SU/BOS/Sci & Tech/ 315

Date: 16/05/2025

To,

The Principal / Director,
All Concerned Affiliated Colleges / Institutions,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech. Part - II (Sem– III - IV)** degree **Programme (Affiliated College)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. Part - II (Sem - III & IV) under the Faculty of Science & Technology as per NEP 2020.

No.	Course Syllabus
1	Civil Engineering
2	Mechanical Engineering
3	Mechanical and Mechatronic Engineering (Additive Manufacturing)
4	Electrical Engineering and Technology
5	Electrical and Computer Engineering
6	Electronics and Telecommunication Engineering
7	Electronics & Computer Science Engineering
8	Computer Science and Engineering
9	Artificial Intelligence & Machine Learning (AIML)
10	Data Science (DS)
11	Artificial Intelligence & Data Science (AIDS)

This Syllabus, shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in NEP-2020@suk (Online Syllabus)**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2025 & March / April 2026. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dr. S. M. Kubal
Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	7	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	8	P.G.Admission Section, /P.G Seminar Section
4	OE 4 Exam Section,	9	Computer Centre,/IT Cell
5	Eligibility Section,	10	Internal Quality Assorance Cell (IQAC)

Shivaji University Kolhapur

Revised Syllabus as per National Education Policy-2020 (NEP-2.0)

S. Y. B. Tech.

Computer Science and Engineering
(Artificial Intelligence and Data Science)

To be Implemented from

Academic Year 2025-26

First Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.1 Rule: Award of Degree

If a student passes all the courses of first year and earns the requisite number of credits, the student will become entitled to Undergraduate Certificate (One year or two semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Certificate. However, for the award of one year UG Certificate in Major with 44 credits, an additional 8 credits are required to earn.

[II] First Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant

industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.

3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute.

The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

Direct Second Year Entry: Teaching Methodology, Assessment and Evaluation

[I] For the students admitted directly into the second year of a programme (at the entry level) from a different programme, earning of an additional 2 credits is mandatory.

[II] As per R. R. B. Tech. 13.3 Rule, For direct second year admitted students (at entry level) to concern programme, the earning of additional 2 credits is mandatory. It is required to conduct examination and evaluation for same at institute level at the time of third semester ESE examination. The evaluation report must be submitted to The Director, Board of Examination and Evaluation, Shivaji University, Kolhapur.

[III] Examination scheme:

Students admitted directly into the second year of a programme from another programme are required to complete a 2-credit entry-level course as per the prescribed curriculum. This course should be completed at their own pace to ensure alignment with the programme foundational requirements. End Semester Examination (ESE) of 100 marks will be conducted at the institute level. It is mandatory to organize the examination and evaluate the performance of such students at the institute level during the third semester ESE. The evaluation report must be submitted to The Director, Board of Examination and Evaluation, Shivaji University, Kolhapur.

Open Elective Courses: Teaching Methodology, Assessment and Evaluation

Open Elective (OE) courses other than faculty of Science and Technology through Massive Open Online Courses (MOOCs) allowing students to engage with a broad spectrum of ideas and knowledge areas. The OE courses are likely to be available online and can be completed at the student's own pace within a set timeframe. For OE course, students are required to visit to the website https://swayam.gov.in for registration and create an account. Afterward, students should Login the account and join the course assigned by the course coordinator and follow the instructions to compete the course. Minimum 25 students can register for one OE course in the concerned institute. There will be only one course coordinator for one OE course.

1. **For Semester-III,** OE theory course of 3 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.

2. **For Semester-III,** OE practical lab course of 1 credit consists of In Semester Evaluation/Continuous Assessment (ISE/CA) of 25 Marks and End Semester Examination-Practical Oral Examination (ESE-POE) of 25 Marks. Course Coordinator assigned by Institute should complete the selected course practical through expert of that course.

3. **For Semester-IV,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester

Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.

4. The Mid Semester Examination (MSE) of 30 Marks based on selected OE Course will be conducted by Concerned Departmental Course Coordinator. The course expert of concerned faculty should set question paper of MSE and evaluate the same.

5. Online submitted assignments by students using SWAYAM platform for concerned OE course will be used for In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks by Concerned Departmental Course Coordinator appointed for particular course by Principal of the Institute. Assignments may be of varied in nature for OE course.

6. The setting of ESE question paper of Concerned OE Course should be done through course expert of concerned faculty as per University rules and is responsibility of Institute/ Departmental Course Coordinator.

7. Student may get failure in the said OE course or the examination may get delayed by SWAYAM, in either cases, ESE of the said course will be conducted as per the University rules.

Note: One OE course is to be floated by the institute for 60 intake.

Second Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.2 Rule: Award of Degree

If a student passes all the courses of first year, second year and earns the requisite number of credits, the student will become entitled to Undergraduate Diploma (Two years or four semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Diploma certificate. However, for the award of two years UG Diploma Certificate in Major with 88 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Second Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.

3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from

relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

शिवाजी विद्यापीठ, कोल्हापूर
SHIVAJI UNIVERSITY, KOLHAPUR

Exit Course for Artificial Intelligence and Data Science after 1st Year

- As part of the NEP 2020 Revised Syllabus, for the First Year B. Tech Exit, students must earn a total of 8 additional credits. This includes 6 credits from online SWAYAM NPTEL courses and 2 credits from Virtual Lab performance.
- Students must complete two SWAYAM NPTEL courses (12-week duration) from the provided list and successfully perform two Virtual Labs from the specified list.
- Each SWAYAM NPTEL course carries 3 credits, while each Virtual Lab is worth 1 credit.

Sr. No.	Name of NPTEL Course
1	Programming In Modern C++
2	Introduction to python programming
3	Computer Networks and Internet Protocol
4	Discrete Mathematics
5	Problem Solving Through Programming In C
6	The Joy of Computing Using Python

Sr. No.	Name of Virtual Lab
1	Problem Solving Lab
2	Data Structures Lab
3	Computer Programming Lab
4	Python Programming Lab

Examination Scheme

- Swayam NPTEL Course Certificate Should be submitted to Department   6 Credits
- Lab Experiments Report must be prepared and submitted to department   2 Credits

Earning of additional 2 mandatory credits for direct second year admitted students to Artificial Intelligence & Data Science branch

Sr. No.	Semester	Subject	Credit
1	III	Basics of python programming	2

Direct Second Year Entry Course Syllabus

Basics Of Python Programming

Second Year	B.Tech	Sem-III	Artificial Intelligence and Data Science	
Direct Second year Entry course syllabus			Credit - 2	

Course Objective	1	Effective Problem-Solving Skills to develop programming logic in Python
	2	Understanding and Implementing Programming concepts of Python
	3	Develop arrays using python numpy package
Course Outcomes		After competition of this course Students will be able to….
	CO1	Understand the python programming basics
	CO2	Solve programs on decision making &looping statement in python
	CO3	Understand python list, tuple ,and dictionary collection concepts
	CO4	Understand array programs using numpy library
	CO5	Design &Apply numpy library functions to model realtime problems.

Unit No.	Title and Content of Unit	Hours
Unit1	**Introduction to Python**	4
	Why high-level language, Scope of python, interactive mode and script mode. Variables, Operators and Operands in Python. Arithmetic, relational and logical operators,Operatorprecedence,Takinginputusingrawinput()andinput()method And displaying output-print statement, Comments in Python.	
Unit2	**Conditional and Looping**	5
	if-else statement and nested if–else while,for,use of range function in for, Nested loops,break, continue,pass statement Use of compound expression in conditional constructs, Nested conditional statements, Nested Looping structures	
Unit3	**Functions**	5
	Built-In Function, Functions from math, random, time& date module. Composition User Define Function : Defining, invoking functions, passingparameters, Intra-package References, Packages in Multiple Directories	
Unit4	**List**	4
	Lists Concept of mutable lists, creating, initializing and accessing the elements of list, List operations, Concatenation, Membership, list slices, List comprehensions List functions&methods:len,insert,append,extend,sort,remove,reverse,pop functions	
Unit5	**Tuples& sets**	5
	Immutable concept, creating, initializing and accessing the elements in a tuple; Tuple functions: cmp(), len(), max(), min(), tuple() Sets Concept of Sets, creating, initializing and accessing the elements of Sets operation Membership, union, intersection, difference, and symmetric differenceDictionariesConceptofkey-valuepair,creating,initializing and accessing the Elements in a dictionary, Traversing, appending, updating and deleting elements	
Unit6	NumPy	5
	NumPy Create, access, modify, and sort multidimensional NumPy arrays (ndarrays), Load and save ndarrays, Use slicing, Boolean indexing, and set operations to select or change subsets of an ndarray, Understand difference between a view and a copy of ndarray, Perf ndarrays, Use broadcasting to perform operations on ndarrays of differentsizes.	

