

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
(Affiliated to Savitribai Phule Pune University, Pune)



Choice Based Credit System (CBCS)
Bachelor of Science (B.Sc. Computer Science)

Syllabus of
B. Sc. Computer Science
Implemented from
Academic year 2022 -2023

1. Prologue/ Introduction of the programme:

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system for improving and upgrading the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes across all undergraduate programs in science, humanities, commerce and professional streams of higher education including computer science.

B.Sc. (Computer Science) has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms.

Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic.

Computer Science education at undergraduate level (+3) will result in earning Bachelor of Science (BSc) degree in Computer Science. The coursework required to earn a BSc is equally weighted in mathematics and science. B.Sc. with Computer Science are aimed at undergraduate level training facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in Computer Science and can be employable at IT industries. There are several employment opportunities and after successful completion of an undergraduate programme in Computer Science, graduating students can fetch employment directly in companies as Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

2. Programme outcomes for B.Sc. with Computer Science

These outcomes describe what students are expected to know and be able to do by the time of graduation. They relate to the skills, knowledge, and behaviors that students acquire in their graduation through the program.

The Bachelor of Science with Computer Science (B.Sc. (Computer Science)) program enables students to attain, by the time of graduation:

1. Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.
2. Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation.
3. Ability to link knowledge of Computer Science with other two auxiliary disciplines of study.
4. Display ethical code of conduct in usage of Internet and Cyber systems.
5. Ability to pursue higher studies of specialization and to take up technical employment.
6. Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.
7. Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.
8. Ability to present result using different presentation tools.
9. Ability to appreciate emerging technologies and tools.
10. Apply standard Software Engineering practices and strategies in real-time software project development.
11. Design and develop computer programs/computer -based systems in the areas related to algorithms, networking, web design, cloud computing, IoT and data analytics.
12. The ability to work independently on a substantial software project and as an effective team member.

Structure of CGPA and Marking Scheme of CBCS for B.Sc.(Comp. Sci.)**Semester -III**

Course Code	Type of Course	Course Name	Credits	Max Int Marks	Max Ext Marks	Total
BSC-CS 301T	T	Data Structures and Algorithms	02	15	35	50
BSC-CS 302T	T	Software Engineering	02	15	35	50
BSC-CS 303P	P	Practical course based on CS 301 and CS 302	02	15	35	50
BSC-CS 304T	T	Groups and Coding Theory	02	15	35	50
BSC-CS 305T	T	Numerical Techniques	02	15	35	50
BSC-CS 306P	P	Mathematics Practical:	02	15	35	50
BSC-CS 307T	T	Embedded System	02	15	35	50
BSC-CS 308T	T	Computer Networking	02	15	35	50
BSC-CS 309P	P	Electronics Practical Course - I	02	15	35	50
BSC-CS 310T	T	MIL (Technical English)	02	15	35	50
BSC-CS 311T	T	Critical Thinking/ Scientific Temper	02	15	35	50
BSC-CS 312T	T	Web Technologies	02	15	35	50
BSC-CS 313P	P	Practical course based on CS-312	02	15	35	50
Semester Total			26	195	455	650

Semester -IV

Course Code	Type of Course	Course Name	Credits	Max Int Marks	Max Ext Marks	Total
BSC-CS 401T	T	Object Oriented Concepts using C++	02	15	35	50
BSC-CS 402T	T	NoSQL	02	15	35	50
BSC-CS 403P	P	Practical course based on CS 401 and CS 402	02	15	35	50
BSC-CS 404T	T	Computational Geometry	02	15	35	50
BSC-CS 405T	T	Operation Research	02	15	35	50
BSC-CS 406P	P	Mathematics Practical:	02	15	35	50
BSC-CS 407T	T	Internet of Things and Applications	02	15	35	50
BSC-CS 408T	T	Advanced Computer Networking	02	15	35	50
BSC-CS 409P	P	Electronics Practical Course - II	02	15	35	50
BSC-CS 410T	T	* MIL (Foreign Languages : French / Japanese)	02	15	35	50
BSC-CS 411T	T	Environmental Awareness	02	15	35	50
BSC-CS 412T	T	Core Python	02	15	35	50
BSC-CS 413P	P	Practical course based on CS 412	02	15	35	50
Semester Total			26	195	455	650

Distribution of Internal and External Marks

Class	Subjects	Semester	Credit	Internal Evaluation	External Evaluation	Total Maximum Marks
F.Y. B. Sc. (Comp.Sci.)	01	I	22	180	420	600
F.Y. B. Sc. (Comp.Sci.)	01	II	22	180	420	600
S.Y. B. Sc. (Comp.Sci.)	01	III	26	195	455	650
S.Y. B. Sc. (Comp.Sci.)	01	III	26	195	455	650
T.Y. B. Sc. (Comp.Sci.)	01	V	22	165	385	550
T.Y. B. Sc. (Comp.Sci.)	01	VI	22	165	385	550
Total		06	140	1080	2520	3600

Additional grade-based credits for all UG Programmes

Sr. No.	Title	Credits	Remark
1.	Democracy, Election and Governance: Semester I	02	Compulsory
2.	Physical Education: Semester II	02	Compulsory
3.	Completion of skill-based certificate programme organized by any department of the college	02	Compulsory
4.	SWAYAM certificate course	02	Optional
5.	Participation in NSS Winter Camp	02	Optional
6.	'C' Certificate in NCC	02	Optional
7.	Selection and participation in RDC parade at New Delhi	02	Optional
8.	Representation at State/ National level Co-curricular Activities	02	Optional
9.	Representation at State/ National level Extra-curricular Activities	02	Optional
10.	Winning Medal/ Prize at International/National level Co-curricular/ Extracurricular activities	02	Optional
11.	Prize in Curricular/ Extracurricular/ Cultural Activities at college level	01	Optional
12.	Active participation in Excursion tours/Study tours and Experiential Learning Activities	01	Optional
13.	Survey Report	02	Optional
14.	Book Review on a book suggested by the Academic Council	02	Optional

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Syllabus of B. Sc. Computer Science
Faculty of Science and Technology
Semester- I

Sr. No.	Class	Course Code	Course Title	Credits
1.	F.Y. B.Sc. Computer Science	BSC-CS 101T	Problem Solving using Computer and 'C' Programming	02
2.	F.Y. B.Sc. Computer Science	BSC-CS 102T	Database Management Systems	02
3.	F.Y. B.Sc. Computer Science	BSC-CS 103P	Practical course based on CS101 and CS102	1.5
4.	F.Y. B.Sc. Computer Science	BSC-CS 104T	Matrix Algebra	02
5.	F.Y. B.Sc. Computer Science	BSC-CS 105T	Discrete Mathematics	02
6.	F.Y. B.Sc. Computer Science	BSC-CS 106P	Mathematics Practical-I	1.5
7.	F.Y. B.Sc. Computer Science	BSC-CS 107T	Principles of Analog Electronics	02
8.	F.Y. B.Sc. Computer Science	BSC-CS 108T	Principles of Digital Electronics	02
9.	F.Y. B.Sc. Computer Science	BSC-CS 109P	Electronics Practical Course - I	1.5
10.	F.Y. B.Sc. Computer Science	BSC-CS 110T	Descriptive Statistics- I	02
11.	F.Y. B.Sc. Computer Science	BSC-CS 111T	Mathematical Statistics	02
12.	F.Y. B.Sc. Computer Science	BSC-CS 112P	Statistics-Practical - I	1.5

Semester- II

Sr. No.	Class	Course Code	Course Title	Credits
1.	F.Y. B.Sc. Computer Science	BSC-CS 201T	Advanced 'C' Programming	02
2.	F.Y. B.Sc. Computer Science	BSC-CS 202T	Relational Database Management Systems	02
3.	F.Y. B.Sc. Computer Science	BSC-CS 203P	Practical course based on CS201 and CS202	1.5
4.	F.Y. B.Sc. Computer Science	BSC-CS 204T	Linear Algebra	02
5.	F.Y. B.Sc. Computer Science	BSC-CS 205T	Graph Theory	02
6.	F.Y. B.Sc. Computer Science	BSC-CS 206P	Mathematics Practical-II	1.5
7.	F.Y. B.Sc. Computer Science	BSC-CS 207T	Analog Device Applications	02
8.	F.Y. B.Sc. Computer Science	BSC-CS 208T	Digital Circuits and Computer Organization	02
9.	F.Y. B.Sc. Computer Science	BSC-CS 209P	Electronics Practical Course - II	1.5
10.	F.Y. B.Sc. Computer Science	BSC-CS 210T	Method of Applied Statistics	02
11.	F.Y. B.Sc. Computer Science	BSC-CS 211T	Continuous Probability	02
12.	F.Y. B.Sc. Computer Science	BSC-CS 212P	Statistics-Practical – II	1.5

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Semester- III

Sr. No.	Class	Course Code	Course Title	Credits	
1.	S.Y. B.Sc. Computer Science	BSC-CS 301T	Data Structures and Algorithms	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
2.	S.Y. B.Sc. Computer Science	BSC-CS 302T	Software Engineering	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
3.	S.Y. B.Sc. Computer Science	BSC-CS 303P	Practical course based on CS 301 and CS 302	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
4.	S.Y. B.Sc. Computer Science	BSC-CS 304T	Groups and Coding Theory	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
5.	S.Y. B.Sc. Computer Science	BSC-CS 305T	Numerical Techniques	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
6.	S.Y. B.Sc. Computer Science	BSC-CS 306P	Mathematics Practical:	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
7.	S.Y. B.Sc. Computer Science	BSC-CS 307T	Embedded System	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
8.	S.Y. B.Sc. Computer Science	BSC-CS 308T	Computer Networking	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
9.	S.Y. B.Sc. Computer Science	BSC-CS 309P	Electronics Practical Course - I	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
10.	S.Y. B.Sc. Computer Science	BSC-CS 310T	MIL (Technical English)	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
11.	S.Y. B.Sc. Computer Science	BSC-CS 311T	Critical Thinking/ Scientific Temper	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
12.	S.Y. B.Sc. Computer Science	BSC-CS 312T	Web Technologies	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm
13.	S.Y. B.Sc. Computer Science	BSC-CS 313P	Practical course based on CS-312	02	Formatted: Space After: 0 pt, Line spacing: single, Numbered + Level: 1 + Numbering Style: 1, 2, 3, ... + Start at: 1 + Alignment: Left + Aligned at: 0.63 cm + Indent at: 1.27 cm

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Semester- IV

Sr. No.	Class	Course Code	Course Title	Credits
1.	S.Y. B.Sc. Computer Science	BSC-CS 401T	Object Oriented Concepts using C++	02
2.	S.Y. B.Sc. Computer Science	BSC-CS 402T	NoSQL	02
3.	S.Y. B.Sc. Computer Science	BSC-CS 403P	Practical course based on CS 401 and CS 402	02
4.	S.Y. B.Sc. Computer Science	BSC-CS 404T	Computational Geometry	02
5.	S.Y. B.Sc. Computer Science	BSC-CS 405T	Operation Research	02
6.	S.Y. B.Sc. Computer Science	BSC-CS 406P	Mathematics Practical:	02
7.	S.Y. B.Sc. Computer Science	BSC-CS 407T	Internet of Things and Applications	02
8.	S.Y. B.Sc. Computer Science	BSC-CS 408T	Advanced Computer Networking	02
9.	S.Y. B.Sc. Computer Science	BSC-CS 409P	Electronics Practical Course - II	02
10.	S.Y. B.Sc. Computer Science	BSC-CS 410T	* MIL (Foreign Languages : French / Japanese)	02
11.	S.Y. B.Sc. Computer Science	BSC-CS 411T	Environmental Awareness	02
12.	S.Y. B.Sc. Computer Science	BSC-CS 412T	Core Python	02
13.	S.Y. B.Sc. Computer Science	BSC-CS 413T	Practical course based on CS 412	02

Note: * Students can opt for any one of the above foreign languages.

