber Security and Digital Forensics                                                                                            |
| 2       | <b>Eligibility</b><br>O: <u>TVU – 502A</u>          | <b>A</b>                                                                                                                 | A Student should have Passed the 10+2 examination and the Government of Maharashtra State Circular <b>OR</b> Passed Equivalent Academic Level 4.0 |
|         | O: <u>TVU – 502B</u>                                | <b>B</b>                                                                                                                 | Under Graduate Certificate in Cyber Security and Digital Forensics <b>OR</b> Passed Equivalent Academic Level 4.5                                 |
|         | O: <u>TVU – 502C</u>                                | <b>C</b>                                                                                                                 | Under Graduate Diploma in Cyber Security and Digital Forensics <b>OR</b> Passed Equivalent Academic Level 5.0                                     |
|         | O: <u>TVU – 502D</u>                                | <b>D</b>                                                                                                                 | Bachelors of Cyber Security and Digital Forensics with minimum CGPA of 7.5 <b>OR</b> Passed Equivalent Academic Level 5.5                         |
| 3       | <b>Duration of program</b><br>R: <u>TVU – 501</u>   | <b>A</b>                                                                                                                 | One Year                                                                                                                                          |
|         |                                                     | <b>B</b>                                                                                                                 | Two Years                                                                                                                                         |
|         |                                                     | <b>C</b>                                                                                                                 | Three Years                                                                                                                                       |
|         |                                                     | <b>D</b>                                                                                                                 | Four Years                                                                                                                                        |
| 4       | <b>Intake Capacity</b><br>R: <u>TVU – 502</u>       |                                                                                                                          |                                                                                                                                                   |
| 5       | <b>Scheme of Examination</b><br>R: <u>TVU – 503</u> | NEP<br>40% Internal<br>60% External, Semester End Examination<br>Individual Passing in Internal and External Examination |                                                                                                                                                   |

|    |                                                                                         |                             |                |
|----|-----------------------------------------------------------------------------------------|-----------------------------|----------------|
| 6  | R: <u>TVU – 504</u><br>Standards of Passing                                             | 40%                         |                |
| 7  | Credit Structure<br>Sem. I - R: <u>TVU – 505A</u><br>Sem. II -R: <u>TVU – 505B</u>      | Attached herewith           |                |
|    | Credit Structure<br>Sem. III - R: <u>TVU - 505C</u><br>Sem. IV - R: <u>TVU - 505D</u>   |                             |                |
|    | Credit Structure<br>Sem. V - R: <u>TVU - 505E</u><br>Sem. VI - R: <u>TVU - 505F</u>     |                             |                |
|    | Credit Structure<br>Sem. VII - R: <u>TVU - 505G</u><br>Sem. VIII - R: <u>TVU - 505H</u> |                             |                |
| 8  | Semesters                                                                               | A                           | Sem I & II     |
|    |                                                                                         | B                           | Sem III & IV   |
|    |                                                                                         | C                           | Sem V & VI     |
|    |                                                                                         | D                           | Sem VII & VIII |
| 9  | Program Academic Level                                                                  | A                           | 4.5            |
|    |                                                                                         | B                           | 5.0            |
|    |                                                                                         | C                           | 5.5            |
|    |                                                                                         | D                           | 6.0            |
| 10 | Pattern                                                                                 | Semester                    |                |
| 11 | Status                                                                                  | New                         |                |
| 12 | To be implemented from Academic Year Progressively                                      | From Academic Year: 2024-25 |                |



Sign of the BOS  
Chairman  
Dr. Vaishali D. Khairnar  
BOS in IT,  
University of Mumbai



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



Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science and  
Technology  
University of Mumbai

# Preamble

To meet the challenge of ensuring excellence and NEP 2020 policy in bachelor of vocational education, the issue of quality needs to be addressed, debated, and taken forward systematically. Accreditation is the principal means of quality assurance in higher education. The major emphasis of the accreditation process is to measure the outcomes of the program that is being accredited. In line with this, the Faculty of Science and Technology (in particular Bachelor of Vocational Courses) of the University of Mumbai has taken the lead in incorporating the philosophy of NEP 2020 education in the process of curriculum development.

The First Year Bachelor of Vocational course is a broad foundation training program to impart scientific and logical thinking Training to learners in general with a choice of course selection in the Basic sciences, Engineering Sciences, and Skill Components. Simultaneously NEP- 2020 objectives demand nurturing the basic skills required for familiarizing within the respective chosen Branch of Vocational Courses by the learner. Keeping this in view, a pool of courses is offered in Basic sciences covering fundamentals required to understand modern vocational skills practices and emerging trends in engineering and technology. Considering the change in pedagogy and the convenience of the stress-free learning process, in the course work under heads of Vocational Sciences, a choice-based subject pool is offered in the second semester. Essentially to give a glimpse of trends in the industry under vocational skill practices, the pool is offered to nurture and develop creative skills in contemporary industrial practices. Criteria met in the structure is the opportunity for learners to choose the course of their interest in all disciplines.

Basic sciences cover Applied Mathematics and Professional Skills where a pool of subjects is given for selection, the rationale for the same is that generalized basic science courses are not feasible from learners' point of view. Considering the present scenario, diverse choices need to be made available to fulfill the expectation of a learner to aspire for a career in the field of current trends of Professional Skills, Technology, and interdisciplinary research. Ability enhancement can be achieved in Undergraduate training by giving an objective viewpoint to the learning process and transitioning a learner from a rote learner to a creative professional, for the purpose Design Thinking is introduced in the First Semester to orient a journey learner to become a skilled professional. Considering the NEP-2020 structure of award of Certificate & Diploma at multiple exit-point pools of Vocational skills is arranged for giving exposure to the current Industry practices.

Faculty resolved that course objectives and course outcomes are to be clearly defined for every course so that all faculty members in affiliated higher education institutes understand the depth and approach of the course to be taught, which will enhance the learner's learning process. NEP 2020 grading system enables a much-required shift in focus from teacher-centric to continuous-based learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. Credit assignment for courses is based on a 15-week teaching-learning process for NEP 2020, however, the content of courses is to be taught in 12-13 weeks and the remaining 2-3 weeks are to be utilized for revision, tutorial, guest lectures, coverage of content beyond the syllabus, etc.

There was a concern that in the present system, the first-year syllabus must not be heavily loaded to the learner and it is of utmost importance that the learner entering into the first year of a vocational course should feel at ease by lowering the burden of syllabus and credits. This is necessary for a learner to get accustomed to the new environment of a college and to create a bond between the teacher and the learner. The present curriculum will be implemented for the First Year Bachelor of Vocational from the academic year 2024-25. Subsequently, this system will be carried forward for Second Year Bachelor of Vocational in the academic year 2025-26, and for Third Year and Final Year Bachelor of Vocational in the academic years 2026-27, and 2027-28, respectively.



