



# Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

## SCHEME OF INSTRUCTIONS & SYLLABI

Programme: Computer Science & Engineering

Scheme of Instructions: Second Year B.Tech. in Computer Science & Engineering

Semester--III

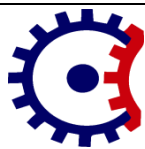


Sr. No.	Course Category	Course Code	Course Title	T/P	Contact Hours				Credits	Exam Scheme			ESE Duration (Hours)	Total Marks
					L	P	SL	Hrs.		CT/IA	CA	ESE		
1	PCC	BCS42301	Advance Object Oriented Programming	T	2	-	-	2	2	14	06	30	2	50
2	PCC	BCS42302	Data Structure	T	3	-	-	3	3	30	10	60	3	100
3	MDM	BSH32305	Mathematical Transform & Signal Series	T	2	-	-	2	2	14	6	30	2	50
4	OEC	BCS42303	OE – I Object Oriented Programming	T	4	-	-	4	4	30	10	60	3	100
5	HSSM	BBA42307	Human Resource Management	T	2	-	-	2	2	14	6	30	2	50
6	VEC	BCE42309	Sustainable Development Goal	T	2	-	-	2	2	14	6	30	2	50
7	PCC	BCS42304	Advance Object Oriented Programming - Lab	P	-	2	-	2	1	-	25	25	2	50
8	PCC	BCS42305	Data Structure - Lab	P	-	2	-	2	1	-	25	25	2	50
9	CEP	BCS42306	Micro Project	P	-	2	-	2	1	-	25	25	2	50
10	AEC	BSH423XX	Liberal Learning Module-III	P	-	2	-	2	1	50	-	-	2	50
<b>Total</b>				-	<b>15</b>	<b>08</b>		<b>23</b>	<b>19</b>	<b>166</b>	<b>119</b>	<b>315</b>	<b>22</b>	<b>600</b>

Course Category	BSC/ESC (Basic Science Course/Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective Course)	Multi-disciplinary courses	VSEC (Skill Course)	VEC (Value Education Courses)	Humanities Social Science & Management		Experiential Learning Courses
								AEC (Ability Enhancement Course)	IKS (Indian Knowledge System)	
Credits	-	10	-	4	2	-	2	1		2
Cumulative Sum	16/13	12	-	4	2	4	2	5		2

**PROGRESSIVE TOTAL CREDITS: 43+19=62**

				June, 2026	1.00	Applicable for AY 2026-27
Chairperson HOD	Director Academics / Vice-Principal <b>Director Academics</b> Tulsiramji Gaikwad-Patil College Of Engineering And Technology, Nagpur	Director Administration Dt.	Premnand Naktode Principal TGPCET, Nagpur	Date of Release	Version	



**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441108

NAAC Accredited (A+ Grade)

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**Second Year(Semester-III) B.Tech.(CSE)**

**Course Code:BCS42301(Advance Object Oriented Programming)**

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/week		CT-1	7 Marks
Tutorial	-		CT-2	7 Marks
Total Credit	2		CA	6 Marks
			ESE	30 Marks
		Total	50 Marks	
		Duration of ESE: 02Hrs 00Min.		

**Course Objective:**

1	To understand the basic concepts of object-oriented programming ,creation and usage of classes ,objects.
2	To understand the methods and analyze the concepts of Inheritance, Interface, and Packages.
3	To study how to handle Exceptions and multi-threaded in object oriented programming.

**Course Contents**

<b>Unit I</b>	<b>Introduction to JAVA</b> -Introduction to Java, Java Virtual Machine, Object Oriented Principle, Object and Classes, Java Keywords, Variable, Data types and Literals in Java, String, Operators and Casting, Control of Flow, (Selection Statements, Iteration Statements), Command Line Argument.
<b>Unit II</b>	<b>Classes and inheritance: Introduction</b> to Class and Object, Method Overloading, Constructor Inheritance, Multilevel, Hierarchy, Abstract class. <b>Package and Interface:</b> Package (Defining Package, Finding Package), Introduction to Interface, Defining and Implementing Interface, Predefined Package.
<b>Unit III</b>	<b>Exception Handling and Threads:</b> Exception Handling, Type of Exception, Try, Catch and Finally. Multiple Catch blocks, Nested Try Statements, throw, throws, Thread Model. Java generics Advantage of Java Generics, Types of Java Generics: Generic methods bounded Methods, Bounded Type Parameters, Generic Classes.Thread Lifecycle Synchronization.