Semester- V

Sr. No.	Class	Course Code	Course Title	Credits
1.	T.Y. B.Sc. Computer Science	BSC-CS 501T	Operating Systems – I	02
2.	T.Y. B.Sc. Computer Science	BSC-CS 502T	Computer Networks – II	02
3.	T.Y. B.Sc. Computer Science	BSC-CS 503T	Web Technologies – I	02
4.	T.Y. B.Sc. Computer Science	BSC-CS 504T	Foundations of Data Science	02
5.	T.Y. B.Sc. Computer Science	BSC-CS 505T	Object Oriented Programming using Java - I	02
6.	T.Y. B.Sc. Computer Science	BSC-CS 506T	Theoretical Computer Science	02
7.	T.Y. B.Sc. Computer Science	BSC-CS 507P	Practical course on CS 501	02
8.	T.Y. B.Sc. Computer Science	BSC-CS 508P	Practical course on CS 503 & CS 504	02
9.	T.Y. B.Sc. Computer Science	BSC-CS 509P	Practical course on CS 505	02
10.	T.Y. B.Sc. Computer Science	BSC-CS 510T	Python Programming	02
11.	T.Y. B.Sc. Computer Science	BSC-CS 511P	Python Programming Practical	02

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Semester- VI

Sr. No.	Class	Course Code	Course Title	Credits
1.	T.Y. B.Sc. Computer Science	BSC-CS 601T	Operating Systems – II	02
2.	T.Y. B.Sc. Computer Science	BSC-CS 602T	Software Testing	02
3.	T.Y. B.Sc. Computer Science	BSC-CS 603T	Web Technologies – II	02
4.	T.Y. B.Sc. Computer Science	BSC-CS 604T	Data Analytics	02
5.	T.Y. B.Sc. Computer Science	BSC-CS 605T	Object Oriented Programming using Java - II	02
6.	T.Y. B.Sc. Computer Science	BSC-CS 606T	Compiler Construction	02
7.	T.Y. B.Sc. Computer Science	BSC-CS 607P	Practical course on CS 601	02
8.	T.Y. B.Sc. Computer Science	BSC-CS 608P	Practical course on CS 603 & CS 604	02
9.	T.Y. B.Sc. Computer Science	BSC-CS 609P	Practical course on CS 605	02
10.	T.Y. B.Sc. Computer Science	BSC-CS 610T	Block chain Technology	02
11.	T.Y. B.Sc. Computer Science	BSC-CS 611Pr	Project	02

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Syllabus of B. Sc. Computer Science
Faculty of Science and Technology

Sr. No.	Class	Semester	Course Code	Course Title	Credits
<u>41.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 101T	Problem Solving using Computer and 'C' Programming	02
<u>42.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 102T	Database Management Systems	02
<u>43.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 103P	Practical course based on CS101 and CS102	1.5
<u>44.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 104T	Matrix Algebra	02
<u>55.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 105T	Discrete Mathematics	02
<u>66.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 106P	Mathematics Practical-I	1.5
<u>77.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 107T	Principles of Analog Electronics	02
<u>88.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 108T	Principles of Digital Electronics	02
<u>99.</u>	F.Y. B.Sc. Computer Science	I	BSC-CS 109P	Electronics Practical Course - I	1.5

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40 10.	F.Y. B.Sc. Computer Science	I	BSC-CS 110T	Descriptive Statistics- I	02
41 11.	F.Y. B.Sc. Computer Science	I	BSC-CS 111T	Mathematical Statistics	02
42 12.	F.Y. B.Sc. Computer Science	I	BSC-CS 112P	Statistics-Practical - I	1.5
43 13.	F.Y. B.Sc. Computer Science	II	BSC-CS 201T	Advanced 'C' Programming	02
44 14.	F.Y. B.Sc. Computer Science	II	BSC-CS 202T	Relational Database Management Systems	02
45 15.	F.Y. B.Sc. Computer Science	II	BSC-CS 203P	Practical course based on CS201 and CS202	1.5
46 16.	F.Y. B.Sc. Computer Science	II	BSC-CS 204T	Linear Algebra	02
47 17.	F.Y. B.Sc. Computer Science	II	BSC-CS 205T	Graph Theory	02
48 18.	F.Y. B.Sc. Computer Science	II	BSC-CS 206P	Mathematics Practical-II	1.5
49 19.	F.Y. B.Sc. Computer Science	II	BSC-CS 207T	Analog Device Applications	02
20 20.	F.Y. B.Sc. Computer Science	II	BSC-CS 208T	Digital Circuits and Computer Organization	02
21 21.	F.Y. B.Sc. Computer Science	II	BSC-CS 209P	Electronics Practical Course - II	1.5

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2222.	F.Y. B.Sc. Computer Science	II	BSC-CS 210T	Method of Applied Statistics	02
2323.	F.Y. B.Sc. Computer Science	II	BSC-CS 211T	Continuous Probability	02
2424.	F.Y. B.Sc. Computer Science	II	BSC-CS 212P	Statistics-Practical- II	1.5
2525.	S.Y. B.Sc. Computer Science	III	BSC-CS 301T	Data Structures and Algorithms	02
2626.	S.Y. B.Sc. Computer Science	III	BSC-CS 302T	Software Engineering	02
2727.	S.Y. B.Sc. Computer Science	III	BSC-CS 303P	Practical course based on CS 301 and CS 302	02
2828.	S.Y. B.Sc. Computer Science	III	BSC-CS 304T	Groups and Coding Theory	02
2929.	S.Y. B.Sc. Computer Science	III	BSC-CS 305T	Numerical Techniques	02
3030.	S.Y. B.Sc. Computer Science	III	BSC-CS 306P	Mathematics Practical	02
3131.	S.Y. B.Sc. Computer Science	III	BSC-CS 307T	Embedded System	02
3232.	S.Y. B.Sc. Computer Science	III	BSC-CS 308T	Computer Networking	02
3333.	S.Y. B.Sc. Computer Science	III	BSC-CS 309P	Electronics Practical Course - I	02

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<u>3434.</u>	S.Y. B.Sc. Computer Science	III	BSC-CS 310T	MIL (Technical English)	02
<u>3535.</u>	S.Y. B.Sc. Computer Science	III	BSC-CS 311T	Critical Thinking/ Scientific Temper	02
<u>3636.</u>	S.Y. B.Sc. Computer Science	III	BSC-CS 312T	Web Technologies	02
<u>3737.</u>	S.Y. B.Sc. Computer Science	III	BSC-CS 313P	Practical course based on CS 312	02
<u>3838.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 401T	Object Oriented Concepts using C++	02
<u>3939.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 402T	NoSQL	02
<u>4040.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 403P	Practical course based on CS 401 and CS 402	02
<u>4141.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 404T	Computational Geometry	02
<u>4242.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 405T	Operation Research	02
<u>4343.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 406P	Mathematics Practical	02
<u>4444.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 407T	Internet of Things and Applications	02
<u>4545.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 408T	Advanced Computer Networking	02

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<u>4646.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 409P	Electronics Practical Course - II	02
<u>4747.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 410T	*MIL(Foreign Languages : French/ Japanese)	02
<u>4848.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 411T	Environmental Awareness	02
<u>4949.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 412T	Core Python	02
<u>5050.</u>	S.Y. B.Sc. Computer Science	IV	BSC-CS 413T	Practical course based on CS 412	02
<u>5151.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 501T	Operating Systems – I	02
<u>5252.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 502T	Computer Networks – II	02
<u>5353.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 503T	Web Technologies – I	02
<u>5454.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 504T	Foundations of Data Science	02
<u>5555.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 505T	Object Oriented Programming using Java - I	02
<u>5656.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 506T	Theoretical Computer Science	02
<u>5757.</u>	T.Y. B.Sc. Computer Science	V	BSC-CS 507P	Practical course on CS 501	02

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5858.	T.Y. B.Sc. Computer Science	V	BSC-CS 508P	Practical course on CS 503 & CS 504	02
5959.	T.Y. B.Sc. Computer Science	V	BSC-CS 509P	Practical course on CS 505	02
6060.	T.Y. B.Sc. Computer Science	V	BSC-CS 510T	Python Programming	02
6161.	T.Y. B.Sc. Computer Science	V	BSC-CS 511P	Python Programming Practical	02
6262.	T.Y. B.Sc. Computer Science	VI	BSC-CS 601T	Operating Systems – II	02
6363.	T.Y. B.Sc. Computer Science	VI	BSC-CS 602T	Software Testing	02
6464.	T.Y. B.Sc. Computer Science	VI	BSC-CS 603T	Web Technologies – II	02
6565.	T.Y. B.Sc. Computer Science	VI	BSC-CS 604T	Data Analytics	02
6666.	T.Y. B.Sc. Computer Science	VI	BSC-CS 605T	Object Oriented Programming using Java - II	02
6767.	T.Y. B.Sc. Computer Science	VI	BSC-CS 606T	Compiler Construction	02
6868.	T.Y. B.Sc. Computer Science	VI	BSC-CS 607P	Practical course on CS 601	02
6969.	T.Y. B.Sc. Computer Science	VI	BSC-CS 608P	Practical course on CS 603 & CS 604	02

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7070.	T.Y. B.Sc. Computer Science	VI	BSC-CS 609P	Practical course on CS 605	02
7171.	T.Y. B.Sc. Computer Science	VI	BSC-CS 610T	Block chain Technology	02
7272.	T.Y. B.Sc. Computer Science	VI	BSC-CS 611P	Project	02
Total Credits					140

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**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar.
(Autonomous)**

**Syllabus of B. Sc. Computer Science
under
Faculty of Science and Technology**

Semester –III	Paper –I
Course Code: BSC-CS 301T	Title of the Course : Data Structure & Algorithms
Credits: 02	Total Hours: 33 Hrs.