## 1) Credit Structure of the Program (Sem I, II)

### Under Graduate Certificate in (Cyber Security and Digital Forensics) Credit Structure (Sem. I & II)

| Level | Semester | Major     |           | Minor | OE | VSC, SEC<br>(VSEC) | AEC, VEC, IKS |         | OJT, FP, CEP, CC,RP |   | Cum . Cr. / Sem. | Degree/ Cum. Cr.  |    |
|-------|----------|-----------|-----------|-------|----|--------------------|---------------|---------|---------------------|---|------------------|-------------------|----|
|       |          | Mandatory | Electives |       |    |                    |               |         |                     |   |                  |                   |    |
| 4.5   | I        | GBSC102   | 3         |       | -  |                    |               | 3       | SCC104              | 2 | 22               | UG Certificate 44 |    |
|       |          | SESC101   | 4         |       |    |                    | GAEC101       |         |                     |   |                  |                   |    |
|       |          | SPESC102  | 4         |       |    |                    | GVSEC103      | 2       |                     |   |                  |                   |    |
|       |          | SESC103   | 4         |       |    |                    |               |         |                     |   |                  |                   |    |
|       | II       | GBSC202   | 3         |       |    | GVS EC2 01         | 3             | GIKS203 | 2                   |   |                  |                   | 22 |
|       |          | SPCC201   | 4         |       |    |                    |               |         |                     |   |                  |                   |    |
|       |          | SESC202   | 4         |       |    |                    |               |         |                     |   |                  |                   |    |
|       |          | SESC203   | 4         |       |    |                    |               |         |                     |   |                  |                   |    |
|       |          | SCC204    | 2         |       |    |                    |               |         |                     |   |                  |                   |    |
|       | Cum Cr.  |           |           |       |    |                    |               |         |                     |   | 44               |                   |    |

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

## 2) Credit Structure of the Program (Sem III, IV)

### Under Graduate Diploma in (Cyber Security and Digital Forensics) Credit Structure (Sem. III & IV)

| Level | Semester | Major     |           | Minor | OE | VSC, SEC<br>(VSEC) | AEC, VEC, IKS |   | OJT, FP, CEP, CC,RP |         | Cum. Cr. / Sem. | Degree/ Cum. Cr. |    |                   |    |  |
|-------|----------|-----------|-----------|-------|----|--------------------|---------------|---|---------------------|---------|-----------------|------------------|----|-------------------|----|--|
|       |          | Mandatory | Electives |       |    |                    |               |   |                     |         |                 |                  |    |                   |    |  |
| 5.0   | III      | GHSSM301  | 3         |       | -  | SOE303             | 4             |   | GVEC302             | 3       | SCC304          | 2                | 22 | UG Certificate 44 |    |  |
|       |          | GPCC303   | 2         |       |    |                    |               |   |                     |         |                 |                  |    |                   |    |  |
|       |          | SPCC301   | 4         |       |    |                    |               |   |                     |         |                 |                  |    |                   |    |  |
|       |          | SPCC302   | 4         |       |    |                    |               |   |                     |         |                 |                  |    |                   |    |  |
|       | IV       | GPCC402   | 3         |       |    |                    | SVSEC402      | 4 |                     | GAEC401 | 2               | SCC404           | 2  |                   | 22 |  |
|       |          | GPCC403   | 3         |       |    |                    |               |   |                     | SVEC403 | 4               |                  |    |                   |    |  |
|       |          | SPCC401   | 4         |       |    |                    |               |   |                     |         |                 |                  |    |                   |    |  |
|       | Cum Cr.  |           |           |       |    |                    |               |   |                     |         |                 | 44               |    |                   |    |  |

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

### 3) Credit Structure of the Program (Sem V, VI)

#### Bachelor of Vocational in (Cyber Security and Digital Forensics)

#### Credit Structure (Sem. V & VI)

| Level                                                                                      | Semester | Major     |   |           |        | Minor  |   | OE | VSC, SEC<br>(VSEC) |   | AEC, VEC, IKS |   | OJT,<br>FP,<br>CEP,<br>CC, RP |                             | Cum<br>. Cr.<br>/<br>Sem. | Degree/<br>Cum. Cr. |
|--------------------------------------------------------------------------------------------|----------|-----------|---|-----------|--------|--------|---|----|--------------------|---|---------------|---|-------------------------------|-----------------------------|---------------------------|---------------------|
|                                                                                            |          | Mandatory |   | Electives |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
| 5.5                                                                                        | V        | GPCC501   | 3 |           | GMD502 | 3      |   |    |                    |   | SCC504        | 2 | 22                            | UG<br><br>Certificate<br>44 |                           |                     |
|                                                                                            |          | GPCC503   | 2 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SPCC501   | 4 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SPCC502   | 4 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SPEC503   | 4 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            | VI       | GPCC602   | 3 |           |        | SMD603 | 4 |    | GVSEC601           | 3 |               |   |                               | 22                          |                           |                     |
|                                                                                            |          | GPCC603   | 2 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SPCC601   | 4 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SPEC602   | 4 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            |          | SCC604    | 2 |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |
|                                                                                            | Cum Cr.  |           |   |           |        |        |   |    |                    |   |               |   |                               |                             | 44                        |                     |
| Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor |          |           |   |           |        |        |   |    |                    |   |               |   |                               |                             |                           |                     |

### 4) Credit Structure of the Program (Sem VII, VIII)

#### B.Voc. ( Hons.) in (Cyber Security and Digital Forensics)

#### Credit Structure (Sem. VII & VIII)

| Level | Semester | Major     |           | Minor | OE | VSC, SEC<br>(VSEC) | AEC, VEC, IKS | OJT, FP, CEP, CC, RP | Cum . Cr. / Sem. | Degree/ Cum. Cr. |
|-------|----------|-----------|-----------|-------|----|--------------------|---------------|----------------------|------------------|------------------|
|       |          | Mandatory | Electives |       |    |                    |               |                      |                  |                  |
| 6.0   | VII      | MRP701    | 10        | -     |    |                    |               |                      | 20               | UG               |
|       |          | MIP702    | 10        |       |    |                    |               |                      |                  |                  |
|       | VIII     | OJT801    | 20        |       |    |                    |               |                      | 20               | Certificate 40   |
|       | Cum Cr.  |           |           |       |    |                    |               |                      | 40               |                  |
|       |          |           |           |       |    |                    |               |                      |                  |                  |

[Abbreviation - OE – Open Electives, VSC – Vocation Skill Course, SEC – Skill Enhancement Course, (VSEC), AEC – Ability Enhancement Course, VEC – Value Education Course, IKS – Indian Knowledge System, OJT – on Job Training, FP – Field Project, CEP – Continuing Education Program, CC – Co-Curricular, RP – Research Project, IP – Industry Project]