**Text Books**

1	The Complete Reference (8 <sup>th</sup> Edition)by Herbelt Scheldt,TataMcGrawHill Publications
2	Head First J ava,2 <sup>nd</sup> Edition by Kathy Sierra ,Bert Bates, O'Reilly Media
3	ProgramminginJava(Fifthedition)byEBalguruswami,McGrawHillEducation

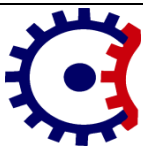
**Reference Books**

1	Sun Certified Java Programmer for Java 6 by Kathy Sierra
2	The Java TM Programming Language(3rdEdition)by Arnold,Holmes,Gosling,Goteti
3	Core Java for Beginners by Rashmi Kanta Das(IIIEdition) Vikas Publication

**Useful Links**

1	<a href="https://nptel.ac.in/courses/106/105/106105191/">https://nptel.ac.in/courses/106/105/106105191/</a>
2	<a href="https://www.nptelvideos.com/video.php?id=1472">https://www.nptelvideos.com/video.php?id=1472</a>

BCS42301	Course Outcomes	CL	Class Session
BCS42301.1	<b>Define</b> the Principle of Object-oriented approach to design software.	1	9
BCS42301.2	<b>Identify</b> Classes ,objects and use of inheritance in programs.	3	9
BCS42301.3	<b>Make Use</b> of Exception handling ,multithreading in real time situations and Generic Programming.	3	9



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**Second Year (Semester-III) B.Tech. (CSE)**

**Course Code: BCS42302 (Data Structure)**

Teaching Scheme		Examination Scheme	
Lectures	3 Hrs./week	CT-1	15 Marks
Tutorial	-	CT-2	15 Marks
Total Credit	3	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs. 00Min.	

**Course Objective:**

1	To <b>understand</b> the fundamentals of data structures, algorithms, recursion, and abstract data types.
2	To <b>demonstrate</b> basic and advanced searching and sorting algorithms for solving computational problems.
3	To <b>develop</b> linear data structures such as arrays, linked lists, stacks, and queues along with their operations and applications.
4	To <b>examine</b> non-linear data structures including trees, heaps, and graphs, and analyze their traversals and operations.
5	To <b>explore</b> advanced and modern data structures including hashing, B-Trees, Trie, Segment Trees, and their applications in Big Data, AI/ML, and real-world problems.

