Fourth Semester

Open Source Programming (24B51CS241)

Course Description

Course Code	**24B51CS241**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024	
Course Name	**Open Source Programming**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	define open source software (OSS) and relate the benefits of various OSS models.	Remembering (C1)
CO2	understand the concept of Python for open source software development	Understanding (C2)
CO3	develop applications and database using the open source Python language.	Applying (C3)
CO4	analyze data charts or graphs using open source tools.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction to open source	What is open source software, what is proprietary software, open source governance models, advantages of OSS, contributing to OSS projects.	3
2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, expression, Python programming continued: conditional statements, functions, strings.	9
3.	Data structure in Python	Array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	9
4.	Python libraries	Introduction to Python libraries: NumPy, case study for the implementation of all libraries.	4
5.	Data storage and retrieval	File processing, reading, writing and appending to files, connectivity of Python with SQL database, querying and retrieving data.	7
6.	Data Visualization	Introduction to Matplotlib, introduction to data visualization, types of charts, steps for creating data visualization.	7
7.	Case Studies: Popular open source software	Study popular open source software, their architecture, development time-line, challenges.	3

Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., and Wilson G.,** The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks. Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.,** Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.

Reference Books

3.	**Barry P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey C.**., Coding Club Python: Next Steps Level 2, Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	1		2	1	2	3	3	3
CO3	2	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Open source Programming Lab (24B55CS242)

Course Description

Course Code	**24B55CS242**	**Semester: Even**	**Semester** IV **Session** 2023-24 **Month from** Jan-May 2024	
Course Name	**Open Source Programming Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	define open source software (OSS) and relate the benefits of various OSS models.	Remembering (C1)
CO2	understand the concept of Python for open source software development	Understanding (C2)
CO3	develop applications and database using the open source Python language.	Applying (C3)
CO4	analyze data charts or graphs using open source tools.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to Open Source	Hands on existing open source software.	1
2.	Introduction to Python	Python programming, Python as a language, installing Python and writing a program, Python interpreter, identifiers and keywords, literals, strings, operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator. Ternary operator, Bit wise operator, Increment or Decrement operator), Expression, conditional statements, functions, strings.	3
3.	Data structure in Python	Programming practice on array, matrix, the power of lists, list methods, accessing an item from a list, adding an item to a list, dictionary keys and values, dictionary methods, tuples.	3
4.	Python libraries	Working on Python libraries: NumPy, case study for the implementation of all libraries	2
5.	Data Storage & Retrieval	File processing, reading, writing, and appending to files, connectivity of Python with SQL database, querying and retrieving data.	2
6.	Data Visualization	Program using Matplotlib, data visualization.	2

7.	Case Studies: Popular Open Source Softwares	Case study on popular open source softwares, their architecture, development time-line, challenges.	1
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: The students will work in a group of 3/4 members. In the mini-project, students will be able to develop applications using Python and its Libraries. Further they will be able to explore various open source tools and techniques used in different domains like data-science, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown A., Wilson G.**, The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks, Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.**, Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.
3.	**Barry, P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey, C.**, Coding Club Python: Next Steps Level 2. Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	1		2	1	2	3	3	3
CO3	2	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Data Base Management System (24B51CS243)