## Program Structure for First Year B.Voc (Cyber Security and Digital Forensics)

**UNIVERSITY OF MUMBAI**  
(NEP 2020 With Effect from Academic Year 2024-2025)

### Semester I

| Course Code                 | Course Name                                   | Teaching Scheme (Contact Hours) |        |                         | Credits Assigned        |           |              |       |     |
|-----------------------------|-----------------------------------------------|---------------------------------|--------|-------------------------|-------------------------|-----------|--------------|-------|-----|
|                             |                                               | Theory                          | Pract. | Tut.                    | Theory                  | Pract.    | Tut.         | Total |     |
| General Education Component |                                               |                                 |        |                         |                         |           |              |       |     |
| GAEC101                     | Professional Skill-I (Soft Skill Development) | 2                               | -      | 1*                      | 2                       | --        | 1            | 3     |     |
| GBSC102                     | Applied Mathematics                           | 2                               | -      | 1*                      | 2                       | --        | 1            | 3     |     |
| GVSEC103                    | Programming principles with C                 |                                 | 2*+2   | -                       | —                       | 2         | --           | 2     |     |
|                             | Total                                         | 4                               | 4      | 2                       | 4                       | 2         | 2            | 8     |     |
| Skill Component             |                                               |                                 |        |                         |                         |           |              |       |     |
| SESC101                     | Computer Networks                             | 3                               | 2      | -                       | 3                       | 1         | --           | 4     |     |
| SPESC102                    | Cybersecurity Fundamentals                    | 3                               | 2      | -                       | 3                       | 1         | --           | 4     |     |
| SESC103                     | Operating System and Network Security         | 3                               | 2      | -                       | 3                       | 1         | --           | 4     |     |
| SCC104                      | On Job Training/ Skill based Internship       | -                               | 80     | -                       | --                      | 2         | --           | 2     |     |
|                             | Total                                         | 9                               | 86     | --                      | 9                       | 5         | --           | 14    |     |
| Grand Total                 |                                               | 13                              | 90     | 2                       | 13                      | 7         | 2            | 22    |     |
| Course Code                 | Course Name                                   | Examination Scheme              |        |                         |                         |           |              |       |     |
|                             |                                               | Theory                          |        |                         |                         | Term Work | Pract. &oral | Total |     |
|                             |                                               | Internal Assessment             |        | End Sem. Exam           | Exam. Duration (in Hrs) |           |              |       |     |
|                             |                                               | IAT-I                           | IAT-II | Total (IAT-I) + IAT-II) |                         |           |              |       |     |
| General Education Component |                                               |                                 |        |                         |                         |           |              |       |     |
| GAEC101                     | Professional Skill-I (Soft Skill Development) | 20                              | 20     | 40                      | 60                      | 02        | 25           | --    | 125 |
| GBSC102                     | Applied Mathematics                           | 20                              | 20     | 40                      | 60                      | 02        | 25           | --    | 125 |
| GVSEC103                    | Programming principles with C                 | -                               | -      | -                       | -                       | -         | 25           | 25    | 50  |
| Skill Component             |                                               |                                 |        |                         |                         |           |              |       |     |
| SESC 101                    | Computer Networks                             | 20                              | 20     | 40                      | 60                      | 02        | 25           | 25    | 150 |
| SPESC102                    | Cybersecurity Fundamentals                    | 20                              | 20     | 40                      | 60                      | 02        | 25           | 25    | 150 |
| SESC103                     | Operating System and Network Security         | 20                              | 20     | 40                      | 60                      | 02        | 25           | 25    | 150 |

|              |                                         |    |    |            |            |    |            |            |            |
|--------------|-----------------------------------------|----|----|------------|------------|----|------------|------------|------------|
| SCC104       | On Job Training/ Skill based Internship | -- | -- | --         | --         | -- | 50#        | --         | 50         |
| <b>Total</b> |                                         | -- | -- | <b>200</b> | <b>300</b> | -- | <b>200</b> | <b>100</b> | <b>800</b> |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)

# Program Structure for First Year B.Voc (Cyber Security and Digital Forensics)

**UNIVERSITY OF MUMBAI**  
(NEP 2020 With Effect from Academic Year 2024-2025)

## Semester II

| Course Code                 | Course Name                                              | Teaching Scheme<br>(Contact hours) |        |                         | Credits Assigned |                         |              |       |     |
|-----------------------------|----------------------------------------------------------|------------------------------------|--------|-------------------------|------------------|-------------------------|--------------|-------|-----|
|                             |                                                          | Theory                             | Pract. | Tut.                    | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                                          |                                    |        |                         |                  |                         |              |       |     |
| GVSEC201                    | Professional Skill-II<br>(Business communication Ethics) | 2                                  | -      | 1*                      | 2                | --                      | 1            | 3     |     |
| GBSC202                     | Statistics for Data Science                              | 2                                  | -      | 1*                      | 2                | --                      | 1            | 3     |     |
| GIKS203                     | Indian Knowledge System (IKS)                            | 2                                  | -      | -                       | 2                | -                       | --           | 2     |     |
|                             | Total                                                    | 6                                  | 0      | 2                       | 6                | 0                       | 2            | 8     |     |
| Skill Component             |                                                          |                                    |        |                         |                  |                         |              |       |     |
| SPCC201                     | Python Programming                                       | 2                                  | 4      | -                       | 2                | 2                       | --           | 4     |     |
| SESC202                     | Web Application Security                                 | 3                                  | 2      | -                       | 3                | 1                       | --           | 4     |     |
| SESC203                     | Database Management and Security                         | 3                                  | 2      | -                       | 3                | 1                       | --           | 4     |     |
| SCC204                      | Skill based Internship                                   | -                                  | 80     | -                       | --               | 2                       | --           | 2     |     |
|                             | Total                                                    | 8                                  | 88     | --                      | 8                | 7                       | --           | 14    |     |
| Grand Total                 |                                                          | 14                                 | 88     | 2                       | 14               | 7                       | 2            | 22    |     |
| Course Code                 | Course Name                                              | Examination Scheme                 |        |                         |                  |                         |              |       |     |
|                             |                                                          | Theory                             |        |                         |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                                          | Internal Assessment                |        |                         | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                                          | IAT-I                              | IAT-II | Total (IAT-I) + IAT-II) |                  |                         |              |       |     |
| General Education Component |                                                          |                                    |        |                         |                  |                         |              |       |     |
| GVSEC201                    | Professional Skill-II<br>(Business communication Ethics) | 20                                 | 20     | 40                      | 60               | 02                      | 25           | --    | 125 |
| GBSC202                     | Statistics for Data Science                              | 20                                 | 20     | 40                      | 60               | 02                      | 25           | --    | 125 |
| GIKS203                     | Indian Knowledge System (IKS)                            | -                                  | -      | -                       | -                | -                       | 25           | 25    | 50  |
| Skill Component             |                                                          |                                    |        |                         |                  |                         |              |       |     |
| SPCC201                     | Python Programming                                       | 20                                 | 20     | 40                      | 60               | 3                       | 25           | 25    | 150 |
| SESC202                     | Web Application Security                                 | 20                                 | 20     | 40                      | 60               | 3                       | 25           | 25    | 150 |
| SESC203                     | Database Management and Security                         | 20                                 | 20     | 40                      | 60               | --                      | 25           | 25    | 150 |
| SCC204                      | Skill based Internship                                   | --                                 | --     | --                      | --               | --                      | 50#          | --    | 50  |
| Total                       |                                                          | --                                 | --     | 200                     | 300              | --                      | 200          | 100   | 800 |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)