Exit Course for Artificial Intelligence & Data Science After 1st Year

<table>
<tr><td colspan="5" style="background-color:orange">Exit option: Award of UG Certificate in Major with 44 credits and an additional 8 credits from following Exit Courses</td></tr>
<tr><th>Sr. No</th><th>CourseCode</th><th>Course Title</th><th>Mode</th><th>Credits</th></tr>
<tr><td>1</td><td>AI&DS-EC-01</td><td>DataStructureUsingC.</td><td rowspan="3">Online/offline certificationCourse or project of total 8 credits</td><td>8</td></tr>
<tr><td></td><td></td><td align="center">OR</td><td></td></tr>
<tr><td>2</td><td>AI&DS-EC-02</td><td>Web Development using HTML and CSS</td><td>8</td></tr>
</table>

Earning of additional 2 mandatory credits for direct second year admitted students to Artificial Intelligence & Data Science branch

Sr. No.	Semester	Subject	Credit
1	III	Basics of python programming	2

SCHEMEOFINSTRUCTION&SYLLABI

Programme- **Artificial Intelligence & Data Science**

Scheme of Instructions: Second Year B.Tech. Artificial Intelligence & Data Science

Semester–III

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	AI&DS2101	Discrete Mathematical structure	3	--	-	3	3	30	10	60	100
2	PCC	AI&DS2102	Data Structures Using C	3	--	--	3	3	30	10	60	100
3	PCC	AI&DS2103	Fundamentals of AI	3	--	--	3	3	30	10	60	100
4	EL	AI&DS2104	Data Structures Using C Lab	--	--	4	4	2	--	50	50	100
5	MDM	AI&DS2105	Multi-disciplinary Minor–01	2	--	--	2	2	30	10	60	100
6	OE	AI&DS2106	Open Elective -01	3	--	--	3	3	30	10	60	100
7	PCC	AI&DS2107	Fundamentals of AI Lab	--	--	2	2	1	-	50	50	100
8	HSSM	AI&DS2108	Cyber Laws	3	1	--	4	4	-	50	-	50
9	OE	AI&DS2109	Open Elective -01Lab	--	--	2	2	1	-	25	25	50
			Total	**17**	**1**	**8**	**26**	**22**	**150**	**225**	**425**	**800**

L-Lecture   T-Tutorial   P-Practical

MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses(BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular Programme (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular and Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	16	16	--	-	-	06	04	--	02
Semester Credits	--	-	10	-	06	--	04	02	--
Cumulative Sum	16	16	10	-	06	06	08	02	02

PROGRESSIVETOTALCREDITS:44+**22=66**

Programme-Artificial Intelligence & Data Science

Scheme of Instructions: Second Year B.Tech. Artificial Intelligence & Data Science

Semester–IV

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	AI&DS2201	Python for Data Science	3	--	--	3	3	30	10	60	100
2	PCC	AI&DS2202	Object Oriented Programming	2	--	--	2	2	30	10	60	100
3	PCC	AI&DS2203	Operating System	3	1	--	4	4	30	10	60	100
4	MDM	AI&DS2204	Multi-disciplinary Minor–02	2	--	--	2	2	30	10	60	100
5	OE	AI&DS2205	Open Elective-02	2	--	--	2	2	30	10	60	100
6	HSSM	AI&DS2206	Soft Skills	--	2	--	2	2	-	50	25	75
7	HSSM	AI&DS2207	Employability Enhancement Skills	2	--	--	2	2	-	25	-	25
8	VSEC	AI&DS2208	Python for Data Science Lab	--	--	2	2	1	-	25	25	50
9	VEC	AI&DS2209	Object Oriented Programming Lab	--	--	4	4	2	-	25	25	50
10	VSEC	AI&DS2210	Mini Project Lab	--	--	2	2	1	--	25	25	50
11	BSC	AI&DS2211	Environmental Science	2	--	--	2	Audit	30	10	60	100
12	VSEC	AI&DS2212	Computer Maintenance Technology	--	--	2	2	1		50	--	50
			Total	**16**	**3**	**10**	**29**	**22**	**180**	**260**	**460**	**800+100**(Audit)

L-Lecture   T-Tutorial   P-Practical

MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective Other than particular Programme (OE/MDM)	Vocational and Skill Enhancement Course(VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular and Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	16	16	10	-	06	06	08	02	02
Semester Credits	-	-	09	-	04	03	06	--	-
Cumulative Sum	16	16	19	-	10	09	14	02	02

PROGRESSIVETOTALCREDITS:66 +22= 88

Exit option: Award of UG Diploma in Major with 88 credits and an additional 8credits from following Exit Courses				
Sr. No	Course Code	Course Title	Mode	Credits
1	AI&DS-EC-03	Full Stack web development	Online/offline certification Course or project of total 8 credits	8
		OR		
2	AI&DS-EC-04	Python Programming		8

Year and Semester	Second Year B.Tech-Semester III-Artificial Intelligence &Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	Discrete Mathematical Structure			Course Code	AI&DS2101
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50% syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25% on syllabus covered for MSE(First Three Units) and 75% on remaining syllabus (Last Three Units).

Year and Semester	Second Year B.Tech-Semester III-Artificial Intelligence &Data Science				
Course Category	Programme Core Course(PCC)				
Title of Course	Discrete Mathematical Structure			Course Code	AI&DS2101
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   • Mid sem. examination will be based on 50% syllabus from beginning (First Three Units).   • No compulsory passing for MSE.   • ESE paper setting weightage will be, 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).

UnitNo.	Title and Content of Unit	Hours
1	**Unit1: Mathematical Logic**	8

	Statements & Notations, Connectives, Statement Formulas & truth table, Well-formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological Implications, Functionally complete set of connectives, Other connectives, Normal Forms, Theory of Inference for statement calculus.	
2	**Unit2: Set Theory:**	05
	Basic concepts of set theory, Operations on Sets, Ordered pairs & n-tuples, Cartesian product.	
3	**Unit 3: Relations & Functions:**	07
	Relations, Properties of binary relations, Matrix & Graph Representation of Relation, Partition & covering of Set, Equivalence Relations, Composition of Binary Relation, POSET & Hasse Diagram, Functions, Types of Functions, Composition of functions	
4	**Unit 4: Algebraic Systems:**	07
	Algebraic Systems: Examples & general Properties, Semi-Groups, Monoids, Groups, Subgroups and Their Properties, Homomorphism of Groups	
5	**Unit 5: Lattice and Boolean Algebra**	06
	Lattice as partially ordered sets, Lattice as Algebraic Systems., Special Lattices., Boolean Algebra: Definitions & examples, Boolean Functions., Representation & Minimization of Boolean Functions.	
6	**Unit 6: Graph Theory**	06
	Basic concepts of graph theory., Paths, Reachability & Connectedness, Matrix, Representations of Graphs., Storage Representation & Manipulations of Graphs. PERT & Related technologies.	