Course Description

Course Code	**24B51CS243**	**Semester: Even**	**Semester IV** **Session** 2023-24 **Month from** Jan-May2024	
Course Name	**Data Base Management System**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	explain the basic concepts of database systems and programming languages.	Understanding (C2)
CO2	explain data models, functional dependencies, relational algebra and concurrency.	Understanding (C2)
CO3	apply programming languages on various data models.	Applying (C3)
CO4	apply various database techniques for transaction and recovery management.	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	**Introduction to Databases**	Introduction to databases, physical level of data storage; Structure of relational databases.	4
2.	**Data Models and database design**	Database design and ER model, entity type, attributes, relation types, notations, constraints, extended ER features, relational model	6
3.	**Structured Query Language (SQL)**	Data definition and manipulation, SQL create, insert, update, delete, select statements, order by, aggregate function, join and nested queries	6
4.	**FDs and Normalization**	Anomalies, data dependencies, closures, 1NF, 2NF, 3NF, BCNF, building normalized databases	5
5.	**Relational Algebra**	Introduction, selection and projection, set operations, renaming, joins, division, operators, grouping	5
6.	**Procedural Language**	PL/SQL: stored procedures, functions, cursors, triggers	6
7.	**Transaction Management**	Transactions, concurrency, recovery, security.	5
8.	**Concurrency & Recovery**	Introduction to databases and transactions, ACID properties, serializability and concurrency control, lock based concurrency control (2PL, Deadlocks), time	5

		stamping methods, database recovery management.	
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End-Term	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Henry F K., Abraham S., Sudurshan, S.,** Database System Concepts, McGraw-Hill, 5th Edition, 2006.
2.	**Elmasri R., Navathe, S.B.,** Fundamentals of Database Systems, Pearson Education, 4th Edition, 2006.
3.	**Ramakrishnan R., Gehrke J.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4.	**Connolly T., Begg C.,** Database Systems-A Practical Approach to Design, Implementation and Management, Addison-Wesley, 3rd Edition, 2002.
5.	**Date C.J. ,** Database Design and Relational Theory: Normal Forms and All That Jazz, 2012.
6.	**Chopra R.,** Database Management System (DBMS): A Practical Approach, 5th Edition, 2016.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	1		2	1	2	3	3	3
CO3	2	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2.00**	**1.00**		**1.75**	**1.00**	**2.00**	**3.00**	**3.00**	**3.00**

Data Base Management System-Lab (24B55CS244)

Course Description

Course Code	**24B55CS244**	**Semester: Even**	**Semester IV** **Session** 2023-24 **Month from** Jan-May 2024	
Course Name	**Data Base Management System-Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	demonstrate the basic commands of programming languages.	Understanding (C2)
CO2	construct code in PL/SQL programming for simple problems.	Applying (C3)
CO3	develop and implement a database schema for a given problem-domain.	Applying (C3)
CO4	compare data base management techniques by developing a project.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MySQL commands.	MySQL Create, Insert, Update, Delete and Select Statements.	6
2.	SQL	Simple queries, sorting results (ORDER BY Clause), SQL aggregate functions, grouping results (GROUP BY Clause), subqueries, ANY and ALL, multi-table queries, EXISTS and NOT EXISTS, combining result tables (UNION, INTERSECT, EXCEPT), database updates	4
3.	Procedural Language	1. Write PL/SQL program for storing data using procedures. 2. Write PL/SQL program for storing data using stored functions. 3. Write PL/SQL program for storing data using cursors and Triggers.	4
Total Number of Labs			**14**

Evaluation Criteria	
Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20

Day-to-Day	60
Total	**100**

Project based learning: Each student in a group of 2-3 will develop a project based on different real-world problems pertaining to database related Technologies. Project development will enhance the knowledge and employability of the students in IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Korth H.F. , Silberschatz A., Sudarshan S.** Database System Concepts, McGraw-Hill, 7th Edition, 2019.
2.	**Elmasri R., Navathe S.B.**, Fundamentals of Database Systems, Pearson Education, 5th Edition, 2015.

Reference Books

3.	**Ramakrishnan G.,** Database Management Systems, Mcgraw-Hill, Addison-Wesley, 3rd Edition, 2006.
4.	**Connolly T., Begg C.,** Database Systems - A Practical Approach to Design, Implementation and Management, Addison-Wesley, 6rd Edition, 2015.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	1		2	1	2	3	3	3
CO3	2	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	2.75	2.75	2.75	2.00	1.00		1.75	1.00	2.00	3.00	3.00	3.00