Course Outcomes(COs):

1. Differentiate primitive and non-primitive structures.
2. To use well-organized data structures in solving various problems.
3. To differentiate the usage of various structures in problem solution.
4. Implementing data structures in various applications.

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Unit	Course Contents	Allotted Hours
Unit I	Introduction 1.1 Concept 1.2 Datatype, Data Object Abstract Datatype (ADT) 1.3 Data structure Classification 1.4 Need of data structure 1.5 Application of data structure 1.6 Algorithm: Definition, characteristics, algorithm analysis (Time and space complexity) 1.7 Asymptotic notation	(02)

Unit II	Sorting Terminologies 2.1 Array: Definition, 1-D, 2-D, multidimensional array 2.2 Sorting: Definition, types of sorting (Internal, External, In Place) 2.3 Lower bound on comparison based sorting 2.3.1 Insertion sort 2.3.2 Bubble sort 2.3.3 Selection sort 2.4 Divide and conquer strategy 2.4.1 Quick sort 2.4.2 Merge sort 2.5 Non comparison based sorting 2.5.1 Counting sort 2.5.2 Radix sort	(08)
Unit III	Linear Dynamic Data Structure-I (Linked list) 3.1 List as data structure, difference with array (linked list) 3.2 Static/Dynamic implementation of linked list 3.3 Types of linked list 3.3.1 Singly linked list 3.3.2 Doubly linked list 3.3.3 Circular linked list 3.4 Operations on linked list 3.4.1 Create, insert, delete, search, reverse, concatenate, merge, traverse 3.5 Time complexity 3.6 Application of linked list 3.6.1 Polynomial representation 3.7 Generalized link list (GLL) 3.7.1 Concepts, representation, polynomial representation using GLL	(10)
Unit IV	Linear Dynamic Data Structure-II (Stack) 4.1 Definition of stack	

	<p>4.2 Operations on stack</p> <p>4.2.1 init(), push(), pop(), isempty(), isfull(), peek()</p> <p>4.3 Time complexity</p> <p>4.4 Implementation: Static and Dynamic</p> <p>4.5 Applications of stack</p> <p>4.5.1 Function call & recursion</p> <p>4.5.2 String reversal, palindrome checking</p> <p>4.5.3 Expression types</p> <p>4.5.3.1 Infix, Prefix, Postfix</p> <p>4.5.3.2 Expression conversion and evaluation</p>	(04)
Unit V	<p>Linear Dynamic Data Structure-III (Queue)</p> <p>4.1 Introduction</p> <p>4.2 Operations</p> <p>4.2.1 Enqueue(), dequeue(), isempty(), isfull(), peek()</p> <p>4.3 Implementation (Static & Dynamic)</p> <p>4.4 Types of Queue</p> <p>4.4.1 Linear Queue</p> <p>4.4.2 Circular Queue</p> <p>4.4.3 Priority Queue</p> <p>4.4.4 Double ended Queue</p> <p>4.5 Applications</p> <p>4.5.1 CPU scheduling in multiprogramming environment.</p> <p>4.5.2 Round Robin Algorithm</p>	(05)
Unit VI	<p>Non-linear Data structure (Tree)</p> <p>6.1 Introduction</p> <p>6.2 Types of Tree</p> <p>6.2.1 Binary Tree</p> <p>6.2.2 Skewed Tree</p> <p>6.2.3 Strictly binary Tree</p> <p>6.2.4 Full binary Tree</p> <p>6.3 Representation</p>	(04)

	6.4 Implementation & operations on binary search tree 6.4.1 Tree Traversal.	
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Suggested Readings:

1. Data Structures, Horowitz, Sahani, Galgotia publication
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahni
and Sanguthevar Rajasekara, Galgotia Pub. 2001 ed.
3. Data Structures Through C in Depth, S.K.Srivastava and Deepali
Srivastava, BPB Publication

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar.
(Autonomous)

Syllabus of B. Sc. Computer Science
under
Faculty of Science and Technology

Semester –III	Paper –II
Course Code: BSC-CS 302T	Title of the Course : Software Engineering
Credits: 02	Total Hours: 31 Hrs.

Course Outcomes:

1. Identify requirements analyze and prepare models.
2. Prepare the SRS, Design document, Project plan of a given software system.
3. Develop design schemes in software project.
4. To improve the quality of the software project.

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Unit	Course Contents	Allotted Hours
Unit I	Introduction to Software Engineering 1.1 Software definition 1.2 Software characteristics 1.3 Changing nature of software 1.4 SDLC 1.5 Software process 1.5.1 The process framework 1.5.2 Umbrella activities 1.5.3 Process adaptation	(05)
Unit II	Software Development Models & Architecture 2.1 Waterfall model 2.2 V-model 2.3 Spiral model 2.4 Iterative model 2.5 Incremental model	(05)

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Unit III	Agile Methodology 3.1 What is Agility? 3.2 Agile development model 3.3 Agile testing methods 3.4 Scrum 3.5 Extreme Programming (XP) 3.6 Crystal 3.7 Dynamic Software Development Method (DSDM) 3.8 Need of Agile model 3.9 Advantage & Disadvantage of agile	(06)
Unit IV	Software Requirements 4.1 Types of Requirements 4.1.1 Functional requirement 4.1.1 Non-functional requirement 4.1.3 Domain functional requirement 4.2 Software Requirement Specification (SRS) 4.2.1 Definition 4.2.2 Need of SRS 4.2.3 How to write good SRS for project 4.2.3.1 Introduction 4.2.3.2 Overview • Customer • Functionality • Platform • Development Responsibility 4.2.3.3 Goals & scopes 4.2.3.4 Deliverables 4.2.3.5 Risk Management • Risk identification • Risk mitigation. 4.2.3.6 Scheduling & Estimates 4.2.3.7 Technical Process 4.3 Characteristics of SRS	(05)

Unit V	Design Models 5.1 Introduction to UML 5.2 Structural Modeling 5.2.1 Use Case Model 5.2.2. Class Model 5.3 Behavioral Modeling 5.3.1 Sequence Diagram 5.3.2 Activity Diagram 5.3.3 Communication or Collaboration Diagram 5.4 Architectural Model 5.4.1 Component diagram 5.4.2 Artifact diagram 5.4.3 Deployment diagram	(08)
Unit VI	Design Concepts 6.1 Introduction 6.2 Abstraction 6.3 Pattern 6.4 Modularity 6.5 Information hiding 6.6 Functional independence 6.7 Refinement 6.8 Refactoring 6.9 Design classes	(02)

Suggested Readings:

1. Software Engineering : A Practitioner's Approach - Roger S. Pressman, McGraw hill(Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6
2. The Unified Modeling Language Reference Manual - James Rumbaugh, Ivar Jacobson, Grady Booch ISBN 0-201-30998-X

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**Syllabus of B. Sc. Computer Science
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Semester -III	Paper -III
Course Code: BSC-CS 303P	Title of the Course: Practical Course on CS 301 & CS 302
Credits: 02	Total Hours: 60 Hrs.

Course Outcomes(COs):

- Understanding the concept of dynamic memory management.
- Understanding basic data structure such as array, queue, linked list, stack.
- To develop the methods and procedures for software development that can scale up for large system and can be used consistently to produce high quality software.

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Suggested List of Assignments:

SECTION-I

Data Structure Practical

Assignment 1

Implementation of sorting algorithms: Bubble sort, Insertion Sort & Selection sort

Assignment 2

Divide and Conquer Strategy:

i) Implementation of Merge sort

ii) Implementation Quick sort

Assignment 3

Non-comparison based sort:

i) Implementation of Count sort

ii) Implementation of Radix sort

Assignment 4

i) Structures- structure with array, structure with function, structure with pointer

ii) Pointer- pointer with array, pointer with structure, pointer to pointer

iii) Use of typedef, dynamic memory allocation

Linear singly link list:

i) Static implementation of linear singly linked list

ii) Dynamic implementation of linear singly linked list

iii) Create, insert, delete, display, search, count, Reverse

Assignment 5**Application of linear singly linked list:**

i) Merge two linked list

ii) Concatenation of two linked list

iii) Polynomial addition of linked list

Assignment 6**Linear doubly linked list:**

i) Dynamic implementation of linear singly linked list

Create, insert, delete, display, search, count, Reverse

Assignment 7**Circular linked list:**

i) Dynamic implementation of circular singly linked list

ii) Dynamic implementation of circular doubly linked list

Basic operations: Create, display, delete, insert, delete

Assignment 8**Stack:**

Static and dynamic implementation of stack to perform basic operations init(), push(), pop(),

peek(), isfull(), isempty()

Assignment 9**Applications of Stack:**

- i) Checking for string is Palindrome or not?
- ii) Evolution Post-Fix expression
- iii) Evolution Pre-Fix expression
- iv) Infix to Post-Fix conversion
- v) Infix to Pre-Fix conversion

Assignment 10**Queue:**

Implementation of (Static and Dynamic) of Queue to perform basic operations: Create, Insert, Delete, Display

Assignment 11**Implementation of circular queue:**

Implementation of Priority queue and Dequeue

Assignment 12**Dynamic implementation of binary search tree to perform basic operations:**

- Create
- Traversing of tree
- In Order
- Post Order
- Pre Order

SECTION-II**Software Engineering Mini-Project****1. Detail study of UML diagrams:**

- ER Diagram

-Components of ER Diagram

Example-1: Draw ER diagram for library management system.

Example-2: Draw ER diagram for blood bank system.

Example-3: Draw ER diagram for hotel management system.

2. Detail study of Data Flow Diagram of Level-0 and Level-1:

Example-1: Draw DFD diagram for library management system.

Example-2: Draw DFD diagram for blood bank system.

Example-3: Draw DFD diagram for hotel management system.

3. Detail study of Use-Case diagram:

Example-1: Draw Use-Case diagram for library management system.

Example-2: Draw Use-Case diagram for blood bank system.

Example-3: Draw Use-Case diagram for hotel management system.

4. Detail study of Activity diagram.

Example-1: Draw Activity diagram for library management system.

Example-2: Draw Activity diagram for blood bank system.

Example-3: Draw Activity diagram for hotel management system.

5. Detail study of Class diagram.

Example-1: Draw class diagram for library management system.

Example-2: Draw class diagram for blood bank system.

Example-3: Draw class diagram for hotel management system.

6. Detail study of component diagram.

Example-1: Draw component diagram for library management system.

Example-2: Draw component diagram for blood bank system.

Example-3: Draw component diagram for hotel management system.

7. Detail study of Sequence diagram.

Example-1: Draw Sequence diagram for library management system.