## Program Structure for First Year B.Voc in (Cyber Security and Digital Forensics)

### UNIVERSITY OF MUMBAI (NEP 2020 With Effect from Academic Year 2024-2025)

#### Semester III

| Course Code                 | Course Name                                | Teaching Scheme (Contact Hours) |        |                         | Credits Assigned |                         |              |       |     |
|-----------------------------|--------------------------------------------|---------------------------------|--------|-------------------------|------------------|-------------------------|--------------|-------|-----|
|                             |                                            | Theory                          | Pract. | Tut.                    | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                            |                                 |        |                         |                  |                         |              |       |     |
| GHSSM301                    | Professional Skill-III (Entrepreneurship)  | 2                               | -      | 1*                      | 2                | --                      | 1            | 3     |     |
| GVEC302                     | Ethical Hacking                            | 2                               | -      | 1*                      | 2                | --                      | 1            | 3     |     |
| GPCC303                     | Cyber Threat Intelligence                  | 2                               | -      | -                       | 2                | -                       | --           | 2     |     |
|                             | Total                                      | 6                               | 0      | 2                       | 6                | 0                       | 2            | 8     |     |
| Skill Component             |                                            |                                 |        |                         |                  |                         |              |       |     |
| SPCC301                     | Cybersecurity Risk Management and Auditing | 3                               | 2      |                         | 3                | 1                       | --           | 4     |     |
| SPCC302                     | Malware Analysis and Reverse Engineering   | 3                               | 2      | —                       | 3                | 1                       | --           | 4     |     |
| SOE303                      | Machine Learning I                         | 3                               | 2      | -                       | 3                | 1                       | --           | 4     |     |
| SCC304                      | Skill based Internship                     | -                               | 80     | -                       | --               | 2                       | --           | 2     |     |
|                             | Total                                      | 9                               | 86     | --                      | 9                | 5                       | --           | 14    |     |
| Grand Total                 |                                            | 15                              | 86     | 2                       | 15               | 5                       | 2            | 22    |     |
| Course Code                 | Course Name                                | Examination Scheme              |        |                         |                  |                         |              |       |     |
|                             |                                            | Theory                          |        |                         |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                            | Internal Assessment             |        |                         | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                            | IAT-I                           | IAT-II | Total (IAT-I) + IAT-II) |                  |                         |              |       |     |
| General Education Component |                                            |                                 |        |                         |                  |                         |              |       |     |
| GHSSM 301                   | Professional Skill-III (Entrepreneurship)  | 20                              | 20     | 40                      | 60               | 02                      | 25           | --    | 125 |
| GVEC302                     | Ethical Hacking                            | 20                              | 20     | 40                      | 60               | 02                      | 25           | --    | 125 |
| GPCC 303                    | Cyber Threat Intelligence                  | -                               | -      | -                       | -                | -                       | 25           | 25    | 50  |
| Skill Component             |                                            |                                 |        |                         |                  |                         |              |       |     |
| SPCC301                     | Cybersecurity Risk Management and Auditing | 20                              | 20     | 40                      | 60               | 02                      | 25           | 25    | 150 |
| SPCC302                     | Malware Analysis and Reverse Engineering   | 20                              | 20     | 40                      | 60               | 02                      | 25           | 25    | 150 |
|                             |                                            | 20                              | 20     | 40                      | 60               | 02                      | 25           | 25    | 150 |

|              |                           |    |    |            |            |    |            |            |            |
|--------------|---------------------------|----|----|------------|------------|----|------------|------------|------------|
| SOE303       | Machine Learning I        |    |    |            |            |    |            |            |            |
| SCC304       | Skill<br>based Internship | -- | -- | --         | --         | -- | 50#        | --         | 50         |
| <b>Total</b> |                           | -- | -- | <b>200</b> | <b>300</b> | -- | <b>200</b> | <b>100</b> | <b>800</b> |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)



## Program Structure for First Year B.Voc in (Cyber Security and Digital Forensics)

### UNIVERSITY OF MUMBAI (NEP 2020 With Effect from Academic Year 2024-2025)

#### Semester IV

| Course Code                 | Course Name                                         | Teaching Scheme (Contact Hours) |        |                         | Credits Assigned |                         |           |              |       |
|-----------------------------|-----------------------------------------------------|---------------------------------|--------|-------------------------|------------------|-------------------------|-----------|--------------|-------|
|                             |                                                     | Theory                          | Pract. | Tut.                    | Theory           | Pract.                  | Tut.      | Total        |       |
| General Education Component |                                                     |                                 |        |                         |                  |                         |           |              |       |
| GAEC401                     | Professional Skill-IV (Aptitude and Logic Building) | 2                               | –      | -                       | 2                | –                       | --        | 2            |       |
| GPCC402                     | Security Architecture and Engineering               | 2                               | -      | 1*                      | 2                | --                      | 1         | 3            |       |
| GPCC403                     | Digital Forensics                                   | 2                               | -      | 1*                      | 2                | --                      | 1         | 3            |       |
|                             | Total                                               | 6                               | 0      | 2                       | 6                | 0                       | 2         | 8            |       |
| Skill Component             |                                                     |                                 |        |                         |                  |                         |           |              |       |
| SPCC401                     | Penetration Testing and Vulnerability Assessment    | 3                               | 2      |                         | 3                | 1                       | --        | 4            |       |
| SVSEC402                    | Cybercrime Investigation Techniques                 | 3                               | 2      | –                       | 3                | 1                       | --        | 4            |       |
| SVEC403                     | Network Forensics                                   | 3                               | 2      | -                       | 3                | 1                       | --        | 4            |       |
| SCC404                      | Skill based Internship                              | -                               | 80     | -                       | --               | 2                       | --        | 2            |       |
|                             | Total                                               | 9                               | 86     | --                      | 9                | 5                       | --        | 14           |       |
| Grand Total                 |                                                     | 15                              | 86     | 2                       | 15               | 5                       | 2         | 22           |       |
| Course Code                 | Course Name                                         | Examination Scheme              |        |                         |                  |                         |           |              |       |
|                             |                                                     | Theory                          |        |                         |                  |                         | Term Work | Pract. &oral | Total |
|                             |                                                     | Internal Assessment             |        |                         | End Sem. Exam    | Exam. Duration (in Hrs) |           |              |       |
|                             |                                                     | IAT-I                           | IAT-II | Total (IAT-I) + IAT-II) |                  |                         |           |              |       |
| General Education Component |                                                     |                                 |        |                         |                  |                         |           |              |       |
| GAEC401                     | Professional Skill-IV (Aptitude and Logic Building) | -                               | -      | -                       | -                | -                       | 25        | 25           | 50    |
| GPCC402                     | Security Architecture and Engineering               | 20                              | 20     | 40                      | 60               | 2                       | 25        | --           | 125   |
| GPCC403                     | Digital Forensics                                   | 20                              | 20     | 40                      | 60               | 02                      | 25        | --           | 125   |
| Skill Component             |                                                     |                                 |        |                         |                  |                         |           |              |       |
| SPCC401                     | Penetration Testing and Vulnerability Assessment    | 20                              | 20     | 40                      | 60               | 2                       | 25        | 25           | 150   |
| SVSEC402                    | Cybercrime Investigation Techniques                 | 20                              | 20     | 40                      | 60               | 2                       | 25        | 25           | 150   |
| SVEC403                     | Network Forensics                                   | 20                              | 20     | 40                      | 60               | 2                       | 25        | 25           | 150   |

|              |                           |    |    |            |            |    |            |            |            |
|--------------|---------------------------|----|----|------------|------------|----|------------|------------|------------|
| SCC404       | Skill<br>based Internship | -- | -- | --         | --         | -- | 50#        | --         | 50         |
| <b>Total</b> |                           | -- | -- | <b>200</b> | <b>300</b> | -- | <b>200</b> | <b>100</b> | <b>800</b> |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)