Design and Analysis of Algorithms (24B21MA211)
Course Description

Course Code	**24B21MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024	
Course Name	**Design and Analysis of Algorithms**			
Credits	**3**	**Contact Hours**	3-0-0	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	explain different sorting and searching methods.	Understanding (C2)
CO2	identify the complexity of different algorithms using asymptotic analysis.	Applying (C3)
CO3	apply algorithmic principles for solving computational problems.	Applying (C3)
CO4	analyze an efficient solution to a given problem using appropriate data structure and algorithm design techniques.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Introduction to problem solving approach; asymptotic analysis: growth of functions and solving recurrences; notations- big O, big omega, big theta, little O; empirical analysis of sorting and searching algorithms – merge sort, quick sort, heap sort, radix sort, count sort, linear search, binary search and median search.	6
2.	Divide and Conquer Methods	Fundamentals of divide and conquer (D&C) approach using binary search, quick sort and merge sort; Strassen's matrix multiplication and closest pair, etc.	6
3.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm, fractional and 0/1 Knapsack; coinage problem, bin packing; job scheduling–shortest job first, Shortest remaining job first, etc., graph coloring; and text compression using Huffman coding and Shannon-Fanon coding, etc.	7
4.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem; Hamiltonian cycle detection, travelling salesman problem, network flow.	6
5.	Dynamic Programming	Fundamentals of dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, coinage problem; matrix chain multiplication, longest common subsequence, longest	7

		increasing sequence, string editing.	
6.	String Algorithms	Naive string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, solving string problems using string data structures like tries, suffix tree and suffix array.	7
7.	Tractable and Non- Tractable Problems	Efficiency and tractability, P, NP, NP-complete, NP-hard problems.	3
Total Number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on data structures algorithms. The students can opt any real-world application where these algorithms can be applied. The students have to implement the mini project using C/C++/Java language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material:

1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	1		2	1	2	3	3	3
CO3	2	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	**2.75**	**2.75**	**2.75**	**2**	**1**		**1.75**	**1**	**2**	**3**	**3**	**3**

Design and Analysis of Algorithms Lab (24B25MA211)

Course Description

Course Code	**24B25MA211**	**Semester: Even**	**Semester IV Session 2023-24** **Month from** Jan-May 2024	
Course Name	**Design and Analysis of Algorithms Lab**			
Credits	**1**	**Contact Hours**	0-0-2	
	Coordinator(s)			
	Teacher(s) (Alphabetically)			

COURSE OUTCOMES: After pursuing the above-mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	understand various data structures and algorithm design techniques with the help of examples.	Understanding (C2)
CO2	develop an efficient solution to a given problem using appropriate data structure and algorithm design technique.	Applying (C3)
CO3	apply and build various algorithms and design techniques to solve given problems.	Applying (C3)
CO4	evaluate the correctness and complexity of the algorithm for a given problem.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Labs**
1.	Introduction to MatLab	Basic operations in MatLab, saving workspaces and files, operations on arrays, matrices, strings and graph objects, native data structures in MatLab, using inbuilt functions and toolboxes, if conditional statements, for and while loops, saving functions,	1
2.	Analysis of algorithms, searching and sorting based problems	Introduction to problem solving approach; asymptotic analysis; solving recurrences; empirical analysis of sorting and searching algorithms – merge sort, Quick sort, heap sort, radix sort, count sort, binary search, and median search,	2
3.	Divide and Conquer Methods	Problems based on divide and conquer (D&C) approach such as binary search, quick sort and merge sort and closest pair, etc.	1
4.	Greedy Algorithms	Introduction to greedy based solution approach, minimum spanning trees (Prim's and Kruskal algorithms), shortest path using Dijkstra's algorithm, fractional and 0/1 Knapsack, coinage problem, bin packing, job scheduling – shortest job first, shortest remaining job first, etc., graph coloring, and text compression using Hamming coding and Shannon-	2