Text Books:

Discrete Mathematical Structures with Application to Computer Science" by J.P. Tremblay
R. Manohar (MGH International)

Reference Books:

1. Discrete Mathematics –Seymour Lipschutz, Marc Lipson (MGH), Schaum"s outlines.
2. Discrete Mathematics and its Applications – Kenneth H. Rosen (AT & T Bell Labs)
(mhhe.com/rosen)
3. Discrete Mathematical Structures – Bernard Kolman, Robert Busby, S. C. Ross and
Nadeemur- Rehman (Pearson Education)

Year and Semester	Second Year B. Tech - Semester III - Artificial Intelligence & Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	Data Structures Using C			Course Code	AI&DS2102
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   • No compulsory passing for MSE.   • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	No. of. Lectures
1.	**Introduction to Data Structures**	07
	Pointers: Introduction to Pointers, Pointer Arithmetic, Dynamic Memory Allocation (Malloc and Calloc) Structures: Array of Structures, Passing Structures to Function, Structure and Pointers Data structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity.	
2.	**Searching and Sorting and Hashing Techniques**	07
	Linear search, Binary search, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Radix sort, Complexity and analysis. **Hashing** – Definition, hash functions, Collision, overflow, open hashing and closed hashing, Rehashing Techniques.	
3.	**Stacks and Queues**	06
	Stack: Definition, operations, Array representation of stack, applications **Queue**: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue, Dequeue.	
4.	**Linked Lists**	07
	Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. Linked representation of stack and Queue, Applications of Linked List.	
5.	**Trees**	07
	Terminology, representation, binary tree, traversal methods, binary search tree, AVL search tree, B tree, B+ tree, Heaps- Operations and their applications, Heap sort.	
6.	**Graphs:**	05
	Basic concept of graph theory, storage representation, graph traversal techniques- BFS and DFS, Graph representation using sparse matrix.	

TEXT BOOKS:
1. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)

REFERENCE BOOKS:

2. Data Structure using C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI)

3. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon

2nd Edition

Year and Semester	Second Year B. Tech - Semester III - Artificial Intelligence & Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	**Fundamentals of Artificial Intelligence**			Course Code	AI&DS2103
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	No.of Lectures
1.	**Introduction:**	7
	What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Introduction: Philosophy of AI, Definitions, AI Future. Stages of AI. (ANI, AGI,ASI with examples). **Intelligent Agents**: Agents and Environments Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	
2.	**Search Methods**	7

		State Space Search Generate and test, simple search, Depth first search (DFS), Breadth First search (BFS), Comparison, Quality of Solution, Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search: Heuristic Functions, Search Techniques: Best-first search, Hill climbing, Local Maxima, Solution Space Search, Variable Neighbourhood Descent, Beam Search, Tabu Search, Peak to peak method.	
3.		**Randomized Search:**	7
		Population Based Methods: Escaping Local Optima, Iterated Hill Climbing, Simulated Annealing, Genetic Algorithms, Neural Network, Emergent Systems, Ant Colony Optimization.	
4.		**Optimal Path Finding**	7
		Brute Force, Branch & Bound, Refinement Search, Dijkstra Algorithm, Algorithm A*, Admissible A*, Iterative Deepening A*, Recursive Best First Search, Pruning the CLOSED List, Pruning the OPEN List, Conquer Beam Stack Search.	
5.		**Constraint Satisfaction**	7
		N Queens, Constraint Propagation, Scene labelling, Higher order consistency, Algorithm backtracking, Look-head strategies, Strategic retreat.	
6	66666+	**Applications**	4
		AI Applications-Language Models-Information Retrieval-Information Extraction-Natural Language Processing-Machine Translation-Speech Recognition-Robot	

Text Books

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw-Hill Education, 2013.

2. Eugene, Charniak, Drew Mcdermott, "Introduction to artificial intelligence", Addison Wesley, 1985.

3. Elaine Rich, Kevin Knight, Shivashankar B Nair:Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013.

4. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books

1. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.

2. Herbert A. Simon, "The Sciences of the Artificial ", MIT Press, 3rd Edition (2nd Printing), 1995. 3. Tim Jones, "Artificial Intelligence

Application Programming", Dreamtech Publication.

3. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.
4. Prolog Programming for A.I. by Bratko, TMH

Year and Semester	Second Year B. Tech - Semester III - Artificial Intelligence & Data Science				
Course Category	Experimental Learning (EL)				
Title of Course	Data Structure using C Lab			Course Code	AI&DS2104
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	04	04	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	50	100	

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks
Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc.
Lab File should be prepared and should be assessed continuously during academic.
End Semester Evaluation has 50 Marks
External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 08 to 10 Experiments should get performed.	
Exp. No.	**Title of Experiment/ Problem Statement**

1	Write a 'C' Program to Search a particular data from the given Array of numbers using: Linear Search Method.
2	Write a 'C' Program to Search a particular data from the given Array of Strings using Linear Search Method.
3	Write a 'C' program to Search a particular data from the given Array of numbers using Binary Search Method.
4	Write a 'C' Program to Search a particular data from the given Array of Strings using Binary Search Method.
5	Write a 'C' Program to Sort an Array of numbers using Bubble Sort Method.
6	Write a 'C' Program to Sort an Array of Strings using Bubble Sort Method.
7	Write a 'C' Program to Sort an Array of numbers using Selection Sort Method.
8	Write a 'C' Program to Sort an Array of Strings using Selection Sort Method.
9	Write a 'C' Program to Sort an Array of numbers using Insertion Sort Method.
10	Write a 'C' Program to Sort an Array of Strings using Insertion Sort Method.
11	Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at beginning, (ii) Search, (iii) Display
12	Write a 'C' Program to Implement Singly Linked List with Operations: (i) Insert at end, (ii) Insert After, (iii) Delete (iv) Display
13	Write a 'C' Program to Create Two Polynomials using a Linked List.
14	Write a 'C' Program to add Two Polynomials using a Linked List.
15	Write a 'C' Program to perform PUSH and POP Operations on Stack using an Array.
16	Write a 'C' Program to perform PUSH and POP Operations on a Stack using a Linked List.

17	Write a 'C' program to perform multiplication of two numbers using recursion.
18	Write a 'C' program to print given string in reverse using recursion.
19	Write a 'C' program to create a Singly Linked List and traverse in reverse order using recursion.
20	Write a 'C' Program to perform INSERT and DELETE Operations on Linear Queue using an Array.
21	Write a 'C' Program to perform INSERT and DELETE operations on Linear Queue using a Linked List.
22	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using an Array.
23	Write a 'C' Program to perform INSERT and DELETE operations on Circular Queue using a Linked List.
24	Write a 'C' Program to Create a Priority Queue using a Linked List.
25	Write a 'C' Program to Implement BST (Binary Search Tree) and Traverse in In-Order.
26	Write a 'C' Program to Traverse BST in Preorder, and Post-Order.

TEXT BOOKS:
1. Schaum's Outlines Data Structures – Seymour Lipschutz (MGH)
REFERENCE BOOKS:
2. Data Structure using C- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI)
3. Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A.
   Forouzon 2nd Edition

Year and Semester	Second Year B. Tech - Semester III – Artificial Intelligence & Data Science				
Course Category	Multi-Disciplinary Minor-01				
Title of Course	Fundamentals of AI			Course Code	AI&DS2105
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	-	-	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme

- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %

- Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).

- No compulsory passing for MSE.

- ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	No.of Lectures
1.	**Introduction:**	3
	What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Introduction: Philosophy of AI, Definitions, AI Future. Stages of AI. (ANI, AGI,ASI with examples).	
2.	**Search Methods**	6
	State Space Search Generate and test, simple search, Depth first search (DFS), Breadth First search (BFS).. Heuristic Search: Heuristic Functions, Search Techniques: Best-first search, Hill climbing, Local Maxima, Solution Space Search..	
3.	**Randomized Search:**	5
	Population Based Methods: Escaping Local Optima, Iterated Hill Climbing, Simulated Annealing, Genetic Algorithms, Neural Network, Emergent Systems, Ant Colony Optimization.	

4.	**Optimal Path Finding**		5
	Brute Force, Branch & Bound, Refinement Search, Dijkstra Algorithm, Algorithm A*, Admissible A*, Iterative Deepening A*, Recursive Best First Search.		
5.	**Constraint Satisfaction**		5
	N Queens, Constraint Propagation, Scene labelling, Higher order consistency, Algorithm backtracking, Look-head strategies, Strategic retreat.		
6.	**Applications**		2
	AI Applications-Language Models-Information Retrieval-Information Extraction-Natural Language Processing-Machine Translation-Speech Recognition-Robot		

Text Books

5. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw-Hill Education, 2013.