Example-2: Draw Sequence diagram for blood bank system.

Example-3: Draw Sequence diagram for hotel management system.

8. Detail study of collaboration diagram.

Example-1: Draw collaboration diagram for library management system.

Example-2: Draw collaboration diagram for blood bank system.

Example-3: Draw collaboration diagram for hotel management system

Sample case study:

- 1) Library management system
- 2) Electronic cash counter
- 3) School management system
- 4) Blood bank system
- 5) On-line share market trading
- 6) Hotel Management System.
- 7) Online examination system
- 8) Bank management system.
- 9) Image processing system.
- 10) E-commerce.

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Suggested Readings:

Laboratory handbook prepared by the college.

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Semester -III	Paper - IV
Course Code: BSC-CS 304T	Title of the Course: Groups and Coding Theory
Credits: 2	Total Lectures: 30 Hours

Course Outcomes:

- a. Student will understand Division algorithm, Congruence relation on set of integers
- b. To understand concept of Binary Operation, Group and its properties
- c. To understand concept of the Decoding and Error Correction Public Key Cryptography
- d. To understand concept of permutation group, examples on it.
- e. To be familiar about basic concepts of programming such as data, loops and function.

Unit	Course Contents	Allotted Hours
Unit I	Integers 1.1.Division Algorithm (without Proof) 1.2.G.C.D. using division algorithm and expressing it as linear combination 1.3.Euclid's lemma Equivalence relation (revision), Congruence relation on set of integers, Equivalence class partition	(7)
Unit II	Groups 2.1 Binary Operation 2.2 Group: Definition and Examples	(7)

	2.3 Elementary Properties of Groups	
Unit III	Finite Groups and Subgroups 3.1 Order of a group, order of an element 3.2 Examples ($\mathbb{Z}_n, +$) and ($U(n), *$) 3.3 Subgroup definition, Finite subgroup test, subgroups of \mathbb{Z}_n 3.4 Generator, cyclic group, finding generators of \mathbb{Z}_n (Corollary 3,4 without proof) 3.5 Permutation group, definition, composition of two permutations, representation as product of disjoint cycles, inverse and order of a permutation, even/ odd permutation	(10)
Unit IV	Groups and Coding Theory 5.1 Coding of Binary Information 5.2 Error detection 5.3 Decoding and Error Correction 5.4 Public Key Cryptography	(06)

Suggested Readings

1. Contemporary Abstract Algebra by J. A. Gallian (Seventh Edition)
Unit 1: Chapter 0, Unit 2: Chapter 2, Unit 3: Chapter 3, 4, 5
2. Bernard Kalman, Robert C. Busby and Sharon Discrete Mathematical Structures
Pearson Prentice Hall, 2004 Unit 4: Chapter 11
3. P. B. Bhattacharyya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra,
Cambridge University Press, Second Edition. (1995)
4. J. B. Farleigh, A First Course in Abstract Algebra, 7th Edition, Pearson
Edition Ltd, Seventh Edition (2002)

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Semester – III	Paper – V
Course Code: BSC-CS 305T	Title of the Course: Numerical Techniques
Credits: 02	Total Lectures: 30 Hours.

Course Outcomes (COs):

- a. Understanding the theoretical and practical aspects of the use of numerical methods.
- b. Implementing numerical methods for a variety of multidisciplinary applications.
- c. Establishing the limitations, advantages and disadvantages of numerical methods.

Unit	Course Contents	Allotted Hours
Unit I	Algebraic and Transcendental Equation 1.1 Introduction to Errors 1.2 False Position Method 1.3 Newton-Raphson Method	(04)
Unit II	Calculus of Finite Differences and Interpolation 2.1 Differences 2.2 Forward Differences 2.3 Backward Differences 2.4 Central Differences 2.5 Other Differences (δ , μ operators) 2.6 Properties of Operators 2.7 Relation between Operators 2.8 Newton's Gregory Formula for Forward Interpolation 2.9 Newton's Gregory Formula for Backward Interpolation 2.10 Lagrange's Interpolation Formula	(10)

	2.11 Divided Difference 2.12 Newton's Divided Difference Formula	
Unit III	Numerical Integration 3.1 General Quadrature Formula 3.2 Trapezoidal Rule 3.3 Simpson's one-Third Rule 3.4 Simpson's Three-Eight Rule	(07)
Unit IV	Numerical Solution of Ordinary Differential Equation 4.1 Euler's Method 4.2 Euler's Modified Method 4.3 Runge-Kutta Methods	(07)

Suggested Readings:

1. A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal. New Age International Publishers.
Unit 1: Chapter 2: Sec. 2.1, 2.5, 2.7
Unit 2: Chapter 3: Sec. 3.1, 3.2, 3.4, 3.5, Chapter 4: Sec. 4.1, 4.2, 4.3,
Chapter 5: Sec. 5.1, 5.2, 5.4, 5.5
Unit 3: Chapter 6: Sec. 6.1, 6.3, 6.4, 6.5, 6.6, 6.7
Unit 4: Chapter 7: Sec. 7.1, 7.4, 7.5, 7.6
2. S.S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.
3. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.
K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications

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Semester -II	Paper -VI
Course Code: BSC-CS 306P	Title of the Course: Mathematics Practical
Credits: 02	Total Lectures: 60 Hours

Course Outcomes:

- a. To write Scilab programs and develop a small application project.
- b. To write Scilab programming of Regula-Falsi Method Newton-Raphson Method.
Newton-Raphson Method
- c. To write examples on finite groups
- d. To solve numerical integration of given function by Scilab programming.

Details of Syllabus:

<p>Practical 1: Revision of scilab with some basic commands e.g., size, length, eye, ones, rand, zeros etc. use of ' deff ' command for one and two variables functions.</p> <p>Practical 2: basic operations on matrices. e.g., addition, subtraction, multiplication, square etc. solution for system of linear equation. Draw 2-D and 3-D graph for some standard functions</p> <p>Practical 3: Scilab programming: Regula-Falsi Method Newton-Raphson Method.</p> <p>Practical 4: Scilab programming: Newton-Raphson Method</p> <p>Practical 5: Scilab programming: Newton's forward interpolation formula.</p>
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Practical 6: Scilab programming: Newton's backward interpolation formula.

Practical 7: Scilab programming:

- i. Lagrange's interpolation for unequal interval.
- ii. Newton's divided difference formula.

Practical 8: Scilab programming:

- Numerical Integration by Trapezoidal method.
- Numerical Integration by Simpson's $(1/3)^{\text{rd}}$ rule.
- Numerical Integration by Simpson's $(3/8)^{\text{th}}$ rule.

Practical 9: Scilab programming:

- i. Euler's Method
- ii. Runge-Kutta Method

Practical 10: Written practical: Groups

Practical 11: Written practical: Finite Groups and Subgroups

Practical 12: Written practical: Coding Theory and cryptology

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Semester – III	Paper – VII
Course Code: BSC-CS307T	Title of the Course: Embedded System
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- On completion of the course, student will be able
- To interface I/O peripherals to 8051 microcontroller
 - To design small microcontroller based projects
 - Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded system application.
 - Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.

Detailed Syllabus:

Unit	Course Contents	Allotted Hours
Unit I	Basics of Microcontroller & Intel 8051 architecture Introduction to microcontrollers, difference in controller and processor. Internal block diagram, features and Architecture of 8051, Programming model, Flags and PSW, PC, SP, SFRS. Internal RAM organization, pin functions of 8051, I/O port structure & Operation. Internal ROM, External memory. Interfacing memory to 8051. Oscillator and clock. Timer / counter: TMOD, Timer modes, TCON, SCON, SBUF, PCON Registers.	(09)
Unit II	Real World Interfacing Introduction to 8051 programming in C, I/O programming. Interfacing: LED, Thumbwheel switch, 7 segment display, LCD, stepper motor, Opto-coupler.	(06)

Unit III	Architecture of System on Chip (SOC) Embedded System: Block diagram, basic structure, characteristics Single Boards Computer: block diagram, types, Comparison of SBC models, Specifications. SOC: Architecture of SoC, Comparison of SoC and SBC. Basic version Broad Coprocessor. Raspberry Pi: Pin Description, Architectural features, Block diagram of BCM2835 ARM116JZF-S: CPU Overview, Block diagram, Component such as Integer core, LSU, Prefetch unit, Memory System, AMBA AXI interface, Coprocessor interface, Debug. CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview	(09)
Unit IV	Interfacing of devices to Raspberry Pi Introduction to Python for programming Raspberry Pi: I/O functions (GPIO, Digital), Time functions, Library functions Basic interfacing: LED, Switch Interfacing to Raspberry pi: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, ADC.	(06)

Suggested Readings:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.
3. Rasberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk(O'Reilly Media Inc.)
4. Rasberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.)

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Semester – III	Paper – VIII
Course Code: BCS-CS 308 T	Title of the Course: Computer Networking
Credits: 02	Total Lectures: 33 Hrs.

Course Outcomes (COs): On completion of the course, student will be able,

- a. Explore basic concepts of computer network with application areas
- b. Understanding the layers of OSI and TCP / IP Reference model
- c. Explore various protocols at Data Link Layer
- d. Learning logical addressing, network layer protocol

Detailed Syllabus:

Unit	Course Contents	Allotted Hours
Unit I	<p>Introduction To Computer Network</p> <p>Definition & Applications of Computer Network, Network criteria, network types - LAN, MAN, WAN, Switching, The Internet, Accessing the Internet .</p> <p>Data Communication-Definition, components, data representation, Data Flow. Protocol</p> <p>Hierarchies, Design issues for layers, Connection Oriented & Connectionless services.</p> <p>Service Primitives. Network Models – OSI Reference Model & TCP/IP</p>	(06)

	Model, Comparison of OSI and TCP/IP Reference Models	
Unit II	<p>The Physical Layer</p> <p>Analog and Digital data, Analog and Digital signals, Periodic & Non-periodic signals, Digital Signals- Bit rate, bit length, baseband Transmission, Transmission Impairments –attenuation, distortion and noise.</p> <p>Data Rate Limits – Noiseless channel: Nyquist’s bit rate, noisy channel: Shannon’s law. Performance of the Network Bandwidth, Throughput, Latency(Delay), Bandwidth –Delay Product, Jitter. Transmission Modes, Parallel Transmission and Serial Transmission – Asynchronous and Synchronous. Trunks & Multiplexing FDM and TDM. Switching - Circuit Switching, Message Switching and Packet, Switching, comparison of circuit & packet switching. Physical Layer Devices Repeaters, Hubs- active hub Passive hub</p>	(08)
Unit III	<p>The Data Link Layer</p> <p>Design Issues – Services provided to the Network Layer, Framing – Concept, Methods - Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations, Error Control, Flow Control. Error detection code HAMMING and CRC. Data Link Layer Protocols-HDLC – frame format, all frame types PPP – Use, Frame Format, Use of PPP in the Internet. Data Link Layer Devices – Bridges. Random Access Protocols ALOHA – pure and slotted, CSMA – 1-persistent, p-persistent and non-persistent CSMA/CD, CSMA/CA, Controlled Access Reservation, Polling and Token Passing,</p> <p>Channelization- Definitions- FDMA, TDMA and CDMA</p>	(07)
Unit IV	<p>Network Layer</p> <p>Logical addressing: - IPv4, addresses, Address space, Notation, classful addressing , classless addressing</p> <p>IPv4: - Datagram fragmentation.</p> <p>IPv6 addresses: structure ,address space , packet format, extension headers, difference between IPv4 and IPv6.</p> <p>Network layer devices- Router , router table, network address translation</p>	(06)