		Fano coding, etc.	
5.	Backtracking Algorithms	Review of backtracking based solution approach using N queen, and rat in a maze, M-coloring problem, Hamiltonian cycle detection, travelling salesman problem, network flow.	2
6.	Dynamic Programming	Fundamentals of Dynamic programming based solution approach, 0/1 Knapsack, shortest path using Floyd Warshall, Coinage problem, matrix chain multiplication, longest common subsequence, longest increasing sequence, string editing.	2
7.	String Algorithms	Naïve string matching, finite automata matcher, Rabin Karp matching algorithm, Knuth Morris Pratt, Tries, suffix tree and suffix array.	2
8.	Problem Spaces and Problem solving by search	Problem Spaces: states, goals and operators, factored representation (factoring state into variables) uninformed search (BFS, DFS, DFS with iterative deepening), heuristics and informed search (hill-climbing, generic best-first, A*).	2
Total Number of Labs			**14**

Evaluation Criteria

Components	**Maximum Marks**
Lab Viva-1	20
Lab Viva-2	20
Day-to-Day	60
Total	**100**

Project based learning: Students in a group of 4-5 will be designing an efficient solution to a given problem / case-studies using appropriate data structure and algorithm design technique studies in the course. The students have to implement the mini project using MatLab/C/C++ language. Project development and its presentation will enhance coding skills, knowledge and employability of the students in IT sector.

Recommended Reading material:

1.	**Cormen T.H., Leiserson C.E.,.Rivest R.L., and Stein C.,** Introduction to Algorithms, MIT Press, 3rd Ed, 2009.
2.	**Skiena S.,** The Algorithm Design Manual, Springer; 2nd Ed, 2008.
3.	**Knuth D.,** The Art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional, 3rd Ed,1997.
4.	**Horowitz, E., Sahni, S. ,** Fundamentals of Computer Algorithms, Computer Science Press, 2008.
5.	**Sedgewick R.,** Algorithms in C, Addison Wesley, 3rd Ed, 2002.
6.	**Alfred V. A, Hopcroft J.E. and Ullman J. D.,** Data Structures and Algorithms, Addison-Wesley Series in Computer Science and Information Processing, 1983.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	3	3	3	2	2		1	1	1	3	3	3
CO3	3	2	2	2	1		1	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	**3**	**2.75**	**2.75**	**2**	**1.25**		**1.5**	**1**	**1.75**	**3**	**3**	**3**

Linear Algebra (24B21MA212)

Course Descriptions

Course Code	**24B21MA212**	**Semester: Even**	**Semester** IV **Session** 2023 -2024 **Month from** Jan -May 2024
Course Name	Linear Algebra		
Credits	**4**	**Contact Hours**	**3-1-0**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
CO1	recall basic concepts of algebraic structures and system of linear equations.	Remembering (C1)
CO2	explain vector space, linear transformation, inner product space and eigenvalue problems.	Understanding (C2)
CO3	apply the concept of orthogonality and linear transformations in solving the related problems.	Applying (C3)
CO4	examine the problems related to system of linear equations, diagonalizability of matrices and Gram-Schmidt orthogonalization.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction of modern algebra	Definitions of group, subgroup, cyclic group, normal subgroup, ring, integral domain, field and its examples with simple properties.	8
2.	Vector Spaces	Vector Space, vector subspace, linear dependence and independence, Span of a set, Dimension of a vector space, Direct sum and complement.	7