6. Eugene, Charniak, Drew Mcdermott, "Introduction to artificial intelligence", Addison Wesley, 1985.

7. Elaine Rich, Kevin Knight, Shivashankar B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013.

8. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books

5. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.

6. Herbert A. Simon, "The Sciences of the Artificial ", MIT Press, 3rd Edition (2nd Printing), 1995. 3. Tim Jones, "Artificial Intelligence Application Programming", Dreamtech Publication.

7. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.

8. Prolog Programming for A.I. by Bratko, TMH

Semester	Second Year B. Tech - Semester III - Artificial Intelligence & Data Science				
Course Category	Open Elective-01				
Title of Course	Computer Networks			Course Code	AI&DS2106
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme

- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %

- Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).

- No compulsory passing for MSE.

- ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	No.of Lectures
1.	**Introduction to Computer Network**	05
	Overview of OSI layer Model and TCP/IP protocol model, Addressing, Underlying technologies for LANs, WANs, and Switched WANs	
2.	**Data Link Layer and Medium Access Control Sublayer**	06
	Design issues for Data Link Layers, Framing methods, Error control: detection and correction, Flow control, Elementary Data Link protocols, Static and Dynamic channel allocation, Multiple Access protocols, Ethernet: IEEE 802.3, IEEE 802.4, IEEE 802.5, 802.11	

3	**Network Layer and Internet Protocol**	07
	IPv4 Addresses, Sub-netting and Super netting, Class less Addressing, Delivery, Forwarding and routing; Routing methods, Congestion control algorithms: Principles, Congestion prevention policies, Load Shedding, Jitter Control, Datagram format, Fragmentation and reassembly models, ARP, RARP, ICMP, IGMP	
4	**Transport Layer**	07
	UDP: Process to Process communication, User Datagram Format, Operation and uses of UDP. TCP: TCP Services and Features, TCP segment format, TCP Connections, Flow and error control in TCP, TCP Timers; Berkeley Sockets: Socket Addresses, Elementary Socket system calls byte ordering and address conversion routines, connectionless iterative server, connection oriented concurrent server, TCP and UDP Client server Programs.	
5	**Application layer: DNS, FTP, Telnet**	07
	Domain Name Space, Distribution of name space, Resolution, DNS massages ,BOOTP, DHCP Telnet Concept, NVT, Embedding, Options& options/sub-option negotiation, controlling the server, Out-of-band signaling, Escape charter, Mode of operation, user interface. FTP: Connections, Communication, Command processing, File transfer, User interface, Anonymous FTP, TFTP.	
6.	**Web application and Multimedia Services**	07
	HTTP:Architecture,WebDocuments,HTTPTransaction,Requestand Response, HTTP Headers and Examples Electronic Mail: SMTP commands and responses, Mail transfer phases, MIME, POP3 Multimedia In Internet: Streaming to Real time audio/ video, Streaming live audio/ video, Real time interactive audio/video	

Text Books
1. TCP/IPprotocolsuit4thEd. –BehrouzA. Forouzen(Tata Mag.Hill)
2. Computer Networks – AndrewS.Tanenbaum(PHI)
3. Unix Network Programming–W. RichardStevens (PHI)

Reference Books:
1. TCP/IP Illustrated, The Protocols,Vol.I–W.Richard Stevens,G.Gabrani (Pearson Education.)
2. Internetworking with TCP/IP, Vol. IP principles, Protocols, and Architectures –D.E. Comer(PearsonEd.)
3. Internetworking with TCP/IP,Vol.III ,Client-Server Programming and Application(2nd Ed.) –D.E. Comer, David L. Stevens (Pearson Ed.)

Year and Semester	Second Year B. Tech - Semester III - Artificial Intelligence & Data Science		
Course Category	Programme Core Course (PCC)		
Title of Course	Fundamentals of AI Lab	Course Code	AI&DS2107

Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01

Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	50	100	

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks
Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc.
Lab File should be prepared and should be assessed continuously during academic.
End Semester Evaluation has 50 Marks
External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance
Faculty can create Experiment list based on following listed topics. Minimum 08 to 10 Experiments should get performed.

Exp. No.	Title of Experiment/ Problem Statement
1	Implement a basic intelligent agent in Python that operates in a simple environment (e.g., a grid world).
2	Create a presentation or interactive notebook exploring the differences between ANI (Artificial Narrow Intelligence), AGI (Artificial General Intelligence), and ASI (Artificial Superintelligence). Include examples like ChatGPT (ANI), hypothetical AGI scenarios, and theories of ASI.
3	Implement a rational agent that chooses the best action based on a scoring system. For instance, a "vacuum cleaner" agent can decide whether to clean, move, or turn off based on energy usage and cleanliness scores
4	Write Python programs for BFS and DFS to solve a simple problem, such as finding a path in a maze. Compare their performance in terms of time and space complexity.
5	Implement a heuristic search (e.g., Best-First Search or A*) to solve a problem like the puzzle or path finding in a grid world
6	Write a program to implement a genetic algorithm to solve an optimization problem, such as maximizing a mathematical function or solving the traveling salesman problem.
7	Create a simple feed forward neural network using Python or a library like TensorFlow to classify basic patterns (e.g., handwritten digits).
8	Implement Dijkstra's algorithm and the A* algorithm. Test them on a graph-based map with varying edge weights to find the shortest path.
9	Implement a backtracking algorithm to solve the N-Queens problem. Extend it with constraint propagation techniques for optimization.
10	Implement algorithms to enforce higher-order consistency (e.g., arc consistency or path consistency) in solving a Sudoku puzzle.
11	Simulate a simple scene (e.g., a 2D grid) and apply constraint satisfaction to label each grid cell according to specific rules.
12	Compare basic backtracking with lookahead strategies (e.g., forward checking) in solving constraint satisfaction problems.

Text Books

9. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw-Hill Education, 2013.

10. Eugene, Charniak, Drew Mcdermott, "Introduction to artificial intelligence", Addison Wesley, 1985.

11. Elaine Rich, Kevin Knight, Shivashankar B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013.

12. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Reference Books

9. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.

10. Herbert A. Simon, "The Sciences of the Artificial ", MIT Press, 3rd Edition (2nd Printing), 1995. 3. Tim Jones, "Artificial Intelligence Application Programming", Dreamtech Publication.

11. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.

12. Prolog Programming for A.I. by Bratko, TMH

Semester	Second Year B. Tech - Semester III – Artificial Intelligence & Data Science				
Course Category	HSSM				
Title of Course	Cyber Laws			Course Code	AI&DS2108
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	01	--	04	04
Examination Scheme	MSE	ISE/CA	ESE	Total	
		50		50	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Cyber Laws:**	8

		Overview of Cyber Laws and their importance in the digital world, The history and evolution of Cyber Laws, Types of cybercrimes, International frameworks and treaties on Cyber Laws, The role of law enforcement in combating cybercrimes, Jurisdictional issues in the cyberspace.	
2	**Cybercrime and Legal Frameworks:**	6
	Definition and categories of cybercrime (e.g., hacking, phishing, cyberbullying, identity theft), Cybercrime investigation and prosecution, Cybercrime statistics and global trends, Role of law enforcement agencies in cybercrime, Legal provisions under national and international laws, Types of cybercrimes: Financial, personal, corporate, etc.	
3	**The Information Technology Act, 2000 (India):**	07
	Overview of the IT Act, 2000 and its amendments (e.g., 2008 Amendment), Legal recognition of electronic records and digital signatures, Cybercrimes under the IT Act: Hacking, data theft, identity theft, etc., Cyber Law related to e-commerce and e-contracts, The role of Certifying Authorities (CAs), Legal actions and penalties for cybercrimes.	
4	**Intellectual Property (IP) in Cyberspace:**	06
	Basics of intellectual property law, Copyright, patents, and trademarks in the digital space, Cyber-squatting, domain name disputes, Copyright infringement in digital content (e.g., software piracy, illegal downloading), Licensing and ownership of software, digital media, and databases, Fair use of digital content and the DMCA (Digital Millennium Copyright Act).	
5	**Data Protection and Privacy Laws:**	7
	Overview of data protection principles, National and international data protection laws (e.g., GDPR, CCPA, India's Personal Data Protection Bill), Privacy policies and the rights of individuals, Data collection, processing, storage, and sharing, Data breaches and penalties for non-	

	compliance, Right to be forgotten, consent management, and data portability, Data protection in the context of e-commerce, social media, and cloud computing	
6	**Cyber Ethics and the Role of IT Professionals**	05
	Ethical issues in cyberspace: Privacy, security, and transparency, Role of IT professionals in ensuring compliance with Cyber Laws, Social responsibility of technology companies, The role of cybersecurity professionals in combating cybercrime, Online reputation management and ethical conduct on social media, Cyberbullying, cyberstalking, and ethical responsibilities in online platforms.	