**Course Contents**

<b>Unit I</b>	<b>Introduction to Data Structure and Algorithm Analysis:</b> Definition and need of data structures, Types: Primitive and Non-primitive, Operations on Data Structures, Abstract Data Type (ADT), Introduction to Algorithms, Algorithm Analysis, Recursion (Basic Introduction)
<b>Unit II</b>	<b>Searching and Sorting Techniques:</b> Introduction to Searching, Types of Searching, Linear Search, Binary Search, Introduction to Sorting, Types of Sorting, Basic Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Advanced Sorting Algorithms: Merge Sort, Quick Sort, Shell Sort, Comparison of Sorting Algorithms
<b>Unit III</b>	<b>Linear Data Structures:</b> Introduction to linear data structures, Array: concept, representation, operations (traversal, insertion, deletion, searching), advantages and limitations, Linked List: Types (Singly, Doubly, Circular), Operations and Advantages, Stack: Operations (Push, Pop, Peek), Representation of Stack using Array and Linked List, Applications, Queue: Types (Simple, Circular, Priority), Operations (Enqueue, Dequeue, Front/Rear), Representation of Queue using Array and Linked List, Applications
<b>Unit IV</b>	<b>Non-Linear Data Structures:</b> Introduction to non-linear data structures, Comparison with linear structures, advantages and limitations, Tree: Terminology, types (Binary Tree, Binary Search Tree), Operations (Insertion, Deletion, Traversal – Preorder, Inorder, Postorder), Balanced Trees, Heap, Graph: Terminology, Types (Directed, Undirected), Representation (Adjacency Matrix, Adjacency List), Operations (Traversal – BFS, DFS), Applications of trees and graphs
<b>Unit V</b>	<b>Advanced Data Structures and Recent Trends:</b> Introduction to advanced data structures, Hashing: Hash functions, Collision Handling Techniques (Chaining, Linear probing), Heap: Applications, Heap sort overview, Advanced Trees: B-Tree, B+ Tree, Graphs: Shortest Path Algorithms (Dijkstra's), Applications in Social Networks and Routing, Recent Trends: Trie, Suffix Tree, Segment Tree, Fenwick Tree, Use of Data Structures in Big Data, AI/ML and Persistent/Dynamic data structures, Real-world applications

**Text Books**

T1	Data Structures Using C – Reema Thareja, Oxford University Press
T2	Data Structures and Algorithms in C – Adam Drozdek, Cengage Learning
<b>Reference Books</b>	
R1	Data Structures and Algorithms – A. M. Tenenbaum, Y. Langsam, M. J. Augenstein, Pearson
R2	Introduction to Data Structures in C – G. A. V. Pai, McGraw Hill Education
<b>Useful Links</b>	
1	<a href="https://onlinecourses.swayam2.ac.in/cec19_cs04/preview">https://onlinecourses.swayam2.ac.in/cec19_cs04/preview</a>
2	<a href="https://onlinecourses.swayam2.ac.in/cec26_cs05/preview">https://onlinecourses.swayam2.ac.in/cec26_cs05/preview</a>
3	<a href="https://onlinecourses.nptel.ac.in/noc25_cs81/preview">https://onlinecourses.nptel.ac.in/noc25_cs81/preview</a>

<b>BCS42302</b>	<b>Course Outcomes</b>	<b>CL</b>	<b>Class Session</b>
BCS42302.1	<b>Explain</b> the fundamentals of data structures, algorithms, and recursion	2	9
BCS42302.2	<b>Apply</b> searching and sorting techniques to solve computational problems	3	9
BCS42302.3	<b>Implement</b> linear data structures such as arrays, linked lists, stacks, and queues	3	9
BCS42302.4	<b>Analyze</b> non-linear data structures including trees, heaps, and graphs	4	9
BCS42302.5	<b>Evaluate</b> advanced data structures and recent trends for real-world applications	5	9



Chairperson  
HOD  
Computer Science & E



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**Second Year(Semester-III) B.Tech.(CSE)**

**Course Code:BCS32305( Mathematical Transform & Signal Series )**

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/week		CT-1	7 Marks
Tutorial	-		CT-2	7 Marks
Total Credit	2		CA	6 Marks
			ESE	30 Marks
		Total	50 Marks	
		Duration of ESE: 02Hrs 00Min.		

**Course Objective:**

1	To make students aware about error handling in numerical methods and solving of algebraic equations
2	Aware students about probability and mathematical expectation to real-world Phenomena.
3	Make students use appropriate Stochastic and sampling techniques for a given applied problem.