Unit V	Transport Layer Transport layer Services- Process-to-process communication, Addressing, Encapsulation and decapsulation, Multiplexing and demultiplexing, Flow control, Pushing or pulling, Flow control, Buffers, Sequence numbers, Acknowledgements, sliding window, congestion control. Connectionless and Connection-oriented service, Port numbers. Transport layer protocols- User datagram protocol, user datagram, UDP services. Transmission Control Protocol - TCP Services, TCP Features, TCP Segment format, three-way handshake for connection establishment and termination, State transition diagram, windows in TCP	(06)
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Suggested Readings:

1. Computer Networks By Andrew S Tanenbaum (PHI) 4th edition
2. Data Communication and Networking, Forouzan, Mc Graw Hill publication, 5th edition
3. Networking All In One Dummies Wiley Publication.[5th Edition]
4. Norton Peter, Complete Guide To Networking

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Semester – III	Paper – IX
Course Code: BSC-CS309 P	Title of the Course: Practical Course I
Credits:02	Total Lectures: 60 Hrs.

Course Outcomes (COs):

- To interface I/O peripherals to 8051 microcontroller
- To design small microcontroller based projects
- To design and develop own smart applications using Raspberry-Pi
- To know multiplexing and modulation techniques useful in developing wireless Application
- Do build and test own network and do settings.

Detailed Syllabus:

Minimum no of Practical to be Performed: 12

Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards, Raspberry Pi boards)

Group A

1. Interfacing of LED / Switch to 8051 microcontroller
2. Interfacing of thumbwheel & seven segment display to 8051 microcontroller

3. Traffic light controller using 8051 microcontroller
4. Interfacing LCD to 8051Microcontroller
5. Speed Control of stepper motor using 8051 microcontroller
6. Event counter using opto-coupler, seven segment LED/LCD display interface to 8051Microcontroller
7. Programming of Raspberry Pi to control LEDs attached to the GPIO pins
8. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins
9. Programming of Raspberry Pi to detect temperature using temperature sensor
10. Programming of Raspberry Pi to detect light intensity using photocell sensor
11. Programming of Raspberry Pi for Motion detection
12. Programming of Raspberry Pi for image detection

Group B

1. Study of Time Division Multiplexing
2. Study of Frequency Division Multiplexing
3. Study of Error detection and correction by using Hamming Code technique
4. Study of Computer network components: Cables, Connectors, Routers, Switches, Ethernet and related interfacing cards
5. To study Configuration of IP and MAC address and to study Local Area Network Setup.
6. Configuration of a Router using Packet Tracer.
7. Implementation of a Network using Packet Tracer.
8. Study of High –level data link control Protocol (HDLC).
9. Performance analysis of csma/ca and csma/cd protocols.
10. Simulate a mobile ADHOC network.

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Semester – III	Paper - X
Course Code: BSC-CS310T	Title of the Course: Technical English
Credits: 02	Total Lectures: 30 Hrs.

COURSE OUTCOMES(COs):

Up on successful completion of this course, student will be able to:

1. Acquire the use of grammar effectively (vocabulary and so on) through extensive coursework on writing reports and reading comprehensions, articles, essays, general discussion etc.
2. Assess the skills of writing business letters in various situations and generate skills of writing business letters, essays and memos.
3. Categorize the various structures of reports and compose to use them in the professional scenario.

Detailed Syllabus:

Unit	Course Contents	Allotted Hours
Unit I	Grammar: Sentence and Sentence Construction Vocabulary: Homophones, Homographs, Homonyms Listening: Listening for gist and detailed meaning and to identify the attitudes and opinions of the speakers. Speaking: Mini-presentations on a business theme and giving information and expressing opinions. Reading: Reading for detailed comprehension of detailed material; Skimming and Scanning. Writing: Writing to deal with requests, giving information about a product	(10)
Unit II	Grammar: Concord, Modal Auxiliary, Question Tags.	(10)

	<p>Vocabulary: Business Vocabulary.</p> <p>Listening: Answering multiple choice questions on short conversations or monologues.</p> <p>Speaking: Expressing opinions, Agreeing and Disagreeing, Talking about oneself, one's current situations and plans.</p> <p>Reading: Reading for Understanding Vocabulary and grammar in a short text</p> <p>Writing: Writing for functional/ communicative task- e.g., Re-arranging appointments, asking for permission, giving instructions, apologizing and offering compensation.</p>	
Unit III	<p>Interview Techniques: Job Application Letter Resume Writing GDPI Presentations</p> <p>Soft Skills and Personality Development: An Introduction to Soft Skills SWOC Analysis Goal Setting Project Management</p> <p>*Practice and Discussion Sessions</p>	(10)

Suggested Readings:

1. Whitby, N., Business Benchmark. Cambridge English,2013.
2. Hughes, J. and Newton, J., Business results – Intermediate,2021
3. Frank, M. Writing as Thinking: A Guided Process Approach. Prentice Hall Reagents.
4. Hamp-Lyons, L. and B. Heasley, Study Writing: A Course in Written English for Academic and Professional Purposes. Cambridge UP.
5. Quirk, R. S., Greenbaum, G. Leech and J. Svartik, A Comprehensive Grammar of the English Language. Longman.
6. Riordan, Daniel G. and Steven A., Panley. Technical Report Writing Today. Biztaantra.
7. Gerson, S., Gerson, S., Technical Writing: Process and Product. Pearson, 2011.

WEB REFERENCES:

1. www.cambridgeenglish.org

Each semester shall have 1+1=2 credits for teaching. However, each credit is equal to 15 hours, so this course shall have 30 teaching hours. Changes as per the university guidelines shall be communicated from time to time.

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<u>Semester –III</u>	<u>Paper – XII</u>
<u>Course Code: BSC-CS 312T</u>	<u>Title of the Course : Web Technologies</u>
<u>Credits: 02</u>	<u>Total Hours: 34 Hrs.</u>

Course Outcomes (COs):

- Describe different web technologies and application development issues and trends.
- Distinguish between server-side and client-side web technologies.
- Apply CSS types for different web pages and technologies of World Wide Web as a platform.
- Validate web form fields using JavaScript.

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<u>Unit</u>	<u>Course Contents</u>	<u>Allotted Hours</u>
<u>Unit I</u>	<u>Introduction to web</u> <u>1.1 Internet</u> <u>1.1.1 Definition</u> <u>1.1.2 History of Internet</u> <u>1.1.3 World Wide Web</u> <u>1.1.4 Web client, Web server</u> <u>1.1.5 Basic internal Protocol</u> <u>1.1.6 Client server architecture (Two tier, Multitier)</u> <u>1.1.7 HTTP request & response</u> <u>1.1.8 URL</u>	<u>(04)</u>
<u>Unit II</u>	<u>Hypertext Markup Language</u>	<u>(10)</u>

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	<p>2.1 Introduction</p> <p>2.2 Basic structure of HTML Document</p> <p>2.3 HTML editors</p> <p>2.4 Markup Tags: heading, paragraphs, formatting, line-breaks</p> <p>2.5 HTML color, link, image</p> <p>2.6 Working with text, lists, tables, frames, blocks</p> <p>2.7 Working with Hyperlinks</p> <p>2.8 HTML Images</p> <p>2.9 HTML forms</p> <p>2.10 HTML Layout</p> <p>2.11 HTML Iframe</p>	
Unit III	<p>Cascading Style Sheets</p> <p>3.1 Introduction, Syntax & selectors</p> <p>3.2 Ways to insert CSS</p> <p>3.3 CSS properties</p> <p>3.3.1 Color</p> <p>3.3.2 Background</p> <p>3.3.3 Border</p> <p>3.3.4 Margin</p> <p>3.3.5 Padding</p> <p>3.3.6 Height & Width</p> <p>3.4 Text-formatting, list, tables</p> <p>3.5 Layout</p> <p>3.5.1 The display property</p> <p>3.5.2 The positionary property</p>	(07)
Unit IV	<p>Basic Of JavaScript</p> <p>4.1 Introduction</p> <p>4.2 Datatypes of JavaScript</p> <p>4.3 Control Structure of JavaScript</p> <p>4.4 Examples of JavaScript</p> <p>4.5 JavaScripts block & comments</p>	(04)
Unit V	<p>JavaScript DOM</p> <p>5.1 JavaScript function</p> <p>5.2 Working with events</p> <p>5.3 JS popup boxes</p> <p>5.4 JavaScript objects</p> <p>5.5 JavaScript HTML DOM</p>	(06)
Unit VI	<p>Emerging Trends in Web Technologies</p> <p>6.1 Introduction</p> <p>6.1.1 CMS- WordPress/Drupal/Joomla</p> <p>6.1.2 JQuery</p> <p>6.1.3 Angular JS</p> <p>6.1.4 Bootstrap</p>	(03)

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Suggested Readings:

1. “JavaScript by Example”, Ellie Quigley, Pearson Education, Inc., 2011
2. “Internet & World Wide Web How to Program (4thEdition)”, P.J. Deitel & H.M. Deitel, Pearson –Prentice Hall, 2000
3. Pro HTML5 and CSS3 Design Patterns by Michael Bowers, Dionysios Synodinos and Victor Sumner, Apress edition

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Semester –III	Paper –XIII
Course Code: BSC-CS 313P	Title of the Course : Practical course based on 312
Credits: 02	Total Hours: 60 Hrs.

Course Outcome(COs):

- Understanding the relationship of HTML, CSS & JavaScript.
- Create cascading stylesheet(CSS) for device and browser integration
- Utilize the concept of JavaScript.

Suggested List of Assignments:

Assignment 1

Creating Sample HTML page using Basic tags of HTML. (Text formatting).

Assignment 2

HTML Programming using list, tables hyper link, frame,

Assignment 3

HTML forms designing Using from tag.

Assignment 4

Introduction to CSS & its type. Implementation of CSS element selector.

Assignment 5

Implementation of box model CSS, (Margin padding, border)

Assignment 6.