Text Books:

- "Cyber Law: Text and Cases" by P.K. Agarwal
- Cyber Law and Cyber Security" by V. S. A. R. Kiran
- Internet Law: A Field Guide" by Jonathan L. Zittrain
- "Cyber Law and Digital Technologies" by Dr. K. K. Sharma

Reference Books:

- "Cybersecurity and Cyberlaw" by Dr. S. K. Soni
- "Principles of Cyber Law" by S. S. Bedi
- "The Cybersecurity Law Handbook" by Benjamin J. Shwom and Adam P. Pritchard
- "Digital Privacy and Data Protection" by Peter Carey.
- "Computer Law" by Sara S. R.

Year and Semester	Second Year B. Tech - Semester III – Artificial Intelligence and Data Science				
Course Category	Open Elective-01 Lab				
Title of Course	Open Elective-01 Lab			Course Code	AI&DS2109
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks
Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc.
Lab File should be prepared and should be assessed continuously during academic.
End Semester Evaluation has 50 Marks
External Practical Examination with Performance and Oral Examination

	Guidelines for Lab Performance
Faculty can create Experiment list based on following listed topics. Minimum 08 to 10 Experiments should get performed.	
Exp. No.	**Title of Experiment/ Problem Statement**

1	Study,designandconfigurationofIEEE802.3EthernetandIEEE802.11Wireless LANs (Referring RFCs)
2	Study of following connectivity test tools with all its options–ipconfig, arproute, traceroute nmap, netstat, finger.
3	Implementing Framing methods
4	Implementation of Error detection code CRC and Hamming code
5	Programs to understand IPaddressing, classful& classless addressing
6	Implement shortest path routing algorithm
7	Client program using UDP to connect to well-known services(echo,time of the day service etc.).
8	Implementing concurrent TCP multiservice client/server.
9	Study of network protocol analyzer (Etherealor Wire-Shark) and understanding packet formats for UDP, TCP, ARP, ICMP protocols.
10	Study of following DNS Toolswith all its options .nslookup, dig, host, whois
11	Configuration of basic services for FTP , HTTP, Telnetetc.onLinux Platform
12	Write program to send a mail using SMTP commands and receive a mail using POP3commands

Text Books

4. TCP/IPprotocolsuit4thEd. –BehrouzA. Forouzen(Tata Mag.Hill)
5. Computer Networks – AndrewS.Tanenbaum(PHI)
6. Unix Network Programming–W. RichardStevens (PHI)

Reference Books:

4. TCP/IP Illustrated, The Protocols,Vol.I–W.Richard Stevens,G.Gabrani (Pearson Education.)
5. Internetworking with TCP/IP, Vol. IP principles, Protocols, and Architectures –D.E. Comer(PearsonEd.)
6. Internetworking with TCP/IP,Vol.III ,Client-Server Programming and Application(2nd Ed.) –D.E. Comer, David L. Stevens (Pearson Ed.)

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	Python for Data Science			Course Code	AI&DS2201
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	00	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   • No compulsory passing for MSE.   • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	Contact hrs
1	**Basics of Python**	**6**

		Introduction to data science-why python ?-essential python libraries-python introduction-features, identifiers, reserved words, indentation,comments,build-in data types and their methods..string, list, tuples", dictionaries,set-type conversion-operators. Decision control statement: if statement, if-else-if statement, repetitive control statement:while loop, for loop, the range statement selection control statement: break and continue, else clause.	
2		**Modular Programming**	**7**
		Object oriented programming: concept of class,object and instance,constructor,class attributes and destructor ,real time use of class in live projects, inheritance, overlapping , overloading operators, adding and retrieving dynamic attributes of classes **Function**: What is function, define a function, pass arguments, argument with default values, arbitory arguments, local and global variable, return a value from function, mathematical function , random number function,mathematical constants, recursive function,	
3		**Exception Handling, File Handling:**	**7**
		Errors,Exception handling with try, handling multiple exception, writing your own exception. **File Handling:** File handling modes,reading files, writing and spending to files, Handling File Exception, the with statement.	
4		**Introduction to NumPy and scikit learn:**	**7**
		NumPy basics, arrays and vectorized computations- the NumPy array- creating Nd arrays – Data types for Nd arrays- arithmetic with NumPy arrays- basic indexing and slicing – Boolean indexing-transposing arrays and swapping axes. Universal function: Fast Element-wise array function. Introduction scikit learn library for data science.	
5		**Data Manipulation with Pandas:**	**7**
		Introduction to pandas and data structure: series, data frame, essential functionalities: Dropping entries- indexing, selection and filtering function , Application and mapping, sorting and ranking. Summarizing and Computing Descriptive statistics- Unique value, counts and membership.Reading and writing data in text format.	
6		**Data Cleaning, Preparation and visualization:**	6
		Data cleaning and preparation: Handling missing data- data transformation: removing duplicates , transforming data using a function or mapping , replacing values , detecting and filtering outliers-string manipulation: vectorize string function in pandas. **Plotting with Pandas:** line plots, Bar plots, Histograms.	

Textbooks					
Sr.No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to computing and problem solving with python	Jeeva Jose and SojanLal	Khanna book publishing Co.(P) Ltd	1	2016
02	Programming python	Mark Lutz	O'reilly	2	2001
03	Introduction to programming using python	Y. Daniel Liang	Pearson	---	2012
04	Python data science Handbook	Jake Vanderplas	O'reilly	---	2017

Reference Books					
Sr.No	Title	Author	Publisher	Edition	Year of Edition
01	Core python programming	Wesley J.Chun	Pentice hall	---	2016
02	Learning python	Mark Lutz	O'reilly	4th	2009

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	Object Oriented Programming			Course Code	AI&DS2202
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Basics of Object-Oriented Programming**	

	The Origins of C++, Features of Object-Oriented Programming, relations of Classes & Structures, Classes & Objects, Encapsulation, Data Abstraction, Inheritance, Inline Function, Constructor & Destructor, function overloading & Operator overloading, Static class member, Static Member Function, Scope resolution Operator, Access members Data member & member Function, Defining member functions, Passing Object to Functions, Nested classes, local classes, Friend functions, Friend class	5
2	**Pointers , Arrays, Dynamic allocation Operator**	4
	Arrays Of Object, Pointers to Object, THIS pointer, type checking C++ Pointers, Pointers to Derived types, Pointers to Class members Dynamic Allocation Pointers New & Delete Operator	
3	**Functions & Operator Overloading**	5
	Functions Overloading, Operator Overloading, Types Of Constructors, Destructors, Operator Overloading Using Friend Function, Unary & Binary Operator Overloading(Arithmetic, Comparison Operator Overloading),Assignment Operator Overloading(=,+=)	
4	**Inheritance & Virtual Function**	5
	Inheritance, Single Inheritance, Types of Derivations, Passing parameters to base ,Multiple Inheritance, Multilevel Inheritance, Hybrid Inheritance ,Hierarchical Inheritance , Virtual function, Calling a Virtual function through a base class reference, Virtual functions are hierarchical, Pure virtual functions, Abstract classes, Early and late binding.	
5	**Templates & Exception handling**	6
	Function Template ,Class Template, Generic Classes ,Generic Functions, Applying Generic Functions Type Name, export keyword Power of Templates Standard Template Library (STL):-STL Container, STL Algorithm, STL iterator. Exception handling :-Exception handling fundamentals, Catching, Throwing, & Handling Exception, Exception handling options,	
6	**I/O System Basics, File I/0**	5
	Streams ,File Pointers & Redirections Streams, C++ stream, C++ Predefined stream classes, Formatted I/O, C++ file I/O, manipulators, fstream and the File classes, File operations, namespaces, std namespaces	