# Program Structure for First Year B.Voc (Cyber Security and Digital Forensics)

## UNIVERSITY OF MUMBAI (NEP 2020 With Effect from Academic Year 2024-2025)

### Semester V

| Course Code                 | Course Name                                            | Teaching Scheme<br>(Contact Hours) |        |                         | Credits Assigned |                         |              |       |     |
|-----------------------------|--------------------------------------------------------|------------------------------------|--------|-------------------------|------------------|-------------------------|--------------|-------|-----|
|                             |                                                        | Theory                             | Pract. | Tut.                    | Theory           | Pract.                  | Tut.         | Total |     |
| General Education Component |                                                        |                                    |        |                         |                  |                         |              |       |     |
| GPCC501                     | Professional Skill-IV (Cloud Forensics)                | 2                                  | -      | 1*                      | 2                | --                      | 1            | 3     |     |
| GMD502                      | Environmental Management                               | 2                                  | -      | -                       | 2                | --                      | 1            | 3     |     |
| GPCC503                     | Cyber Security Laws                                    | 2                                  | -      | 1*                      | 2                | -                       | --           | 2     |     |
|                             | Total                                                  | 6                                  | 0      | 2                       | 6                | 0                       | 2            | 8     |     |
| Skill Component             |                                                        |                                    |        |                         |                  |                         |              |       |     |
| SPCC501                     | Blockchain Forensics and Crypto-currency Investigation | 3                                  | 2      |                         | 3                | 1                       | --           | 4     |     |
| SPCC502                     | Ransomware Investigation                               | 3                                  | 2      | –                       | 3                | 1                       | --           | 4     |     |
| SPEC503                     | Mobile Security and Forensics                          | 3                                  | 2      | -                       | 3                | 1                       | --           | 4     |     |
| SCC504                      | Skill based Internship                                 | -                                  | 80     | -                       | --               | 2                       | --           | 2     |     |
|                             | Total                                                  | 9                                  | 86     | --                      | 9                | 5                       | --           | 14    |     |
| Grand Total                 |                                                        | 15                                 | 86     | 2                       | 15               | 5                       | 2            | 22    |     |
| Course Code                 | Course Name                                            | Examination Scheme                 |        |                         |                  |                         |              |       |     |
|                             |                                                        | Theory                             |        |                         |                  | Term Work               | Pract. &oral | Total |     |
|                             |                                                        | Internal Assessment                |        |                         | End Sem. Exam    | Exam. Duration (in Hrs) |              |       |     |
|                             |                                                        | IAT-I                              | IAT-II | Total (IAT-I) + IAT-II) |                  |                         |              |       |     |
| General Education Component |                                                        |                                    |        |                         |                  |                         |              |       |     |
| GPCC501                     | Professional Skill-IV (Cloud Forensics)                | 20                                 | 20     | 40                      | 60               | 3                       | 25           | --    | 125 |
| GMD502                      | Environmental Management                               | -                                  | -      | -                       | -                | -                       | 25           | 25    | 50  |
| GPCC503                     | Cyber Security Laws                                    | 20                                 | 20     | 40                      | 60               | 3                       | 25           | --    | 125 |
| Skill Component             |                                                        |                                    |        |                         |                  |                         |              |       |     |
| SPCC501                     | Blockchain Forensics and Crypto-currency Investigation | 20                                 | 20     | 40                      | 60               | 3                       | 25           | 25    | 150 |
| SPCC502                     | Ransomware Investigation                               | 20                                 | 20     | 40                      | 60               | 3                       | 25           | 25    | 150 |
| SPEC503                     | Mobile Security and Forensics                          | 20                                 | 20     | 40                      | 60               | --                      | 25           | 25    | 150 |
| SCC504                      | Skill based Internship                                 | --                                 | --     | --                      | --               | --                      | 50#          | --    | 50  |
| Total                       |                                                        | --                                 | --     | 200                     | 300              | --                      | 200          | 100   | 800 |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)

**Program Structure for First Year B.Voc. (Cyber Security and Digital Forensics)**  
**UNIVERSITY OF MUMBAI**  
**(NEP 2020 With Effect from Academic Year 2024-2025)**  
**Semester VI**

| Course Code                 | Course Name                                | Teaching Scheme (Contact Hours) |        |                         | Credits Assigned |                         |               |       |     |
|-----------------------------|--------------------------------------------|---------------------------------|--------|-------------------------|------------------|-------------------------|---------------|-------|-----|
|                             |                                            | Theory                          | Pract. | Tut.                    | Theory           | Pract.                  | Tut.          | Total |     |
| General Education Component |                                            |                                 |        |                         |                  |                         |               |       |     |
| GVSEC601                    | Professional Skill-IV (API Pentesting)     | 2                               | -      | 1*                      | 2                | --                      | 1             | 3     |     |
| GPCC602                     | Information Retrieval System               | 2                               | -      | 1*                      | 2                | --                      | 1             | 3     |     |
| GPCC603                     | Distributed Computing                      | 2                               | -      | -                       | 2                | -                       | --            | 2     |     |
|                             | Total                                      | 6                               | –      | 2                       | 6                | –                       | 2             | 8     |     |
| Skill Component             |                                            |                                 |        |                         |                  |                         |               |       |     |
| SPCC601                     | Cloud Computing Security                   | 3                               | 2      |                         | 3                | 1                       | --            | 4     |     |
| SPEC602                     | Machine Learning II                        | 3                               | 2      | –                       | 3                | 1                       | --            | 4     |     |
| SMD603                      | Security information and Event Management. | 3                               | 2      | -                       | 3                | 1                       | --            | 4     |     |
| SCC604                      | Skill based Internship                     | -                               | 80     | -                       | --               | 2                       | --            | 2     |     |
|                             | Total                                      | 9                               | 86     | --                      | 9                | 5                       | --            | 14    |     |
| Grand Total                 |                                            | 15                              | 86     | 2                       | 15               | 5                       | 2             | 22    |     |
| Course Code                 | Course Name                                | Examination Scheme              |        |                         |                  |                         |               |       |     |
|                             |                                            | Theory                          |        |                         |                  | Term Work               | Pract. & oral | Total |     |
|                             |                                            | Internal Assessment             |        |                         | End Sem. Exam    | Exam. Duration (in Hrs) |               |       |     |
|                             |                                            | IAT-I                           | IAT-II | Total (IAT-I) + IAT-II) |                  |                         |               |       |     |
| General Education Component |                                            |                                 |        |                         |                  |                         |               |       |     |
| GVSEC 601                   | Professional Skill-IV (API Pentesting)     | -                               | -      | -                       | -                | -                       | 25            | 25    | 50  |
| GPCC602                     | Information Retrieval System               | 20                              | 20     | 40                      | 60               | 3                       | 25            | --    | 125 |
| GPCC603                     | Distributed Computing                      | 20                              | 20     | 40                      | 60               | 3                       | 25            | --    | 125 |
| Skill Component             |                                            |                                 |        |                         |                  |                         |               |       |     |
| SPCC601                     | Cloud Computing Security                   | 20                              | 20     | 40                      | 60               | 3                       | 25            | 25    | 150 |
| SPEC602                     | Machine Learning II                        | 20                              | 20     | 40                      | 60               | 3                       | 25            | 25    | 150 |
| SMD603                      | Security information and Event Management. | 20                              | 20     | 40                      | 60               | --                      | 25            | 25    | 150 |
| SCC604                      | Skill based Internship                     | --                              | --     | --                      | --               | --                      | 50#           | --    | 50  |
| Total                       |                                            | --                              | --     | 200                     | 300              | --                      | 200           | 100   | 800 |