Implementation of Display and Position property & Basic transition in CSS.

Assignment 7

Implementation of Control structure in Java script.

Assignment 8

Implementation of array & its object in Java script.

Assignment 9

Implementation of function in java script.

Assignment 10

Implementation of pop-up box in java script.

Assignment 11

Implementation of different events in java script.

Assignment 12

DOM manipulation using Java Script.

Suggested Readings:

1. Laboratory handbook prepared by the college.

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Semester –IV	Paper –I
Course Code: BSC-CS 401T	Title of the Course: Object Oriented Concepts Using C++
Credits: 02	Total Hours: 32 Hrs.

Course Outcomes(COs):

- To learn the fundamental concepts and methodologies which are essential to build C++ programs.
- Apply the concepts of object oriented programming.
- Apply virtual and pure virtual functions and complex programming.

Unit	Course Contents	Allotted Hours
Unit I	1.1 Ethics of Object Oriented Programming 1.1.1 Object oriented programming paradigm. 1.1.2 Basic concepts of object oriented programming. (objects, classes, Data abstraction, Data encapsulation, inheritance, polymorphism, Dynamic binding, message passing) 1.1.3 Benefits of OOPs 1.1.4 Applications of OOPs	(05)
	1.2 Introduction of C++	

	<p>1.2.1 What is C++? 1.2.2 Application of C++ 1.2.3 Structure of C++ program 1.2.4 Simple C++ program</p> <p>1.3 Managing Console I/O Operations</p> <p>1.3.1 Streams of C++ 1.3.2 Stream Class of C++ 1.3.3 Unformatted I/O Operations 1.3.4 Formatted I/O Operations 1.3.5 Managing output with Manipulators</p>	
Unit II	<p>Tokens, Expressions of C++</p> <p>2.1 Tokens 2.2 Keywords 2.3 Identifiers 2.4 Basic data types 2.5 User defined data types 2.6 Derived data types 2.7 Symbolic constants 2.8 Dynamic initialization of variables 2.9 Reference variables 2.10 Operators in C++ 2.11 Scope resolution operators 2.12 Memory dereferencing operators 2.13 Memory management operators 2.14 Manipulators 2.15 Type cast operators</p>	(02)
Unit III	<p>Functions in C++</p> <p>12.13.1 Function prototyping 12.23.2 Call by reference 12.33.3 Return by reference 12.43.4 Inline function 12.53.5 Function overloading 12.63.6 Friend function</p>	(04)
Unit IV	<p>Class & Objects in C++</p> <p>4.1 Specifying a class and creating object of class 4.2 Defining member function</p>	(02)

	4.3 A C++ program with class 4.4 Memory allocation of object 4.5 Array of objects 4.6 Static data member 4.7 Static member function	
Unit V	Constructor and Destructor 5.1 Definition of constructor 5.2 Types of constructor 5.3 Destructor 5.4 Operator overloading 5.4.1 Definition, rules for overloading operators 5.4.2 Unary operator overloading 5.4.3 Binary operator overloading	(06)
Unit VI	6.1 Inheritance 6.1.1 Definition, visibility modifier (private, public, protected) 6.1.2 Types of inheritance 6.1.2.1 Single inheritance 6.1.2.2 Multilevel inheritance 6.1.2.3 Multiple inheritance 6.1.2.4 Hierarchical inheritance 6.1.2.5 Hybrid inheritance 6.1.3 Abstract classes 6.1.4 Virtual base classes 6.1.5 Virtual function 6.1.6 Rules for virtual function 6.1.7 Pure virtual function 6.1.8 This pointer 6.2 Working with files 6.2.1 Classes for file stream operations 6.2.2 Opening and closing files 6.2.3 File pointers & their manipulations 6.2.4 Sequential I/P & O/P operations	(13)

Suggested Readings:

1. Object-oriented programming with C++ by E.Balagurusamy, 2nd Edition, TMH.
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3. Mastering C++ - Venugopal, McGraw-Hill Education (India)

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Semester –IV	Paper –II
Course Code: BSC-CS 402T	Title of the Course : NoSQL
Credits: 02	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Explain and compare different types of NoSQL Databases.
- Compare and contrast RDBMS with different NoSQL databases.
- Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
- Apply No-SQL development tools on different types of NoSQL Databases.

Unit	Course Contents	Allocated Hours
Unit I	Introduction to NoSQL 1.1 What is NoSQL DB? 1.2 History of NoSQL DB 1.3 Features of NoSQL 1.4 Types of NoSQL DB 1.5 Difference Between RDBMS & NoSQL 1.6 Why NoSQL? 1.7 When should NoSQL be used? 1.8 NoSQL Database Micro-conceptions.	(05)

	1.9 Benefits of using NoSQL DB	
Unit II	Overview of MongoDB 2.1 What is database? 2.2 What are collections? 2.3 What is Document? 2.4 Where is MongoDB used? 2.5 Why use MongoDB? 2.6 Advantages of using MongoDB.	(04)
Unit III	Concept of MongoDB 3.1 Data modeling of MongoDB 3.2 MongoDB 3.2.1 Create Database 3.2.2 Drop Database 3.2.3 Create collection 3.2.4 Drop collection 3.3 MongoDB Datatypes 3.4 MongoDB 3.4.1 Insert document 3.4.2 Query Document 3.4.3 Update Document 3.4.4 Delete Document	(06)
Unit IV	Operations on MongoDB 4.1 MongoDB 4.1.1 Projection 4.1.2 limiting Records 4.1.3 Sorting Records 4.1.4 Indexing 4.1.5 Aggregation 4.1.6 Replication	(05)
Unit V	Advanced MongoDB	(05)

	5.1 MongoDB 5.1.1 Relationships 5.1.2 References 5.1.3 covered Queries 5.1.4 Analyzing Queries	
Unit VI	Introduction to Cassandra 6.1 Introduction 6.2 Architecture of Cassandra 6.3 Data model of Cassandra	(05)

Suggested Readings:

1. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J Sadalage and Martin Fowler
2. NoSQL for Dummies A Willy Brand
3. <http://nosql-database.org/>.

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Semester –IV	Paper –III
Course Code: BSC-CS 403P	Title of the Course : Practical Course Based on CS 401 & CS 402
Credits: 02	Total Hours: 60 Hrs.

Course Outcomes (COs):.

- Create database tables in MongoDB.
- Write and execute simple, nested queries.
- Make the student capable of making a choice of what database technology to use based on their application need.

Suggested List of Assignments:**SECTION-I****Object Oriented Concepts using C++****Assignment 1**

Structure of C++ program, Header file, comments, main functions, C++ Program template, The standard output stream, cascading of I/O operation.

Assignment 2

Class, object, public, private, protected, defining member function. member function defined inside the class, member function defined outside the class, array of object manipulators.

Assignment 3

function, inline function, friend function, static class member and static member function. static data members, static member function.

Assignment 4

function, overloading way to overload a function, default arguments, sample programs and Examples.

Assignment 5.

constructors and destructors: constructors, types of constructors, default constructor, copy constructor, dynamic constructors, destructor dynamic memory allocation operator new operator.

Assignment 6.

Operator overloading, function overloading, function overriding

Assignment 7

Inheritance, implementation of inheritance in C++, types of Inheritance,

Assignment 8

Virtual function & polymorphism:

Compile time polymorphism, runtime polymorphism, examples virtual functions in derived class, pure virtual class & abstract class, examples

Assignment 9

Working with files:

File, stream, opening file, closing file, text file

SECTION-II**Mongo DB Practical****Assignment 1**

Create database with name movie & a collection of document film, perform insert , display & Delete Operations on collection film

Assignment 2.

Create database with name company & an employee is a collection of document. Perform ,insert, Display, Arithmetic functions, increment Decrement & Delete

Assignment 3.

Create a database with the name student having collection teacher &perform create DB, Drop DB, & create collection

Assignment 4.

This assignment is based on company database having collection employee & Transactions. Perform, insert document, query document, update document & delete

Assignment 5.

- i) Design a database as per your Requirements
- ii) Combine the objects into one document if you will use them together
- iii) Duplicate the data (but limited)
- iv) Do join while write , not on read
- v) Do complex aggregation in the schema.

Assignment 6.

Create database employee & Create a collection & insert data then find ,find one, sort, limit, skip, distinct, projection

Assignment 7

- i) Design your schema according to users requirements.
- ii) Combine objects into one document if you will use them together otherwise separate them (but make sure there should not be need of joins)
- iii) Duplicate the data (but limited)
- iv) Do join while write , not on read
- v) Do complex aggregation in the schema

Assignment 8

Create database college ; create collection named class ; create collection course ; Insert documents in class and course; update modifiers (\$ set , \$ unset , \$ increment , \$ push all , \$ pull , \$ add)

Assignment 9

Create a database with a name hospital. A Doctor is a collection of a documents with the fields performed , drop Database, Drop collection.

Assignment 10

Create a database named sports collection called games

- i) Design your schema according to user's requirements.
- ii) Combine objects into one document if you will use them together otherwise separate them (but make sure there should not be need of joins)
- iii) Duplicate the data (but limited)
- iv) Do join while write , not on read
- v) Do complex aggregation in the schema

Suggested Readings:

Laboratory handbook prepared by the college.

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Semester – IV	Paper – IV
Course Code: BSC-CS 404T	Title of the Course: Computational Geometry
Credits: 2	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- a) Learn about Two dimensional transformations
- b) Learn about Three dimensional transformations
- c) Learn about Orthographic, Axonometric, Oblique Projections
- d) Learn about Plane and space Curves

Detailed Syllabus:

Unit	Course Contents	Allocated Hours
Unit I	Two dimensional transformations: 1.1 Representation of points. 1.2 Transformations and matrices 1.3 Transformation of points. 1.4 Transformation of straight lines 1.5 Midpoint Transformation 1.6 Transformation of parallel lines and intersecting lines 1.7 Transformation: rotations, reflections, scaling, shearing 1.8 Combined transformations. 1.9 Transformation of a unit square 1.10 Solid body transformations. 1.11 Translations and homogeneous coordinates.	(12)

	1.12 Rotation about an arbitrary point 1.13 Reflection through an arbitrary line	
Unit II	Three dimensional transformations: 2.1 Introduction. 2.2 Three dimensional – Scaling, shearing, rotation, reflection, translation. 2.3 Multiple transformations. 2.4 Rotation about – an axis parallel to coordinate axes 2.5 Reflection through – coordinate planes, planes parallel to coordinate Planes	(06)
Unit III	Projection 3.1 Orthographic projections. 3.2 Axonometric projections. 3.3 Oblique projections 3.4 Single point perspective projection	(06)
Unit IV	Plane and space Curves: 4.1 Curve representation. 4.2 Parametric curves. 4.3 Parametric representation of a circle and generation of circle. 4.4 Bezier Curves – Introduction, definition, properties (without proof), Curve fitting (up to $n = 3$), equation of the curve in matrix form (upto $n = 3$)	(06)

Suggested Readings:

1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill In. Second Edition, 2017.
Unit 1: Chapter 2: Sec. 2-1 to 2.17
Unit 2: Chapter 3: Sec. 3.1 to 3.8, 3.10,
Unit 3: Chapter 3: Sec. 3.12 to 3.14
Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8
2. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (Third Edition) 2010
3. Schaum Series, Computer Graphics, Mc Graw Hill, second edition, 2020.