TEXT BOOKS:

Sr No.	Books
1	The Complete Reference C++ by Herbert Schild(Tata McGraw Hill) 4th Edition andonwards.
2	Object oriented Programming in C++ by Rajesh K.Shukla(Wiley) IndiaEdition

REFERENCE BOOKS:

Sr. No.	Books
1	Object-Oriented Programming with C++ by E. Balaguruswamy. (Tata McGraw-Hill) 6th Edition and onwards
2	Object oriented Programming with C++- by Sourav Sahay (Oxford) 2ndedition

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	Programme Core Course (PCC)				
Title of Course	Operating System			Course Code	AI&DS2203
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	01	--	04	04
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction and Process Management**	**7**

	Overview: Introduction to Operating Systems, Operating System structure, Operating System Services, Architecture of the UNIX OS, Introduction to System Concepts, Types of Operating Systems - Batch Processing System, Multiprogramming System, The Time-Sharing System, The Real Time Operating System, Distributed operating system. Process concept: Basic concepts, Processes and programs, Implementing processes, Process States, Process Control Block, Context switch, Operations on processes, Inter-process communication, Threads.	
2	**Processes Synchronization and Scheduling**	**7**
	Processes Synchronization: Background, Process synchronization, Race condition, Critical Section, Synchronization approaches, Classic process synchronization problems, Semaphores, Monitors **Process Scheduling:** Scheduling criteria, Types of Scheduler, Scheduling algorithms, Multiple-Processor scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling	
3	**Deadlock**	**6**
	System model, deadlock characterization, methods for handling deadlocks, deadlock preventions, deadlock avoidance, deadlock detection, deadlock recovery.	
4	**Buffer Cache**	**6**
	Buffer Headers, Structure of the Buffer Pool, Scenarios for Retrieval of a Buffer, Reading and Writing Disk Blocks, Advantages and Disadvantages of Buffer Cache.	
5	**Internal Representation of Files and system calls**	**6**
	I-nodes, Structure of the Regular File, Directories, Conversion of a Pathname to I-node, Super Block, I-node Assignment to a New File, Allocation of Disk Blocks.	
6	**Memory Management**	**7**
	Memory Management Strategies: Background, swapping, contiguous and non- contiguous memory allocation, paging, structure of the page table, Segmentation. Virtual Memory Management: Background, demand paging, copy-on write, page replacement, Thrashing	

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Operating Systems –A Concept Based approach.	Dhananjay M. Dhamdhere	TMGH, 3rdEdition
02	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin &Grege Gagne	Wiley
03	The design of Unix Operating System	Maurice J. Bach	PHI

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Operating System: Concepts and Design	Milan Milenkovic	TMGH
02	Linux System Programming	Robert Love	SPD, O" REILLY

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	Multi-Disciplinary Minor-02				
Title of Course	Python for Data Science			Course Code	AI&DS2204
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	00	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %   - Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).   - No compulsory passing for MSE.   - ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No	Contents	Contact hrs
1	**Basics of Python**	**5**

	Introduction to data science-why python ?-essential python libraries-python introduction-features, identifiers, reserved words, indentation,comments,build-in data types and their methods..string, list, tuples", dictionaries,set-type conversion-operators. Decision control statement: if statement, if-else-if statement, repetitive control statement:while loop, for loop, the range statement selection control statement: break and continue, else clause.	
2	**Modular Programming**	**5**
	Object oriented programming: concept of class,object and instance,constructor,class attributes and destructor ,real time use of class in live projects, inheritance, overlapping , overloading operators. **Function**: What is function, define a function, pass arguments, argument with default values, arbitrary arguments, local and global variable, return a value from function, recursive function.	
3	**Exception Handling, File Handling:**	**4**
	Errors, Exception handling with try, handling multiple exception, writing your own exception. **File Handling:** File handling modes, reading files, writing and apending to files.	
4	**Introduction to NumPy and scikit learn:**	**4**
	NumPy basics, arrays and vectorized computations- the NumPy array- creating Nd arrays – Data types for Nd arrays- arithmetic with NumPy arrays- basic indexing and slicing – Boolean indexing-transposing arrays and swapping axes.	
5	**Data Manipulation with Pandas:**	**4**
	Introduction to pandas and data structure: series, data frame, essential functionalities: Dropping entries- indexing, selection and filtering function , Application and mapping, sorting and ranking.	
6	**Data Cleaning, Preparation and visualization:**	4
	Data cleaning and preparation: Handling missing data- data transformation: removing duplicates, transforming data using a function or mapping , replacing values , detecting and filtering outliers-string manipulation: vectorize string function in pandas. **Plotting with Pandas:** line plots, Bar plots, Histograms.	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to computing and Problem Solving with Python	Jeeva Jose and SojanLal	Khanna Book Publishing Co. (P) Ltd	1	2016
02	Programming Python	Mark Lutz	O'reilly	2	2001
03	Introduction to Programming using Python"	Y. Daniel Liang	Pearson	--	2012
04	Python Data Science Handbook: Essential Tools for Working with Data	JakeVanderPlas	O'Reilly	--	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Core Python Programming	Wesley J. Chun	Prentice Hall	--	2006
02	Learning Python	Mark Lutz,	O'reilly	4th	2009

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	Open Elective- 02				
Title of Course	Ethics in AI & DS			Course Code	AI&DS2205
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %

• Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).

• No compulsory passing for MSE.

• ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units). |

Unit No	Contents	Contact hrs
1	**Introduction to Ethics in AI & DS:**	**4**
	Definition of AI & Data Science Ethics, Importance of Ethics in AI & DS, Overview of Ethical Theories: Utilitarianism, Deontology, Virtue Ethics, Case Studies on Ethical Failures in AI & DS	
2	**Bias and Fairness in AI:**	**5**
	Understanding Bias in Data and Algorithms, Techniques for Bias Mitigation, Fairness-Aware Machine Learning, Real-World Cases of AI Bias	
3	**Data Privacy & Security:**	**5**
	Principles of Data Privacy, GDPR, CCPA, and Other Regulatory Frameworks, Ethical Data Collection and Usage, Security Challenges in AI & DS.	
4	**AI and Societal Impact:**	**4**
	The Role of AI in Employment and Economy, Autonomous Systems and Decision-Making, AI in Healthcare, Finance, and Criminal Justice, AI Ethics in Global Context	
5	**Accountability and Explainability in AI:**	**4**
	Explainable AI (XAI) and Transparency, AI Decision Accountability, Ethical AI Development and Governance, Case Studies on Ethical AI Implementation	
6	**Future of Ethical AI & DS :**	4
	Ethical Challenges in Emerging AI Technologies, Role of AI in Sustainability, Policy and Governance for AI Ethics, Career Paths in Ethical AI & DS	

Text Books:

1. "Weapons of Math Destruction" by Cathy O'Neil

2. "Ethics of Artificial Intelligence and Robotics" by Matthew Liao

3. "The Ethical Algorithm" by Michael Kearns & Aaron Roth

4. "Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	HSSM				
Title of Course	Soft Skills			Course Code	AI&DS2206
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	00	02	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	00	50	25	75	

Unit No.	Title and Content of Unit	Hours
1	**Understanding Communication Skills:** Verbal Communication – Effective Communication - Active listening – Articulation Paraphrasing – Feedback Non- Verbal Communication- Body Language of self and others	4
2	**Behavioral Skills /Self Development:** SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self esteem.	4
3	**Leadership and Team Building** Culture and Leadership- Salient Features of Corporate Culture, Leadership Styles, Leadership Trends, Team Building- Team Development Stages, Types of Teams, Attributes of a successful team – Barriers involved	5
	Developing Writing skills	4

4	E-mail writing, report writing, resumes writing, practice.	
5	**Stress and Time Management**	4
	Stress in Today‚‚s Time- Identify the Stress Source, Signs of Stress, Ways to Cope with Stress. Healthier Ways to Combat Stress, Steps to be taken in the Organizations: Open communication, Time Management, Working towards Your Goals, Smart Work, Prioritize yourTasks	
6	**Professional Skill**	5
	Ethics, Etiquette and Mannerism-All types of Etiquette (at Meetings, Etiquette at Dining. Involuntary Awkward Actions, Public Relations Office(PRO)‚‚s Etiquettes Technology Etiquette: Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, Interview Etiquette. Dressing Etiquettes: for Interview, offices and social functions. Ethical Values: Importance of Work Ethics, Problems in the Absence of Work Ethics.	