**Course Contents**

<b>Unit I</b>	<b>Numerical Methods:</b> Error in numerical calculations, Errors in series approximation, Rounding off errors. <b>Solution of Algebraic and Transcendental Equation:</b> Bisection method, False position method, Newton – Raphson method, Solution of system of simultaneous linear equations: Gauss elimination method, Gauss Jordan method. Gauss Seidel method.
<b>Unit II</b>	<b>Probability Distributions &amp; Mathematical Expectation:</b> Random variables, discrete and continuous random variable, joint distributions. <b>Mathematical Expectations:</b> Definition of mathematical expectation, the variance and standard deviations, moment generating function Binomial, Geometric distribution, Poisson distribution.
<b>Unit III</b>	<b>Stochastic Process &amp; Sampling Techniques</b> <b>Stochastic Process:</b> Introduction of Stochastic Process, Classification of Random Process, Stochastic Matrix. Markov Chain, Transition Matrix and state transition Diagram. <b>Sampling Techniques:</b> Population, sample, standard error, confidence intervals, Testing a hypothesis, Null hypothesis, Alternative hypothesis, t-test and Chi-square test

**Text Books**

1	Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication
2	Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition, Wiley India
3	Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville
4	Fundamentals of Mathematical Statistics (Modern Approach) S.C. Gupta and V. K. Kapoor 10th Edition

**Reference Books**

1	A Text Book of applied Mathematics, Volume I &II, by P.N. Wartikar & J.N. Wartikar, Poona Vidyarthi Griha Prakashan
2	Introductory methods of Numerical Analysis, by S.S. Sastry, PHI
3	Mathematics for Engineers by Chandrika Prasad

<b>BCS32305</b>	<b>Course Outcomes</b>	<b>CL</b>	<b>Class Session</b>
BCS32305.1	<b>Analyze</b> numerical techniques to find the roots of equations different types of equations.	4	9
BCS42301.2	<b>Apply</b> the concept of probability and mathematical expectation to real-world Phenomena.	3	9
BCS32305.3	<b>Apply</b> the most appropriate Stochastic and sampling techniques for a given applied problem	3	9





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**Second Year(Semester-III) B.Tech.(CSE)**

**Course Code:BCS42303(OEC Object Oriented Programming)**

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		CT-1	15 Marks
Tutorial	-		CT-2	15 Marks
Total Credit	4		TA	10 Marks
		CSE	60 Marks	
		Total	100 Marks	
		Duration of CSE :03Hrs 00Min.		

**Course Objective:**

1	To understand the basic concepts of object-oriented programming ,creation and usage of classes ,objects.
2	To understand the methods and analyze the concepts of Inheritance, Interface.
3	To study how to handle events and multi-threaded in object oriented programming C++.
4	Demonstrate the use of a file-based I/O and collections.
5	To Explore Exception Handling Techniques

**Course Contents**

<b>Unit I</b>	<b>Introduction to C++ Programming:</b> Basic Elements of Programming Structure of C++ Program Console Input/Output Operations (cin, cout) Data Types and Variables Operators and Expressions Control Structures (if, switch, loops) Function Definition and Declaration Function Prototyping Call by Value and Call by Reference Inline Functions Default and Const Arguments ,Arrays and Enumeration
<b>Unit II</b>	<b>Object Oriented Methodology and Classes:</b> Basic Concepts/Characteristics of OOP. Advantages and Application of OOPS, Procedural Programming Vs OOP. <b>Classes and Objects:</b> Specifying a Class, Creating Objects, Private & Public Data Members and Member Functions, Defining Inline Member Functions, Static Data Members and Member Functions .Arrays within Class ,Arrays of Objects ,Objects as Function
<b>Unit III</b>	<b>Constructors and Destructors:</b> Introduction, Parameterized Constructors, Multiple Constructors in A Class, Constructors With Default Arguments, Dynamic Initialization of Objects, Copy Constructors, , ‘New’ and ‘Delete’, Dynamic Constructors, Const Objects, Destructors
<b>Unit IV</b>	<b>Operators Overloading and Inheritance:</b> Definition, Unary and Binary Overloading, Rules for Operator Overloading, Function overloading. <b>Inheritance:</b> Defining Derived Classes, Types of Inheritance, Constructors and Destructors In Derived Classes.
<b>Unit V</b>	<b>Pointers, File Handling, and Exception Handling:</b> Pointer to Objects, This Pointer Operators, Virtual Function, Friend Functions, Functions overriding and Runtime Polymorphism. Opening, Closing A File, File Modes, File Pointers and Their Manipulation. <b>Exception Handling:</b> Exception Handling , Types of Exceptions, Exception Handling Keywords, Exception Handling Techniques, throw keyword .