\* Two hours of practical class to be conducted for full class as demo/discussion.

# Indicates Practical and Oral Marks includes report and presentation.

2 Credits for 2 weeks or 80 hrs during semester or after semester-(AICTE Internship Polity)

Program Structure for First Year B.Voc (Cyber Security and Digital Forensics)

UNIVERSITY OF MUMBAI  
(NEP 2020 With Effect from Academic Year 2024-2025)

Semester VII

| S No. | Course Code | Course Title           | Teaching Scheme (Contact Hours) |   |     |        |                   |        |       |              |                       |           |                |       |
|-------|-------------|------------------------|---------------------------------|---|-----|--------|-------------------|--------|-------|--------------|-----------------------|-----------|----------------|-------|
|       |             |                        | L                               | T | P   | Credit | EVALUATION SCHEME |        |       |              |                       |           |                |       |
|       |             |                        |                                 |   |     |        | Test 1            | Test 2 | Total | End Sem Exam | Exam duration in hrs. | Term Work | Practical Exam | Total |
| 1     | MRP701      | Research-based Project | -                               | - | 300 | 10     |                   |        |       |              |                       | 100       | 100            | 200   |
| 2     | MIP702      | Industry-based Project | -                               | - | 300 | 10     |                   |        |       |              |                       | 100       | 100            | 200   |
| TOTAL |             |                        | -                               | - | 600 | 20     |                   |        |       |              |                       | 200       | 200            | 400   |

Program Structure for First Year B.Voc (Cyber Security and Digital Forensics)

UNIVERSITY OF MUMBAI  
(NEP 2020 With Effect from Academic Year 2024-2025)

Semester VIII

| S No. | Course Code | Course Title    | Teaching Scheme (Contact Hours) |   |     |        |                   |        |       |              |                       |           |                |       |
|-------|-------------|-----------------|---------------------------------|---|-----|--------|-------------------|--------|-------|--------------|-----------------------|-----------|----------------|-------|
|       |             |                 | L                               | T | P   | Credit | EVALUATION SCHEME |        |       |              |                       |           |                |       |
|       |             |                 |                                 |   |     |        | Test 1            | Test 2 | Total | End Sem Exam | Exam duration in hrs. | Term Work | Practical Exam | Total |
| 1     | OJT801      | On Job Training | -                               | - | 600 | 20     |                   |        |       |              |                       | 200       | 200            | 400   |
| TOTAL |             |                 | -                               |   | 600 | 20     |                   |        |       |              |                       | 200       | 200            | 400   |

| Course Code: | Course Title                                  | Credit |
|--------------|-----------------------------------------------|--------|
| GAEC101      | Professional Skill-I (Soft Skill Development) | 3      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                                       |
|---|-----------------------------------------------------------------------------------------------------------------------|
| 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 |

**Course Outcomes:**

|   |                                                                                                                                                             |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 |
|--------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      |     | <b>Mechanics of Communication</b>                                                                                                                                                                              | 8   |
|        | 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.                                                                          |     |
| 2      |     | <b>Mastering Language Skills</b>                                                                                                                                                                               | 8   |
|        | 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 |     |
| 3      |     | <b>Presentation Skills</b>                                                                                                                                                                                     | 8   |
|        | 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>6</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:<br>Exercises                                                         |           |
|          |     | <b>Total</b>                                                                                                                          | <b>30</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 Heasley, <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                   |

| Course Code: | Course Title        | Credit |
|--------------|---------------------|--------|
| GBSC102      | Applied Mathematics | 3      |

**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.                                             |

| Module   |     | Content                                                                                                                                                                                                   | Hrs      |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <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</b>                                                                                                                                                        | <b>7</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>Total</b>                                                                                                                                                                 | <b>30</b> |

#### **Textbooks:**

- 1 C. L. Liu and D. P. Mohapatra: *Elements of Discrete Mathematics*, McGraw Hill, Revised Second Edition
- 2 K. Hoffmann and R. A. Kunze: *Linear algebra*, PHI Learning, Second Edition.

#### **References:**

- 1 Stephen H Friedberg, *Linear Algebra*, O 'Eastern Economic Edition, fourth edition
- 2 B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, Thirty Sixth edition .

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

- 1 <https://nptel.ac.in/courses/111105123/>
- 2 <https://www.analyticsvidhya.com/blog/2017/02/lintr oductory-guide-on-linear-programming-explained- in-simple-english/>
- 3 <https://www.u-aizu.ac.jp/~qf- zhao/TEACHING/AI/AI.html>
- 4 <https://www.udemy.com/course/mathematical- foundation-for-machine-learning-and-ai.>

#### **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 Tutorials:**

| <b>Sr. No</b> | <b>Topic</b>                                              |
|---------------|-----------------------------------------------------------|
| 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, adjoin and self-adjoin operators      |

| Course Code: | Course Title                  | Credit |
|--------------|-------------------------------|--------|
| GVSEC103     | Programming principles with C | 2      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                                                 |
|---|---------------------------------------------------------------------------------------------------------------------------------|
| 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. |

**Course Outcomes:** 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 |
|--------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      |     | <b>Introduction to C Programming</b>                                                                                                                                                                                | 8   |
|        | 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 |     |
| 2      |     | <b>Control Structures</b>                                                                                                                                                                                           | 8   |
|        | 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                                     |     |
| 3      |     | <b>Functions</b>                                                                                                                                                                                                    | 6   |
|        | 3.1 | Introduction to functions Function prototype, Function definition, accessing a function and parameter passing.                                                                                                      |     |
|        | 3.2 | Recursion.                                                                                                                                                                                                          |     |
| 4      |     | <b>Arrays and Strings</b>                                                                                                                                                                                           | 8   |
|        | 4.1 | Introduction to Arrays, Declaration and initialization of one dimensional and two-dimensional arrays.                                                                                                               |     |
|        | 4.2 | Definition and initialization of String, String functions.                                                                                                                                                          |     |

|  |  |              |           |
|--|--|--------------|-----------|
|  |  | <b>Total</b> | <b>30</b> |
|--|--|--------------|-----------|

**Textbooks:**

|   |                                                                                                       |
|---|-------------------------------------------------------------------------------------------------------|
| 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 |

**References:**

|   |                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------|
| 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.  |

**Useful Links**

|   |                                                                                                                             |
|---|-----------------------------------------------------------------------------------------------------------------------------|
| 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>     |

**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.                 |

**List of Practical/ Experiments:**

| Practical Number | Practical/ Experiment Topic                                         |
|------------------|---------------------------------------------------------------------|
| 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 |
|--------------|-------------------|--------|
| SESC101      | 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.