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Semester – IV	Paper – V
Course Code: BSC-CS 405T	Title of the Course: Operations Research
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- To understand Linear Programming Problems.
- To understand Assignment Problems.
- To understand Transportation Problems.

Detailed Syllabus:

Unit	Course Contents	Allocated Hours
Unit I	Linear Programming Problem I 1.1 Introduction Definition and Examples 1.2 Problem solving using Graphical method 1.3 Theory of Linear Programming, Slack and surplus variables, Standard form of LPP, Some important definitions, Assumptions in LPP, Limitations of Linear programming, Applications of Linear programming, Advantages of Linear programming Techniques 1.4 Simplex method, Big- M-method	(09)
Unit II	Linear Programming Problem II 2.1 Special cases of LPP: Alternative solution, Unbounded solution, Infeasible solution	(08)

	2.2 Duality in Linear Programming, Primal to dual conversion, Examples	
Unit III	Assignment Models 3.1 Assignment Model –Introduction 3.2 Hungarian method for Assignment problem	(06)
Unit IV	Transportation Models 4.1 Introduction, Tabular representation 4.2 Methods of IBFS (North-West rule, Matrix-minima, Vogel's Approximation) 4.3 The Optimality Test of Transportation Model (MODI method only)	(07)

Suggested Readings:

1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intl Edition.
Unit 1: Chapter 2: Sec. 2-1 to 2.17
Unit 2: Chapter 3: Sec. 3.1 to 3.10,
Unit 3: Chapter 3: Sec. 3.12 to 3.14
Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8

Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (4th Edition)

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Semester -IV	Paper -VI
Course Code: BSC-CS 406P	Title of the Course: Mathematics Practical
Credits: 02	Total Lectures: 60 Hours

Course Outcomes:

- To sort set of points with respect to a line and rectangle
- To find a pair of points with least mutual and farthest distance from the given set
- To sort set of points with respect to a polygon and rectangular block
- To understand Transportation and assignment problem

Details of Syllabus:

Practical 1: C -programming: Sorting a set of points with respect to a line.

Practical 2: C- programming: Sorting a set of points with respect to a rectangle

Practical 3: C- programming: Find a pair of points with least mutual mutual distance from the given set

Practical 4: C- programming: Find a pair of points with farthest mutual distance from the given set.

Practical 5: C – programming: Generation of uniformly n- points on standard Circle

Practical 6: C – programming: Generation of uniformly n- points on standard Ellipse

Practical 7: C -programming Sorting a set of points with respect to a polygon

Practical 8: C -programming Sorting a set of points with respect to a rectangular block

Practical 9: Written practical: Solution of L. P. P. by simplex method

Practical 11: Written practical: 2 -D transformations

Practical 11: Written practical: Transportation and assignment problem

Practical 12: Written practical: 3 -D transformations.

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Semester – IV	Paper – VII
Course Code: BSC-CS407T	Title of the Course: Internet of Things and Applications
Credits: 2	Total Lectures: 30 Hrs.

Course Outcomes (COs): After completing the course, the students will be able to

- Know the basic building blocks of IoT
- Know IoT protocols
- Apply enabling technologies for developing IoT systems
- Design simple IoT applications

Detailed Syllabus:

Unit	Course Contents	Allocated Hours
Unit I	<p>Introduction of IoT</p> <p>Definition, characteristics and Application of IoT, Technical Building blocks of IoT, Devices, Communication Technologies. Physical design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog/Digital Conversion.</p> <p>Logical Design of IoT: IoT functional blocks, IoT Enabling Technologies.</p>	(09)

	IoT Issues and Challenges-Planning, Costs and Quality, Security and Privacy, Risks	
Unit II	Short Range Wireless Technologies Short range Technologies: Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure, BLE Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications RFID: working of RFID system, types of RFID tags, RFID frequencies, applications	(06)
Unit III	IoT Architecture Introduction to IOT: Evolution of IOT, M2M and/or IOT, Seven layer architecture of IoT, IoT Protocols: MQTT, CoAP, XMPP and AMQT. Role of cloud in IoT, cloud topologies, Cloud access, Cross connectivity across IoT System components: Device to Gateway-short range Wireless: cellphone as gateway, dedicated wireless Access points Gateway to cloud: Long range connectivity, (wired, cellular, Satellite, WAN) Direct Device to Cloud connectivity. Networking technologies: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, sigfox NB-IoT, Cat –M	(09)

Unit IV	IoT Applications Arduino: Introduction, types, Architecture, Applications Case studies: Case Study 1: Smart Irrigation system for Agricultural field Case Study 2: Home Automation Case Study 3: Smart Cities Case Study 4: Attendance tracking using RFID	(06)
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Suggested Readings:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things– A hands- on approach", Universities Press, ISBN: 0: 0996025510, 13:978-996025515
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley Publication, ISBN:978-1-119-99435-0
3. Dawoud Shenouda, Peter Dawoud, "Microcontroller and Smart Home Networks", ISBN: 9788770221566, e-ISBN: 9788770221559
4. Charles Crowell, "Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT", ISBN-13 : 979-8613100194
5. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

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Semester – IV	Paper – VIII
Course Code: BSC-CS 408 T	Title of the Course: Advanced Computer Networking
Credits: 2	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- Understand the concept of application layer and their protocol.
- Study the various network services.
- Learn the operating system.

Detailed Syllabus:

Unit	Course Contents	Allocated Hours
Unit I	The Application layer Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Name – Address Resolution. TELNET: Timesharing Environment, Logging, NVT,	(09)

	<p>Embedding, Options, Mode of Operations.</p> <p>E-MAIL: Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP, IMAP, Web Based Mail.</p> <p>File Transfer Protocol (FTP): Communication over control connection, Communication over Data Connection, Anonymous FTP.</p> <p>WWW: Architecture, WEB Documents.</p> <p>HTTP: HTTP Transaction, Persistent and Non-Persistent Connection, Proxy Server.</p>	
Unit II	<p>Network and Web Security</p> <p>Introduction Network security, Security Techniques- Encryption & decryption, Digital Signatures, Cryptography, Firewall Security Services, Authentication Mechanisms- Passwords, Smart Card, Biometrics. Web Security: SSL Encryption, TLS, SET, E-mail Security, PGP / MIME, IP Security.</p>	(06)
Unit III	<p>Wireless Local Area Network</p> <p>Wireless Local Area Networks: Carrier Sense Multiple Access (CSMA/CA) protocol. Distributed Coordination Function, Point Coordination Function, Infrastructure based WLAN, ADHOC WLAN, IEEE 802.11 WLAN standards</p>	(06)
Unit IV	<p>Network Services</p> <p>VPN, Virtual LAN, Wi-Fi Network, Remote Sensing, Global Positioning system (GPS), Global Systems for Mobile combinations (GSM), General Packet Radio Service (GPRS), Bluetooth: Piconet, scatternet, Video Conferencing. Case study: Linux, Installing client & server, Roles & responsibility of Network Administrator Server Management Login Script, Ftp Server, News & search server, Web Server, Samba Server, Mail Server, Proxy Server, Print Server, User & group management.</p>	(09)

Suggested Readings:

1. Computer Networks, Tanenbaum, ISBN:788177581652, Pearson
2. Data Communication and Networking by Behrouz Forouzan, TATA McGraw Hill. Fourth editions
3. Computer Networking by Tannenbaum.
4. Network Security Essentials by William Stallings

5. Dorothy E. Denning, "Cryptography and Data Security", Addison-Wesley
6. Data communication and networking by William Stallings
7. Complete Reference Red Hat Enterprise Linux & Fedora Edition by Petersen Haddan

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Semester – IV	Paper – IX
Course Code: BSC-CS409	Title of the Course: Practical Course II
Credits: 2	Total Lectures: 60 Hrs.

Course Outcomes (COs):

- To build own IoT based system.
- To interface I/O devices and wireless communication modules to Arduino /any other IoT hardware platform.
- To cover basic concepts of networking
- To study LAN setup and understand basic LAN principles

Detailed Syllabus:

Minimum no of Practical to be performed: 10
Electronics lab should have set up for embedded programming (Computers and Arduino / LoRa boards)

Group A

1. To interface LED/buzzer to Arduino and write a program to make it ON or OFF
2. To interface digital sensor/push button to Arduino and write a program to make LED ON when button pressed or sensor detection
3. Study of Zig-bee for one application

4. To interface LDR to Arduino and write a programme to turn ON/OFF LED based on light intensity.
5. To interface Bluetooth to Arduino and write a program to send sensor data to smartphone using Bluetooth
6. Write a program on Arduino/Raspberry pi to upload temperature and humidity data to Things speak cloud.
7. Study of RFID system
8. To study Arduino based LED switching using mobile
9. Temperature and humidity sensing using Arduino
10. LoRa Interfacing.

Group B

1. Study of GSM system
2. To study to install Linux operating system.
3. Networking commands in Linux
4. lectStudy of GPS system
5. Study of network IP
6. Study of GPRS system

Group C

One activity equivalent to 2 experiments by the student.

- a. Continuation of F. Y. activity.
- b. Electronics project Based on the Theory Courses learnt
- c. Documentation type experiments
- d. Presentation/Seminar on Electronics /advanced topic/research topics nterfacing.

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Semester – IV	Paper – X
Course Code: BSC-CS410T	Title of the Course: Foreign Language: Japanese
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- It will Introduce students to the Japanese scripts – Hiragana, Katakana, and about 100 basic kanji's (Chinese characters).
- It will help students to learn the Japanese phonology.
- It will Introduce students to the elementary Japanese structures containing about 700 words.
- It will help students to acquaint with Japan, Japanese Culture, Civilization etc.