**Text Books**

1	K.R.Venugopal,Rajkumar,T.Ravishankar,“MasteringC++”,TMH,ISBN:0-07-463454-2.
2	Farrel,”Object-OrientedProgrammingusingC++”,CengagePub,ISBN:9788131505175

**Reference Books**

1	ParimalaN.,”ObjectOrientationthroughC++”,MacmillanIndiaLtd.Publication,ISBN:-033393202- 1
2	EBalagurusamy,“ObjectOrientedProgrammingwithC++”,TataMcGrawHillPublishingCompany Limited ,New Delhi, ISBN:-13-978-07-066907-9

Useful Links	
1	<a href="https://www.youtube.com/watch?v=vmxTUhn2fBg&amp;list=PLqu1LEUz3ju04dXn0JOgKYPHHnV2at-lG">https://www.youtube.com/watch?v=vmxTUhn2fBg&amp;list=PLqu1LEUz3ju04dXn0JOgKYPHHnV2at-lG</a>
2	<a href="https://www.youtube.com/watch?v=LZFoktwiars&amp;list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY">https://www.youtube.com/watch?v=LZFoktwiars&amp;list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY</a>
3	<a href="https://www.youtube.com/watch?v=LZFoktwiars&amp;list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY">https://www.youtube.com/watch?v=LZFoktwiars&amp;list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY</a>
4	<a href="https://www.youtube.com/watch?v=vLnPwxZdW4Y">https://www.youtube.com/watch?v=vLnPwxZdW4Y</a>

BCS42303	Course Outcomes	CL	Class Session
BCS42303.1	<b>Understand</b> basic Elements of Programming and Function	2	9
BCS42303.2	<b>Understand</b> OOPs concepts ,Classes and objects	2	9
BCS42303.3	<b>Classify</b> the Constructors and Destructors using C++ Programming	3	9
BCS42303.4	<b>Explore</b> the purpose of operator overloading and inheritance.	3	9
BCS42303. 5	<b>Analyze</b> dynamic memory allocation with ' new 'and' delete' operators, and the usage of virtual functions and friend functions.	4	9

  
 Chairperson  
 HOD  
 COMPUTER SCIENCE & E



**Second Year (Semester-III) B.Tech. (CSE)**

**Course Code: BBA42307 (Human Resource Management)**

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs./week		CT-1	07 Marks
Tutorial	-		CT-2	07 Marks
Total Credit	2		CA	06 Marks
			ESE	30 Marks
		<b>Total</b>	<b>50 Marks</b>	
		<b>Duration of ESE: 02Hrs. 00Min.</b>		

**Course Objective:**

1	To provide students with an understanding of HRM concepts, principles, and functions.
2	To develop knowledge about HR planning, recruitment, selection, and training.
3	To enhance skills related to performance management and compensation administration.
4	To familiarize students with contemporary HR practices and challenges in the digital world.

**Course Contents**

<b>Unit I</b>	<b>Introduction to HRM</b> -Concept, definition, nature, scope and objectives of HRM, Functions and importance of HRM, Difference between Personnel Management & HRM, Role and responsibilities of HR Manager. Human Resource Planning (HRP): meaning, process & importance, Job Analysis, Job Description, Job Specification, Recruitment – methods & sources, Selection process.
<b>Unit II</b>	<b>Training &amp; Performance Management</b> -Training: concept, need, methods (on-the-job/off-the-job), Management development programmes, Performance appraisal – concept, objectives & methods, Career planning and development.
<b>Unit III</b>	<b>Compensation &amp; Emerging HR Trends</b> -Compensation: objectives, components & types, Incentives and fringe benefits, Employee welfare and quality of work life (QWL), HRIS, e-HRM, HR analytics, Contemporary issues: gig workforce, hybrid work, diversity & inclusion.