3.	Linear Transformation	Linear transformation and its algebra, its matrix representation, homomorphism, isomorphism, rank and null subspace, rank-nullity theorem, Solution of a system of linear equations, Determinant, Change of basis, Inverse of a linear transformation.	10
4.	Eigenvalues and Eigenvectors	Eigenvalues and Eigenvectors, Modal matrix and diagonalization, Similarity transformation, Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices.	9
5.	Inner Product and Metric	Inner product space, Metric and normed spaces. Orthonormal basis, Orthogonal Subspaces, Gram-Schmidt orthogonalization.	8
		Total Number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project Based Learning: Each student in a group of 4-5 students will apply the concepts of eigenvalues and eigenvectors, Gram-Schmidt orthogonalization process in solving various related problems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Hoffman K., Kunze R.** , Linear Algebra, Prentice Hall of India, Fourth Edition, 2005.
2.	**Strang G.**, Linear Algebra and its Applications, 3rd Ed., 2008.
3.	**Noble B., Daniel J.**, Applied Linear Algebra, Prentice Hall of India, 2000.
4.	**Lipshutz S., Lipsom M. ,** Linear Algebra, 6th Edition, Schaum Series, 2017.
5.	**Krishnamurthy V., Mainra V. P., and Arora J. L.** , An Introduction to Linear Algebra, Affilated East-West, 1976.

CO-PO and CO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	2	2	1						2	1	1	1
CO2	2	3	2						2	2	2	2
CO3	2	2	2						2	2	1	2
CO4	3	3	2						2	1	1	1
Avg	**2.25**	**2.5**	**1.75**						**2**	**1.5**	**1.25**	**1.5**

Open Source Project Based Learning (24B55CS245)
Course Description

Subject Code	**24B21MA212**	**Semester: Even**	**Semester** IV **Session** 2023 -2024 **Month from** Jan -May 2024
Subject Name	Open Source Project Based Learning		
Credits	**3**	**Contact Hours**	**0-0-6**
Faculty (Names)	**Coordinator(s)**		
	Teacher(s)		

COURSE OUTCOMES: After the completion of the course, students will be able to		**COGNITIVE LEVELS**
CO1	compare and contrast their project with existing literature in the area and prepare a project proposal.	Understanding (C2)
CO2	demonstrate ability to function in task oriented team, divide role responsibilities to build a project on open data and understand professional and ethical responsibility.	Understanding (C2)
CO3	identify various open data frameworks, and apply RESTful APIs, Python libraries for project implementation.	Applying (C3)
CO4	analyze and prepare technical report.	Analyzing (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Labs**
1.	Literature review	Literature review to compare and contrast their project with existing work in the area and prepare a project proposal to be delivered to their peers and faculty members.	12
2.	Role Mapping	Develop an ability to function in task oriented team, divide role responsibilities to build a project on open data.	1
3.	Coordination	Understand professional and ethical responsibility & acquire ability to communicate effectively amongst team members, peers & evaluators.	2
4.	Submit Project Development Timeline	Analyze and identify various open data frameworks, RESTful APIs, Python libraries for project implementation; plan & submit project development	12

		timeline.	
5.	Presentation	Appraise by giving milestone presentations to their peers and faculty about their current progress.	3
6.	Prepare technical report	Prepare technical report detailing the problem statement, proposed methodology, software specification, design, test plan, and implementation details.	12
		Total number of Labs	42

Project based learning: Project is an integral part of the lab. Students form a group (of size 3-4) and discuss their project ideas with their faculty before finalising their research areas. The project is done using Open-source software(s), which are easily available with applications ranging from development to research-based projects or mix of both. This helps students in understanding the working of project development in companies and also broadens the spectrum for team work and procedural implementation of projects in hand to be delivered to clients as per the requirements.

Evaluation Criteria

Components	**Maximum Marks**
Monthly Assessment 1, 2 & 3	30
Viva Voce at the end of semester	30
End of semester Report & Presentation	25
Day to day/ Attendance	15
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1.	**Brown, A. and Wilson, G. ,** The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks, Lulu. Com, Vol. 1., 2011.
2.	**Fogel K.,** Producing Open Source Software: How to Run a Successful Free Software Project, O'Reilly Media, 2009.
3.	**Barry P.**, Head First Python: A Brain-Friendly Guide, O'Reilly Media, Inc., 2016.
4.	**Roffey C.,** Coding Club Python: Next Steps Level 2, Cambridge University Press, 2013.

PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO-CS	PSO-IT	PSO-CP
CO1	3	3	3	2	1		2	1	2	3	3	3
CO2	2	2	2	2	1		1	1	2	3	3	3
CO3	3	3	3	2	1		2	1	2	3	3	3
CO4	3	3	3	2	1		2	1	2	3	3	3
Avg	2.75	2.75	2.75	2	1		1.75	1	2	3	3	3

Sustainable Development (24B21HS211)

Course Description

Course Code	**24B21HS211**	**Semester-Even**	**Semester IV Session** 2023-24 **Month from** Jan - May 2024
Course Name	**Sustainable Development**		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES: After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
CO1	understand the fundamental theories, principles, and historical history of sustainable development.	Understanding (C2)
CO2	analysis of factors that support to achieve sustainability and resilience in an individual level and in a community	Analysing (C4)
CO3	understand the possible course of action for SD strategically (efficiency, sufficiency)	Understanding (C2)
CO4	analyse the conflicts that arise from the SD notion both nationally and internationally.	Analysing (C4)
CO5	understand the issues surrounding sustainable development that affect academic institutions, businesses and communities.	Understanding (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Sustainable Development	Overview of sustainable development (SD) including its significance, necessity, effects, and ramifications, definition, development of SD perspectives (MDGs AND SDGs) across time, current discussions, 1987 Brundtland Commission and its results, subsequent UN summits (such as the Rio summit) and their	6

		results.	
2.	Dimensions to Sustainable Development	Society, environment, culture, and economy, contemporary issues: natural, political, and socioeconomic imbalances, international, regional, national, and local sustainable development programmes and policies, demands of the current and future generations: political, economic, and environmental.	4
3.	Evaluation, Administration and Reporting Tools for Sustainability	Tools for SD, sustainability measures, including criteria and indicators, the value of both quantitative and qualitative evaluations of sustainability, analytical frameworks in sustainability research, existing measures and constraints, measures for charting and assessing sustainable development use of the metrics in practical situations.	6
4.	Sustainable Development, Energy, Biodiversity, and Climate Change	Climate Change: A threat to Sustainable Development Adaptation to Current and Future Climate Regimes; Agricultural Failure; The Greenhouse Effect; Technology and Lifestyle Changes as Solutions, Climate Change Mitigation, Political and Economic Tools	6
5.	Critical Views on Sustainable Development: The Implications of Resource Management for Sustainable Development	Conflicts arising from the SD idea at the national and international levels, the difficulties SD presents for academic institutions, businesses, and communities, their accountability and possibilities for action, the influence of policies and governance, Market dynamics, regulations, a fresh outlook on sustainability, and sustainable business practises • Sustainable goods and services • Corporate governance • Social responsibility • Encouraging Sustainable Urban Development	6
		Total number of Lectures	**28**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30
End Semester Examination	40
TA	30 (Quiz, Assignments, Tutorials, PBL)
Total	**100**

Project based learning: A group of 4 to 5 students will be formed. Each group will have a group leader to develop coordination among the group members. Each group will be assigned a topic related to Future Perspectives: Developing Sustainable Development. The group leader of each group will submit a report of 6-7 pages and then finally each member of the group will be evaluated through a viva voce.

Recommended Reading material:

1.	**Elliott J.**, An Introduction to Sustainable Development, Routledge, London, 4th Ed , 2012.
2.	**Franco I.B. and Tracey J.**, Community Capacity-Building for Sustainable Development: Effectively Striving Towards Achieving Local Community Sustainability Targets, International Journal of Sustainability in Higher Education, Vol. 20 No. 4, pp. 691-725, 2019.
3.	**Rogers P. P., Jalal K.F. , and Boyd, J.A.,** "An Introduction to Sustainable Development, Earthscan publisher, 2012.
4.	**Nhamo G.,Mjimba V.,** Sustainable Development Goals and Institutions of Higher Education. Springer, 2020.
5.	**Bell S. , Morse S.,** Sustainability indicators: measuring the immeasurable, Routledge, 2012.