Textbooks			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	Developing Communication Skills by Krishna Mohan and	Meera Banerji	MacMillan India Ltd.,Delhi
02	Soft Skills – An Integrated Approach to Maximize Personality,	Gajendra Singh Chauhan, Sangeeta Sharma:	WILEY INDIA
03	Essentials of Effective Communication,	Ludlow and Panthon	Prentice Hall of India.

Reference Books			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	An Approach to Communication Skills	Indrajit Bhattacharya	Delhi, Dhanpat Rai,2008.
02	Seven Spiritual Laws of Success -	Deepak Chopra	

| 03 | English for Business Communication | Simon Sweeney | Cambridge University Press, |

Year and Semester	Second Year B.Tech- Semester IV-Artificial Intelligence & Data Science				
Course Category	HSSM				
Title of Course	Employability Enhancement Skills			Course Code	AI&DS2207
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	00	25	--	25	

Course Pre-Requisite		
Course Objective	1	To develop verbal and non-verbal communication abilities essential for professional interactions
	2	To train students in presenting technical and non-technical content clearly and confidently
	3	To focus on teamwork and problem-solving approach to meet industry expectations.
	4	To prepare students for interviews by improving their self-presentation and answering techniques.
	5	To help students articulate ideas clearly in written format, including emails, reports, and other technical documentation.
	6	To effectively manage time and complete goals by the deadline.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	effectively communicate and present ideas in both professional and technical environments
	CO2	deliver structured, effective, and confident presentations
	CO3	work efficiently in teams and handle interpersonal issues in a professional manner.
	CO4	Confidently face interviews and improve their chances of employability.
	CO5	produce technical and professional written materials such as reports, emails, and resumes
	CO6	adopt time management techniques to improve their productivity in both academic and professional settings.

Marking Scheme
In Semester Evaluation/Continuous Assessment has 25 Marks Parameters for In Semester Evaluation could be Attendance, Assignments, Unit Tests, Presentation, Online Activities like(Virtual Labs, NPTEL) etc.
Lab File should be prepared and should be assessed continuously during academic.

Unit No.	Title and Content of Unit	Hours
1	**Communication Skills** Verbal communication: Effective speaking and listening skills, Non-verbal communication: Body language, gestures, and expressions, Barriers to communication and overcoming them, Professional email writing and etiquette.	5
2	**Presentation Skills** Basics of presentation: Structure, flow, and delivery, Presentation tools: PowerPoint, Canva, and others, Handling Q&A sessions effectively, Giving technical presentations to a non-technical audience.	4
3	**Interpersonal Skills** Teamwork and collaboration in projects, Conflict resolution and problem-solving, Adaptability and flexibility in a professional environment, Building professional relationships and networks.	4
4	**Interview Preparation** Self-introduction and resume preparation, Mock interviews: HR and technical rounds, Behavioral questions and STAR method (Situation, Task, Action, Result), Technical interview strategies (specific to AIML domain).	5
5	**Professional and Technical Writing** Writing professional emails, Report writing: Lab reports, project documentation, etc. Technical proposals and abstracts, Writing resumes and cover letters.	4
6	**Time Management and Productivity Skills** Prioritization techniques (Eisenhower Matrix, Pomodoro Technique),Setting SMART goals, Managing deadlines in academic and work-life balance, Tools for productivity: Trello, Asana, etc.	4

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Business Communication: Process and Product	Mary Ellen Guffey and Dana Loewy	Cengage Learning, 9th Edition (2018)
02	The Exceptional Presenter: A Proven Formula to Open Up! and Own the Room	Timothy J. Koegel	Greenleaf Book Group Press, Revised Edition (2007)
03	Soft Skills: The Software Developer's Life Manual	John Sonmez	Manning Publications, 1st Edition (2015)
04	Cracking the Coding Interview: 189 Programming Questions and Solutions	Gayle Laakmann McDowell	CareerCup, 6th Edition (2015)
05	Technical Writing: Process and Product	Sharon Gerson and Steven Gerson	Pearson, 8th Edition (2017)
06	Getting Things Done: The Art of Stress-Free Productivity	David Allen	Penguin Books, Revised Edition (2015)

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Effective Communication Skills	MTD Training	MTD Training & Ventus Publishing, 2010
02	Presentation Zen: Simple Ideas on Presentation Design and Delivery	Garr Reynolds	New Riders Press, 3rd Edition (2019)
03	The 7 Habits of Highly Effective People	Stephen R. Covey	Simon & Schuster, 25th Anniversary Edition (2013)
04	How to Answer Interview Questions: 101 Tough Interview Questions	Peggy McKee	Career Confidential, 2012
05	Handbook of Technical Writing	Gerald J. Alred, Charles T. Brusaw, and Walter E. Oliu	Bedford/St. Martin's, 12th Edition (2018)
06	The Pomodoro Technique: The Life-Changing Time-Management System	Francesco Cirillo	Random House, 1st Edition (2018)

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	VSEC				
Title of Course	Python for Data Science Lab			Course Code	AI&DS2208
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 25 Marks
Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc.
Lab File should be prepared and should be assessed continuously during academic.
End Semester Evaluation has 25 Marks
External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance
Faculty can create Experiment list based on following listed topics. Minimum 08 to 10 Experiments should get performed.

Exp. No.	Title of Experiment/ Problem Statement
1	Implement Basic python programs to demonstrate fundamental concepts by reading input from console.
2	Implement Basic python programs to demonstrate decision controls and looping statements.
3	Apply python built in data types: string, list, tuples" , dictionary, set and their methods to solve any given problem.
4	Implement OOP concepts like data heading and data abstraction.
5	Create User-defined function with different type of function arguments.
6	Perform File Manipulation Operations- open,close,read,write,append and copy from one file to any other.
7	Handle Exception using python built in exception.
8	Implement various in-built-functions of NumPy library.
9	Create Pandas series and data frame from various inputs.

10	Import any CSV File to pandas data frame and perform following:
	  a. Visualize first and last ten records.
	  b. Get the shapes, index and column details.
	  c. Select / delete the records(rows/columns) based on conditions.
	  d. Perform ranking and sorting operations.
	  e. Do required statistical operations on the given columns.
	  f. Find the count and uniqueness of the given categorial values.
	  g. Rename single/multiple columns.

11	Import any CSV File to panda data frame and perform the following :
	  a. Handle missing data by detecting and dropping/ filling missing values.
	  b. Transform data using apply(), map() method.
	  c. Detect and filter outliers.
	  d. Perform vectorized string operations on panda series.
	  e. Visualize data using line plot, bar plots, histogram, density plots and scatter plots.

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	VEC				
Title of Course	Object Oriented Programming Lab			Course Code	AI&DS2209
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	04	04	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 25 Marks
Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.
End Semester Evaluation has 25 Marks
External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance
Faculty can create an Experiment list based on following listed topics. Minimum 08 to 10 Experiments should get performed.