#### **Textbooks:**

1. A.S. Tanenbaum: Computer Networks, Pearson Education, 4<sup>th</sup> Edition.

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

2. B.A. Forouzan: Data Communication and Networking, TMH, 5<sup>th</sup> Edition.  
 1. Question paper will comprise a total of six questions.

#### **References:**

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

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)

1. <https://www.udemy.com/course/mta-networking-fundamentals-exam-microsoft-98-366/>

4. Only Four questions need to be solved.  
 2. [https://onlinecourses.nptel.ac.in/noc21\\_cs18/preview](https://onlinecourses.nptel.ac.in/noc21_cs18/preview)



|   |                                                                                                                                     |
|---|-------------------------------------------------------------------------------------------------------------------------------------|
| 5 | In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus. |
|---|-------------------------------------------------------------------------------------------------------------------------------------|

**Practical/**

**Experiments:**

| <b>Practical Number</b> | <b>Practical/ Experiment Topic</b>                                                                                                                                  |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 |
|--------------|-----------------------------|--------|
| SPESC102     | 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 |
|--------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      |     | <b>Security Fundamentals</b>                                                                                                                                                         | 5   |
|        | 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                                                         |     |
| 2      |     | <b>Modular Arithmetic and Cryptography Basics</b>                                                                                                                                    | 10  |
|        | 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                                                 |     |
| 3      |     | <b>Security Threats and Vulnerabilities</b>                                                                                                                                          | 8   |
|        | 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> |

#### **Textbooks:**

1 William Stallings: Computer Security: Principles and Practices, Pearson Publication, 6<sup>th</sup> Edition.

#### **References:**

1 Nina Godbole: Cyber Security- Understanding Cyber Crimes, Wiley India Pvt. Ltd, Third Edition.

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

1 <https://www.udemy.com/course/complete-introduction-to-cybersecurity/>

2 <https://www.coursera.org/learn/cyber-security-fundamentals>

3 [https://onlinecourses.nptel.ac.in/noc23\\_cs127/preview](https://onlinecourses.nptel.ac.in/noc23_cs127/preview)

#### **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 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 |
|--------------|---------------------------------------|--------|
| SESC103      | 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**

| Course Code: | Course Title                  | Credit |
|--------------|-------------------------------|--------|
| GVSEC201     | Business communication Ethics | 3      |

**Prerequisite: Professional Skill-I**

**Course Objectives:**

|   |                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------------|
| 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.                                                       |

**Course Outcomes:** 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.                                       |

| Module |     | Content                                                                                                                                                                                                                                                                                            | Hrs       |
|--------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1      |     | <b>Writing Skills ( Part -II) A Report &amp; Proposal Writing</b>                                                                                                                                                                                                                                  | 12        |
|        | 1.1 | Report Writing: Objectives of Report Writing (on General Topics)<br>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 |           |
| 2      |     | <b>Writing Skills ( Part -II) B Business/ Trade Letters</b>                                                                                                                                                                                                                                        | 6         |
|        | 2.1 | Order credit and status Enquiry<br>Letters of inquiry, letter of complaints, Claim & adjustment letter<br>Sales Letter, promotional leaflets and fliers                                                                                                                                            |           |
| 3      |     | <b>Presentation Skills</b>                                                                                                                                                                                                                                                                         | 6         |
|        | 3.1 | Technical Presentation<br>Business Presentation.                                                                                                                                                                                                                                                   |           |
| 4      |     | <b>Introduction to Interpersonal Skills</b>                                                                                                                                                                                                                                                        | 6         |
|        | 4.1 | Emotional Intelligence,Leadership and Motivation,Team Building,Assertiveness<br>Conflict Resolution and Negotiation Skills,Time Management,Decision Making                                                                                                                                         |           |
|        |     | <b>Total</b>                                                                                                                                                                                                                                                                                       | <b>30</b> |

**Textbooks:**

|   |                                                                                                          |
|---|----------------------------------------------------------------------------------------------------------|
| 1 | Bovée, 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 |

**References:**

|   |                                                                                                                               |
|---|-------------------------------------------------------------------------------------------------------------------------------|
| 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. |

**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.               |

**Useful Links**

|   |                                                                                                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.ease.iitb.ac.in/sites/default/files/downloads/repot_guide.pdf">https://www.ease.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 |
|--------------|-----------------------------|--------|
| GBSC202      | Statistics for Data Science | 3      |

**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 |
|--------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1      |     | <b>Basic Probability</b>                                                                                                                                                                                                                                        | 8   |
|        | 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).                                                                                                   |     |
| 2      |     | <b>Basic Statistics</b>                                                                                                                                                                                                                                         | 8   |
|        | 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).                                     |     |
| 3      |     | <b>Bivariate Statistics</b>                                                                                                                                                                                                                                     | 10  |
|        | 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>                                                                                                                                               | 4         |
|   | 4.1 | Introduction to sampling distributions, Standard Normal Variate, Central Limit Theorem, standard error, Type-I and Type-II errors, estimation, confidence intervals. |           |
|   |     | <b>Total</b>                                                                                                                                                         | <b>30</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:**

| Practical Number | Practical/ Experiment Topic                                                          |
|------------------|--------------------------------------------------------------------------------------|
| 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 |
|--------------|------------------------------|--------|
| GIKS203      | Indian Knowledge System(IKS) | 2      |

### Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

### Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country
3. To analyse sustainable practices in in ancient India
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance

### Course Outcomes:

1. Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.
3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5. Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern society

### Prerequisite:

1. Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS
2. Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.