**Text Books**

T1	Human Resource Management – K. Aswathappa
T2	Human Resource Management – P. Subba Rao

**Reference Books**

R1	Personnel/Human Resource Management – C.B. Mamoria
R2	Human Resource Management – Gary Dessler

**Useful Links**

1	<a href="https://www.sscasc.in/wp-content/uploads/downloads/BBM/Human-Resource-Management.pdf">https://www.sscasc.in/wp-content/uploads/downloads/BBM/Human-Resource-Management.pdf</a>
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BBA42307	Course Outcomes	CL	Class Session
BBA42307.1	<b>Explain</b> the fundamentals of data structures, algorithms, and recursion	2	9
BBA42307.2	<b>Apply</b> searching and sorting techniques to solve computational problems	3	9
BBA42307.3	<b>Implement</b> linear data structures such as arrays, linked lists, stacks, and queues	3	9
BBA42307.4	<b>Analyze</b> non-linear data structures including trees, heaps, and graphs	4	9
BBA42307.5	<b>Evaluate</b> advanced data structures and recent trends for real-world applications	5	9



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**Second Year (Semester- III) B. Tech. Computer Science & Engineering**

**Course code : BCE42309 Course Name : Sustainable Development Goals**

Teaching Scheme		Examination Scheme	
Lectures	2 Hrs./week	CIE	20 Marks
Tutorial	-	ESE	30 Marks
Total Credit	2	Total	50 Marks
		Duration of ESE: 01 Hrs. 00 Min.	

**Course Objectives:**

1.	To develop a comprehensive understanding of the UN Sustainable Development Goals (SDGs) and their interconnections.
2.	To analyze the global challenges addressed by the SDGs and their impact on various sectors.
3.	To explore innovative solutions and best practices for implementing the SDGs.
4.	To evaluate the progress made towards achieving the SDGs at national and international levels.
5.	To foster a sense of global citizenship and social responsibility among students.

**Course Contents**

		Hours
Unit I	<b><u>Introduction to Sustainable Development Goals (SDGs):</u></b> Definition of Sustainability, Aspects of sustainability, historical perspective of sustainable development, Climate Change Conferences and Summits, the Brundtland Commission Report, transition from Millennium Development Goals (MDGs) to SDGs, the role of UN and the need for SDGs and Adoption by the World, scope and inclusion of the 2030 Agenda for Sustainable Development.	(7)
Unit II	<b><u>Framework &amp; Structuring of the 17 SDGs:</u></b> SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 4: Quality Education, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 14: Life below Water, SDG 15: Life on Land, SDG 16: Peace, Justice and Strong Institutions, SDG 17: Partnerships for the Goal	(7)
Unit III	<b><u>SDGs Implementation and Future Perspectives:</u></b> Interconnections between the SDGs, the role of technology and innovation in SDG implementation, financing the SDGs, measuring SDG progress, future challenges and opportunities, Climate change and its impact on sustainable development, Case studies of successful SDG implementation – India, World	(7)

**Text Books**

1	Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2	Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York

### Reference Books

1	Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.
2	OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, <a href="https://doi.org/10.1787/368cf8b4-en">https://doi.org/10.1787/368cf8b4-en</a> .

### Useful Links

1. <https://nptel.ac.in/courses/109106200>
2. <https://www.un.org/sustainabledevelopment/>

<b>BSH423</b>	<b>Course Outcomes</b>	<b>CL</b>
<b>CO 1</b>	To explore the historical origins and evolution of the UN-SDGs.	2
<b>CO 2</b>	To analyze the 17 SDGs and their interlinkages.	2
<b>CO 3</b>	To analyze the role of technology and innovation in achieving the SDGs along with future challenges and opportunities.	2





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**Second Year(Semester-III) B.Tech.(CSE)**

**Course Code:BCS42304(Advance Object Oriented Programming Lab)**

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/week		CT-1	-
Tutorial	-		CT-2	-
Total Credit	1		CA	25 Marks
			ESE	25 Marks
		Total	50 Marks	
		Duration of ESE: 02Hrs 00Min.		