Exp. No.	Title of Experiment/ Problem Statement

1	Classes & objects
2	Constructors & destructors
3	Friend function and Friend class
4	Inline Function, Static data members & member functions,
5	Array, Array of Objects, Pointer to Object, THIS pointer, Dynamic allocation operators (New & Delete)
6	Function overloading, Operator overloading (unary/binary/arithmetic/comparison)
7	Inheritance (multilevel, multiple, hybrid, Hierarchical)
8	Virtual function and Virtual class, early and late binding
9	Generic function & classes
10	STL
11	Exception Handling
12	File handling

Year and Semester	Second Year B. Tech - Semester IV - Artificial Intelligence & Data Science				
Course Category	VSEC				
Title of Course	Mini Project Lab			Course Code	AI&DS2210
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

In Semester Evaluation (ISE)/Continuous Assessment (CA)	
The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews.	
In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.	
Distribution of ISE/ CA marks shall be as below:	Marks
1 Marks awarded by guide/supervisor	10
2 Marks awarded by review committee	10
3 Quality of Project report	05

Guidelines for Mini Project

- ✓ Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- ✓ The Mini Project topic should be based on the any one subject concept that students have studied for their Academic Year.
- ✓ Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculty members
- ✓ In the Synopsis they have to state Flowchart, Usage of the logic, algorithm, functions and suitable data structure for implementing the solution. They have to implement project using C, C++ and Python languages.
- ✓ Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- ✓ Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.

	Guidelines for Assessment of Mini Project Lab
1	Report should be prepared as per the guidelines issued by the Shivaji University, Kolhapur
2	Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by head of Institution.
	Mini Project shall be assessed based on following points;
1	Quality of problem and Clarity
2	Innovativeness in solutions, Cost effectiveness and Societal impact
3	Full functioning of working model as per stated requirements
4	Effective use of skill sets & programming languages learnt.
5	Contribution of an individual's as member or leader
6	Presentation and ability to explain the project.

Year and Semester	Second Year B. Tech - Semester IV (Common to all branches of Engineering)				
Course Category	Basic Science Courses (BSC)				
Title of Course	**Environmental Science**			Contact Hrs/Week	Credits
Teaching Scheme	L	T	P		
	02	--	--	02	Audit
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Objectives: The objectives of the course is to
1. Understand the scope & multidisciplinary nature of Environmental Studies.
2. Get acquainted with the problems associated with natural resources and their conservation.
3. Familiarize the environmental & social problems with global concern.
4. Recognize the importance of Biodiversity with respect to Western Ghats.
Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the importance of Environmental Studies and recognize significance of ecosystem.	II

CO2	Classify the values of natural resources with associated problems for sustainable lifestyles.	II
CO3	Describe the social and global environmental issues	II
CO4	Make aware of Pollution issues with its mitigation measures.	II
CO5	Familiarize the basics of Biodiversity and concerned issues in the context of Western Ghats.	II
CO6	Acquaint with the role of environmental laws and regulations in conservation efforts.	I

Unit No	Content	Hours
	Nature of Environmental Studies and Importance of ecosystems.	
Unit 1	• Definition, scope and importance. • Multidisciplinary nature of environmental studies • Need for public awareness. **Ecosystem** • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Food chains, food webs and ecological pyramids • Introduction, types, characteristics features, structure and function of the following ecosystem a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) • Degradation of the ecosystems and it's impacts.	**06**
	Natural Resources and Associated Problems.	

Unit 2	• Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. • Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. • Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. • Food resources: World food problem, changes caused by agriculture, effect of modern agriculture, fertilizer-pesticide problems. • Energy resources: Growing energy needs, renewable and non- renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy. • Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of individuals in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	06

		Social Issues and the Environment	
Unit 3		• Human population growth and impact on environment. • Environmental ethics: Role of Indian religious traditions and culture in conservation of the environment. • Environmental movements- Chipko Movement, Appiko Movement, Silent Valley Movement. • Resettlement and rehabilitation of people; its problems and concerns. • Water conservation, rain water harvesting. • Disaster management: floods, earthquake, cyclone, tsunami and landslides, Case studies.	**04**
		Environmental Pollution	
Unit 4		• Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Global warming, acid rain, ozone layer depletion. • Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Solid waste management, control & rules, • Role of an individual in prevention of pollution	**04**
		Biodiversity and its conservation:	

Unit 5	• Introduction- Definition: genetic, species and ecosystem diversity. • Bio-geographical classification of India. • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. • India as a mega- diversity nation. • Western Ghat as a biodiversity region. Hot-spots of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts, • Conservation of biodiversity: In-situ and Ex- situ conservation of biodiversity.	**04**	
	Environmental Protection-Policies and practices		
Unit 6	• Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • National and International Conventions and agreements on environment.	**04**	

Field work: (Field work is equal to 4 lectures)   **10 marks Note - The ISE/CA is carried out through the Field work and Report writing.**

- Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.
  References:

	Reference Books
1	Raut P.D., Environmental Studies, Shivaji University Press, 2021
2	Gleick, H.,1993, Water in crisis, Pacific Institute for studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press 473p
3	Hawkins R.e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
4	Heywood, V.H. & Watson, R.T.1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p.
5	Jadhav, H. & Bhosale, V.M.1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.

6	McKinney, M.L. & School. R.M.1196, Environmental Science Systems & Solutions, Web enhanced edition, 639p
7	Mhaskar A.K., Master Hazardous, Techno-Science Publications (TB)

Year and Semester	Second Year B. Tech Semester IV				
Course Category	VSEC				
Title of Course	Computer Maintenance Technology			Course Code	AI&DS2212
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	--	50	

Course Pre-Requisite		Basics of Operating System, Basic Computer knowledge, Basic Problem-Solving Skills.
Course Objective	1	To understand the construction and working of Input & Output devices
	2	To Know the Troubleshooting and preventive maintenance of PC.
	3	Troubleshoot peripherals and networks.
	4	Select processors required for relevant systems.
Course Outcomes	After competition of this course Students will be able to	
	CO1	Identify different types of computer systems.
	CO2	Perform formatting, partitioning and Hard disk installation.
	CO3	Troubleshoot common motherboard problems.
	CO4	Test power supplies.

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3										3
CO2	2	3										3
CO3	2	3										2
CO4	2	3										2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
<u>In Semester Evaluation/ Continuous Assessment has 50 Marks</u> Parameters for In Semester Evaluation could be: Attendance, Assignments, Practical, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.

Guidelines for Practical Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed along with flow chart and Execution.	
Exp. No.	Title of Experiment/ Problem Statement
1	Desktop/laptop/server type identification and its specification
2	Identification and cleaning of Components
3	Preventive Maintenance of PC
4	Perform Internal socket connections
5	Perform BIOS settings
6	Installation of Windows Operating System
7	Installation of Unix family Operating System
8	Peripheral devices cleaning

9	Installation of local and Network printer
10	Share devices, files and folders
11	Installation of scanner
12	Set Input/output devices
13	Connect devices to external port
14	Networking devices connection
15	Fiber optic cable construction
16	Connection of Switches/Hub
17	Setup wired network environment
18	Setup wireless I/O devices
19	Fault diagnostics
20	Component replacement

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	The Complete PC Upgrade And maintenance Guide	Minasi, Mark	BPB Publication, New Delhi
02	Hardware Trouble Shooting and Maintenance	B. Govindarajalu	Tata McGraw Hill

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	The computer hardware installation, interfacing troubleshooting and maintenance	James, K.L.	PHI Learning, New Delhi, 2014, ISBN: 978- 81-203-4798-4
02	PC Upgrade & Repair Bible	--	Wiley India

==SY.Btech Exit (NPTEL & Virtual Lab List) for Artificial Intelligence and Data Science==

- As part of the NEP 2020 Revised Syllabus, for the ==SY.Btech Exit (NPTEL & Virtual Lab List)==, students must earn a total of 8 additional credits. This includes 6 credits from online SWAYAM NPTEL courses and 2 credits from Virtual Lab performance.

- Students must complete two SWAYAM NPTEL courses (12-week duration) from the provided list and successfully perform two Virtual Labs from the specified list.

- Each SWAYAM NPTEL course carries 3 credits, while each Virtual Lab is worth 1 credit.

Sr. No.	Name of NPTEL Course
1	**Artificial Intelligence: Search Methods for Problem Solving**
2	Introduction to python programming
3	An Introduction to Artificial Intelligence
4	Data Science for Engineers
5	The Joy of Computing Using Python

Sr. No.	Name of Virtual Lab
1	Problem Solving Lab
2	Artificial Intelligence Lab
3	Soft Computing in Engineering lab
4	Python Programming Lab

Examination Scheme

- Swayam NPTEL Course Certificate Should be submitted to Department   6 Credits

- Lab Experiments Report must be prepared and submitted to department   2 Credits