| Module | Name of Module | Detailed Content | Hours |
|--------|----------------|------------------|-------|
|        |                |                  |       |

|   |                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |
|---|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1 | <b>Introduction to the Indian Knowledge System (I.K.S.)</b> | <ul style="list-style-type: none"> <li>• Basic knowledge and scope of IKS</li> <li>• IKS in ancient India and modern India,</li> <li>• Bhartiya education system – ancient to modern era,</li> <li>• Sources of Education, Aim of Education, Curriculum, methods of learning,</li> <li>• Educational Institutes, Higher Educational Institutions,</li> <li>• Advantages and Disadvantages of the Gurukul System,</li> <li>• Distinguish between the Gurukul system And the Modern Education System</li> </ul> | 5 |
| 2 | <b>Development of Scientific Thoughts in Ancient India</b>  | <ul style="list-style-type: none"> <li>• Development in Science, Technology, Astronomy, Mathematics, and Life Sciences – Life Science, Physiology, Ayurveda, etc.</li> </ul>                                                                                                                                                                                                                                                                                                                                  | 5 |
| 3 | <b>Development of Arts &amp; Culture in India</b>           | <ul style="list-style-type: none"> <li>• Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc)</li> <li>• Development in performing arts &amp; culture: Music, Art of singing, Art of dancing, Natyakala Cultural traditions and Folk arts</li> </ul>                                                                                                                                                                                                            | 5 |
| 4 | <b>Good Governance in Ancient India</b>                     | <ul style="list-style-type: none"> <li>• Introduction to Indian religions</li> <li>• Moral and Ethical Governance</li> <li>• Vishva Kalyan through Vasudhaiva Kutumbkam</li> <li>• Principles of Good Governance about Ramayana, Mahabharat, Artha Sastra and Kautilyan State</li> </ul>                                                                                                                                                                                                                      | 5 |
| 5 | <b>Contribution of Indian Scientist &amp; Nobel</b>         | <ul style="list-style-type: none"> <li>• Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada &amp; Charak</li> </ul>                                                                                                                                                                                                                                                                                                                                                  | 5 |

|   |                                               |                                                                                                                                                                                                                                                               |   |
|---|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <b>Laureates</b>                              | <ul style="list-style-type: none"> <li>• Rabindranath Tagore, C.V. Raman, Har Gobind Khorana, Mother Teresa, Subrahmanyam Chandrasekhar, Amartya Sen, V.S. Naipaul, Venkatraman Ramakrishnan, Kailash Satyarthi and Abhijit Banerjee</li> </ul>               |   |
| 6 | <b>Sustainable Practices in Ancient India</b> | <ul style="list-style-type: none"> <li>• Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc</li> <li>• Yoga, pranayama, and meditation for health and well-being</li> </ul> | 5 |

**Text Books:**

1. 1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)
5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihas evam Parichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017
9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan) 6. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
10. Traditional Knowledge System in India, Amit Jha

**Online References:**

| Sr. No. | Website Name                                                                                              |
|---------|-----------------------------------------------------------------------------------------------------------|
| 1.      | <a href="https://swayam.gov.in/explorer?searchText=iks">https://swayam.gov.in/explorer?searchText=iks</a> |
| 2.      | <a href="https://iksindia.org/book-list.php">https://iksindia.org/book-list.php</a>                       |
| 3.      | <a href="https://iksindia.org/index.php">https://iksindia.org/index.php</a>                               |



**Assessment:****Suggested Pedagogy and assessment criteria for Teachers:**

1. Project-based activities.
2. Presentation, Group Discussions, and Case studies.
3. Visit historical places.
4. Flip class mode/ Roleplay
5. Quiz MCQ
6. Assignment as per the modules: 06
7. Internal Assessment through flipped class and PowerPoint presentation along with documentation

| Course Code: | Course Title       | Credit |
|--------------|--------------------|--------|
| SPCC201      | Python Programming | 4      |

**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>5</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>5</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>6</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>6</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>4</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>30</b> |

#### Textbooks:

|   |                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------|
| 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.                      |

#### References:

|   |                                                                                                                                                          |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. |

#### Useful Links for E-resources:

|   |                                                                                                                                                                                                       |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <a href="https://www.tutorialspoint.com/python/python_basics_syntax.html">https://www.tutorialspoint.com/python/python_basics_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> |

**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.                 |

**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 |
|--------------|--------------------------|--------|
| SESC202      | 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>                                                                     |

**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                       | 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 |
|--------------|----------------------------------|--------|
| SESC203      | Database Management and Security | 4      |

**Prerequisite: No Prerequisite**

**Course Objectives:**

|   |                                                                                                          |
|---|----------------------------------------------------------------------------------------------------------|
| 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. |

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

|   |                                                                                                                       |
|---|-----------------------------------------------------------------------------------------------------------------------|
| 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> |

#### **Textbooks:**

- |   |                                                                                                                    |
|---|--------------------------------------------------------------------------------------------------------------------|
| 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.                       |

#### **References:**

- |   |                                                                                                                                               |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Thomas Connolly and Carolyn Begg: Database Systems: Design, Implementation, and Management, Pearson Publication, 2019 6 <sup>th</sup> Edition |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------|

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

- |   |                                                                                                                         |
|---|-------------------------------------------------------------------------------------------------------------------------|
| 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>     |

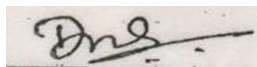
|                                                                                                                                                                                                                                                           |                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <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                                                       |



**Sign of the BOS  
Chairman  
Dr. Vaishali D. Khairnar  
BOS in IT,  
University of Mumbai**



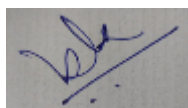
**Offg. Associate Dean  
Dr. Deven Shah  
Faculty of Science and  
Technology  
University of Mumbai**



**Offg. Dean  
Prof. Shivram S. Garje  
Faculty of Science and  
Technology  
University of Mumbai**

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

|    |                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Necessity for starting the course:                                                                                               | Cybersecurity is the process of safeguarding computer networks, systems, servers, and data against malevolent online attacks that could access, alter, or delete private data, disrupt corporate operations, or demand ransom from users. Businesses are willing to pay extremely high salaries and offer the best incentives to the qualified applicants like B.Voc in Cyber Security and Digital Forensics, Professionals in all levels of cyber security are in high demand. At the leadership level, the lack of professionals grows rapidly because there are so few professionals who are capable of managing and mitigating the group of cyber specialists. Since the threat to the digital world is ever-changing and new actors are creating new methods for committing cybercrimes we require trained specialist in security such as B.Voc Cyber Security and Digital Forensics . |
| 2. | Whether the UGC has recommended the course:                                                                                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 3. | Whether all the courses have commenced from the academic year 2023-24                                                            | Yes, the Program started from A.Y 2024-25 as per NEP 2020 Policy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 4. | The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?: | Self-financed Yes. Some experts are called as adjunct or visiting faculties.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 5. | To give details regarding the duration of the Course and is it possible to compress the course?:                                 | 4 years. Not possible to compress the program.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6. | The intake capacity of each course and no. of admissions given in the current academic year:                                     | 30 seats for one division. Admissions will be held from 2024-2025 onwards.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 7. | Opportunities of Employability / Employment available after undertaking these courses:                                           | Students pursuing a B.Voc in Cyber Security and Digital Forensics learn how to protect cloud data from hackers. Businesses and the government spend a lot of money protecting their data, and as cybercrime expands, so does the breadth of B.Voc in Cyber Security and Digital Forensics. They can be employed as, Cyber Security Architect, Information Security Lead, Cyber Security Engineer, Technical Trainee, Lead Cyber Security Analyst, and many other positions are open to graduates of B.Voc in Cyber Security and Digital Forensics programs in cyber security. Candidates may find employment in a range of business and even public industries.                                                                                                                                                                                                                             |



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