**Course Objective:**

- 1 To understand the basic concepts of object-oriented programming ,creation and usage of classes ,objects.
- 2 To understand the methods and analyze the concepts of Inheritance, Interface, and Packages.
- 3 To study how to handle Exceptions and multi-threaded in object oriented programming.

**List of Experiment**

Sr. no.	Name of Experiment	COs
1	Demonstrate installation of Java, set environment variables (PATH), and execute a simple Java program	CO1
2	Execute a program using different operators (arithmetic, relational, logical, bitwise, assignment)	CO1
3	Execute programs using control statements (if-else, switch, loops)	CO1
4	Construct and execute a Java program to define a class, constructors, and demonstrate constructor overloading	CO2
5	Implement inheritance with various access modifiers and demonstrate method overriding	CO2
6	Demonstrate implementation of multiple interfaces using college departmental data	CO2
7	Implement Package and Sub-Packages by taking suitable example.	CO2
8	Implement the concept Exception Handling using predefined exception by creating user defined exception.	CO3
9	Write an application program to implement the concept of threading by extending Thread class and by implementing Runnable Interface	CO3
10	Demonstrate database connectivity using JDBC (insert, update, delete, retrieve records)	CO3

**BCS42304**

**Course Outcomes**

- BCS42304.1 **Define** the Principle of Object-oriented approach to design software.
- BCS42304.2 **Identify** Classes ,objects and use of inheritance in programs.
- BCS42304.3 **Make Use of** Exception handling ,multithreading in real time situations and Generic Programming.



**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441108

NAAC Accredited (A+ Grade)

An Autonomous Institute affiliated to RTMNU Nagpur



**Second Year(Semester-III) B.Tech.(CSE)**

**Course Code:BCS42305(Data Structure Lab)**

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/week		CT-1	-
Tutorial	-		CT-2	-
Total Credit	1		CA	25 Marks
		ESE	25 Marks	
		Total	50 Marks	
		Duration of ESE: 02Hrs 00Min.		

**Course Objective:**

1	<b>Explain</b> the fundamentals of data structures, algorithms, and recursion
2	<b>Apply</b> searching and sorting techniques to solve computational problems
3	<b>Implement</b> linear data structures such as arrays, linked lists, stacks, and queues
4	<b>Analyze</b> non-linear data structures including trees, heaps, and graphs
5	<b>Evaluate</b> advanced data structures and recent trends for real-world applications

**List of Experiment**

Sr. no.	Name of Experiment	COs
1	Implement Linear Search and Binary Search (iterative and recursive).	CO1
2	Implement various sorting algorithms (Selection Sort, Insertion Sort, Bubble Sort, Merge Sort, Quick Sort, and Shell Sort).	CO2
3	Implement applications of Stack: <ul style="list-style-type: none"><li>Evaluation of Postfix expression</li><li>Infix to Postfix conversion</li></ul>	CO3
4	Implement Double Ended Queue (Deque).	CO3
5	Write a program to reverse a singly linked list.	CO3
6	Implement Heap (Min Heap / Max Heap) and perform Heap Sort.	CO4
7	Represent a graph using adjacency matrix and adjacency list.	CO4
8	Implement AVL Tree with insertion and rotation balancing.	CO5
9	Implement shortest path algorithms: <ul style="list-style-type: none"><li>Bellman-Ford Algorithm</li><li>Dijkstra's Algorithm</li></ul>	CO5
10	Implement Minimum Spanning Tree algorithms: <ul style="list-style-type: none"><li>Kruskal's Algorithm</li><li>Prim's Algorithm</li></ul>	CO5

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<b>BCS42305</b>	<b>Course Outcomes</b>
BCS42305.1	<b>Explain</b> the fundamentals of data structures, algorithms, and recursion
BCS42305.2	<b>Apply</b> searching and sorting techniques to solve computational problems
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