Detailed Syllabus:

UNIT	JAPANESE LANGUAGE	Allotted Hours
I	1) Introduction about Japan, geographical features, culture. 2) Introduction and history of Japanese Script. 3) Hiragana and Katakana Script. 4) Greetings and classroom expressions.	(6)

	6) Self introduction.	
II	1) Introduction of demonstrative pronouns. 2) Introduction of particles は, が, も, か. 3) Introduction of verbs, their dictionary form, masu form, (simple present tense and simple future tense.)	(4)
III	1) Introduction of prepositions – なか, した, うえ, etc. 2) Introduction of basic sentence pattern i.e. ~に~が あります/います. (External pattern.) 3) Introduction of Japanese unique counting system, numerals. 4) Introduction of multiples of 100,1000,10,000. 5) Introduction of days, date, year, age, duration, clock.	(8)
IV	1) Introduction of い, な adjectives. 2) To make adverbs from adjectives. 3) Past tense, present tense, affirmation, negation in case of verb, naa an see adjective.	(4)

UNIT	ORAL	Time Required (in Hours)
I	Reading/listening/speaking practice.	6
II	Speech, self-introduction in Japanese.	2

Suggested Readings:**Textbooks prescribed:** (Pertinent portions)

1. Minna No Nihongo I – **Author:** 3A Corporation, **Publisher:** Goyal Pub.& Dist.
2. Nihongo shoho Vol. I – **Publisher:** Japan Foundation, Tokyo, Japan
(paperback edition available with JALTAP, Pune) Author- Japan Foundation.
3. Kanji Picture book **Publisher:** Japan foundation. **Author-** Japan Foundation.

4. Sulabh Japani Vyakarana – Part I **Author** - Dr. V. N. Kinkar, **Publisher: JALTAP**, Pune.

**Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
New Arts, Commerce and Science College, Ahmednagar.
(Autonomous)
Syllabus of B. Sc. Computer Science
under
Faculty of Science and Technology**

Semester – IV	Paper – XI
Course Code: BSC-CS410T	Title of the Course: Foreign Language: French
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes (COs):

- Identify the main point and basic supporting details of level appropriate authentic texts.
- Talk about familiar topics related to sell, personal interest and everyday life, using linked sentences with a moderate level of accuracy both orally and in writing.
- Ask and answer questions about the sell, personal interest everyday life and the immediate environment, orally and in writing .

It will help students to acquaint with Japan, Japanese Culture, Civilization etc

FRENCH SYLLABUS - 30 HOURS COURSE

ENCHANTÉ 1- 15 HOURS

LEÇON	OBJECTIFS DE LA LEÇON	GRAMMAIRE
0.BONJOUR LA FRANCE !	*CONNAISSANCE GÉNÉRALE DE LA FRANCE *DISCUTANT EN	*LES NOMS

	GÉNÉRALE DE LA FRANCE	
1.LES LETTRES ET LES NOMBRES	*EPELER LE NOM ET COMPTER LES NOMBRES *APPRENDRE LES ALPHABETS	*LES ACCENTS ,LES FORMULES POUR DEMANDER LE NOM
2.LES SALUTATIONS	*SAVOIR SALUER, REMERCIER,S' EXCUSER (ENTRE CAMARADES ET ENTRE ADULTES)	*FORMULES DE SALUTATIONS (UNE CONVERSATION FORMELLE ET INFORMELLE) * CONNAÎTRE LES FORMULES POUR PRENDRE CONGÉ
3.À LA CANTINE	*SAVOIR UTILISER LE VERBE ÊTRE. *APPRENDRE LES PRONOMS PERSONNELS.	*CONJUGAISON DU VERBE ÊTRE, LES PRONOMS
4.LES OBJECTS ET LES GENS	*PRÉSENTER QUELQU'UN OU QUELQUE CHOSE.	*LES ADJECTIFS, EXPRESSIONS AVEC QU'EST-CE QUE.....? ET QUI EST -CE?
5.LA CHAMBRE D' ALAIN	*SAVOIR UTILISER LE VERBE AVOIR ,LES ARTICLES DÉFINIS ET LES NOMBRES JUSQU' À CENT.	*CONJUGAISON D' AVOIR, LES ARTICLES DÉFINIS.
6.LE CIEL BLEU,LE PARC VERT	*SAVOIR CONJUGUER LE VERBE ALLER ,ACCORDER LES ADJECTIFS DE COULEUR	*CONJUGAISON DU VERBE ALLER,LES ADJECTIFS LES COULEURS
7.C'EST LE WEEK-END !	*CONNAÎTRE LES JOURS DE LA SEMAINE ET LES MOIS DEMANDEZ LE	*VOCABULAIRE DES JOURS ET DES MOIS

	JOUR	
8.UNE SORTIE ENTRE AMIS	*SAVOIR CONJUGUER LES VERBES EN- ER	*RÈGLES DE CONJUGAISONS DU PREMIER GROUPE DE VERBE.
9.OU HABITES - TU ?	*SAVOIR DIRE SA NATIONALITÉ ET SON PAYS.	*VERBE HABITER, ACCORD DES NATIONALITÉS
10.LA FAMILLE D ' ALAIN	*SAVOIR UTILISER LES ADJECTIFS POSSESSIFS	*LES ADJECTIFS POSSESSIFS

ENCHANTÉ 2 - 15 HOURS

LEÇON	OBJECTIFS DE LA LEÇON	GRAMMAIRE
0.DÉCOUVRONS LA FRANCE !	*IDENTIFIER QUELQUES SYMBOLES DE FRANCE	*LA CULTURE FRANÇAISE
1.BELLES IMAGES	*L'ACCORD DES ADJECTIFS	*LE PLURIEL DES NOMS * LES ADJECTIFS
2.VOICI PAUL!	*DÉCRIRE QUELQU'UN	*LES PARTIES DU CORPS *LA POSITION DES ADJECTIFS
3.LES HABITS	*SAVOIR CONJUGUER LES TROIS GROUPE DE VERBE (ER ,IR ,RE)	*LES VERBES *RÈGLES DES VERBES * LES VÊTEMENTS
4.LES ANIMAUX DU ZOO	*MONTRER SA POSSESSION	*LES ADJECTIFS POSSESSIFS *LES NOMBRES ORDINAUX *LES ANIMAUX *GER ENDINGS VERBS
5.QUEL TEMPS FAIT- IL?	*APPRENDRE LES	*LES SAISONS

	EXPRESSIONS COURANTES AVEC FAIRE ET AVOIR	*LES EXPRESSIONS AVEC FAIRE ET AVOIR
6.AU TRAVAIL!	*PARLER DES PROFESSIONS RÉPONDRE AU NÉGATIF	*LA NEGATION *LES PROFESSIONS *LES MÉTIER
7.CHEZ CLARA	*FAITES DES PHRASES AVEC LES PRÉPOSITIONS	*LES PRÉPOSITIONS *LES VERBES IRRÉGULIERS - RE
8.LA MAISON DE MARIE	*DÉCRIRE LA MAISON	*VOCABULAIRE DE LA MAISON *LES ARTICLES CONTRACTÉS *LES VERBES EN- TIR
9.BON APPÉTIT	*EXPRIMER LA QUANTITÉ, DÉCRIRE LES REPAS D'UNE JOURNÉE.	*LES ARTICLES PARTITIFS *LES VERBES IRRÉGULIERS *LA NÉGATION AVEC L'ARTICLE PARTITIF
10.MA VILLE ,MON QUARTIER.	*APPRENDRE À POSER DES QUESTIONS, POSER LA QUESTIONS AVEC " EST- CE QUE?"	*LES VERBES IRRÉGULIER *EST - CE QUE .

Suggested Readings:

1. Enchanté 0,1,2,3,4

Méthode de Français,

Author: Archna Khurana

Rachna Sagar

2. Apprenons Le Français

Mahitha Ranjit

Saraswati House

3. Encore En Échanges

Neelima Raddi
Anjali Paranjpye
Oxford University Press

4. Langue et Civilisation Françaises
G.Mauger
Goyal Publishers

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(Autonomous)**

**Syllabus of B. Sc. Computer Science
under
Faculty of Science and Technology**

Semester –IV	Paper – XII
Course Code: BSC-CS 412T	Title of the Course: Core Python
Credits: 02	Total Hours: 30 Hrs.

Course Outcomes (COs):

- Acquire knowledge and programming skills in python
- Students will learn the concepts like Basics of Python programming
- Decision Making and Functions in Python

Unit	Course Contents	Allotted Hours
Unit I	Introduction to Python 1.1 History 1.2 Features of Python 1.3 Need of Python 1.4 Applications of Python	(02)

Unit II	Data types and control structure 2.1 Basic syntax 2.2 Python identifiers, variables and keywords 2.3 Data types 2.4 Operators, type conversion 2.5 Input Output functions 2.6 Putting comments 2.7 Conditional statements -if, if-else, Nested if-else 2.8 Looping statements -While, for 2.9 Break, continue, pass statements	(05)
Unit III	Python Strings 3.1 String Literals 3.2 Assign string to variable, Accessing strings. 3.3 Operations on strings -Index operator: Working with character of string, string methods, string length, string slices, string comparison	(05)
Unit IV	Python lists 4.1 Introduction 4.2 Creating, initializing & Accessing lists 4.3 Tracing, updating & deleting elements of lists 4.4 Operations on lists: -Concatenation, list indexing, slices 4.5 Functions and Methods 4.6 Comprehensions	(04)

Suggested Readings:

- 1 An Introduction to Computer Science using Python 3 by Jason Montojo, Jennifer Campbell, Paul Gries, The pragmatic bookshelf-2013
- 2 James Payne, “Beginning Python: Using Python and Python 3.1,Wrox Publication
- 3 Introduction to Problem Solving with Python by E balguruswamy, TMH publication 2016

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Syllabus of B. Sc. Computer Science
under
Faculty of Science and Technology

Semester –IV	Paper –XIII
Course Code: BSC-CS 413P	Title of the Course: practical course based on 412
Credits: 02	Total Hours: 60 Hrs.

Course Outcomes (COs):

- Students will be able to understand why Python is a useful scripting language for developers.
- Students will learn how to design and program Python applications.

Suggested List of Assignments:**Assignment 1**

Write a Python program to add two numbers

Assignment 2.

Write a Python program for factorial of number

Assignment 3.

Write a Python program for simple interest

Assignment 4.

Write a Python program to check leap year or not

Assignment 5.

Write a Python program to check number is positive or not?

Assignment 6.

Write a Python program to check a string is palindrome or not?

Assignment 7

Write a Python program to taken in the marks for five subjects and display a grade.

Assignment 8

Write a Python program to find out ways to remove i^{th} character from string in Python.

Assignment 9

Write a Python program to check if substring is present in a given string

Assignment 10

Write a Python program to swap two elements in a list

Assignment 11

Write a Python program to interchange first and last element in a list.

Assignment 12

Write a Python program to reversing a list.

Assignment 13

Write a Python program to demonstrate use of dictionaries by key or value

Assignment 14

Write a Python program to remove a Key from dictionary.

Assignment 15

Write a Python program to demonstrate Lambda function.

Assignment 16

Write a function in Python to count and display total no. of words in text file.

Suggested Readings:

Laboratory handbook prepared by the college.