S. P. Mandali's

Sir Parashurambhau College, Pune (Autonomous)

Department of Computer Science

REGULATIONS, SCHEME AND SYLLABUS

For the course

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

(B.Sc.(CS))

I to VI Semesters

Under the Choice Based Credit System (CBCS)

Revised w.e.f. Academic Year 2019-2020

Preamble

The undergraduate program in Computer Science (B.Sc. in Computer Science) aims to provide students with thorough knowledge of theoretical and practical aspects of Computer Science. This knowledge of Computer Science coupled with the knowledge of Electronics, Mathematics and Statistics provides the necessary foundation for higher studies and also in shaping a successful career as software professional. The programme acknowledges the relevance of computing and information science to every academic discipline, and emphasizes exposure to interdisciplinary subjects that will drive innovation in the future. The number of electives provided in this course gives vast choice to the student to enhance his/her skills. The program creates opportunities of hands-on learning through projects and gives knowledge and practical experience of the latest technologies. It also encourages a student to work effectively as team member and demonstrate professional behaviour. On completion of this course, a student will not only develop a diverse set of skills to prepare for higher studies in Computer Science and for employment, but will also encourage students to launch their own start-ups or venture into new types of careers using their interdisciplinary training. The B.Sc (Computer Science) degree course (2019 pattern) under autonomy, will be introduced in the following order:

a. First Year B.Sc. (Computer Sci.) 2019-2020
b. Second Year B.Sc. (Computer Sci.) 2020-2021
c. Third Year B. B.Sc. (Computer Sci.) 2021-2022

Goals:

The goals of our undergraduate program are to:

- teach students how to use computers effectively, creatively, and intelligently
- teach computer science as a multifaceted, humanistic discipline of problem solving
- provide up-to-date curricula in the technical and scientific knowledge needed for the professional and academic goals of our students
- encourage and participate in interdisciplinary undergraduate educational opportunities
- teach students how to acquire new knowledge, independently, in a world that changes with ever increasing rapidity
- provide students with experiential learning opportunities
- educate an increasing number of undergraduates in Computer Science to meet the growing demands of the regional and national economy.

Objectives:

Upon successful completion of B.Sc. (Computer Science) students will be able to:

- demonstrate proficiency in problem-solving techniques, identify problems, analyse requirements, formulate design and implement solutions that meet realistic constraints, such as costs, operational, social, cultural, ethical, health and safety
- impart sound technical foundations in computer science
- ability to creatively apply computer and related technologies to practical problems
- demonstrate proficiency in the analysis of complex problems and the synthesis of solutions to those problems

- demonstrate comprehension of modern software engineering principles, use software engineering methods and tools for developing quality software solutions
- demonstrate a breadth and depth of knowledge in the discipline of computer science
- acquire communication and soft skills to function as an effective professional
- gain knowledge in specialized areas with awareness of broad multi-disciplinary issues, and the ability to continue personal development to keep pace with advances in computer technology
- acquire skills to excel in the fields of Information Technology and its enabled services

Abbreviations

CC – Compulsory Core
AECC – Ability Enhancement Compulsory Course
SEC – Skill Enhancement Course
DSEC – Discipline Specific Elective Course
SECC – Skill Enhancement Compulsory Course

T - Theory
P - Practical
CIE - Continuous Internal Evaluation
SEE –Semester End Examination
ATKT – Allowed to keep term

SCHEME OF STUDY

1. **Title of the course**: B.Sc. (Computer Science) (2019 Pattern)
2. **Duration of the course:** 3 years (6 semesters) full time course
3. **Total Number of Credits**: 132
4. **Eligibility:**
   a. Higher Secondary School Certificate (10+2) Science Stream with Mathematics or its equivalent examination.

   OR

   b. Three Years Diploma Course, after S.S.C. (10^{th} standard) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

5. ***Admission:*** Admission to F.Y.B.Sc. (Computer Science) course will be done on the basis of merit and as per the rules and regulations stated by the Government of Maharashtra / national policy. On his/her selection for admission to B.Sc. (Computer Science) programme, the candidate shall, within the time fixed by the College, pay the tuition and other fees prescribed for the programme. If the candidate fails to pay the fees within the stipulated time, his/her admission shall automatically stand cancelled.
6. **Attendance**: 75% mandatory for each semester.
7. **Medium of instruction**: English.
8. **Duration**: The dates for the commencement and conclusion of each semester shall be declared by the institute authorities. In case of theory subjects, each semester shall consist of 15 weeks out of which 12 weeks are for teaching / active learning and 3 weeks for continuous assessment. Each Practical subject in a semester shall also be of 15 weeks out of which 14 weeks are for performing practicals and 1 week for continuous evaluation / journal certification / viva.
9. **Scheme of Study:**
   a. The first year of B.Sc. (Computer Science) comprises of four core subjects viz. Computer Science, Electronics, Mathematics and Statistics. Each core has two theory and one practical paper.
   b. The second year of B.Sc. (Computer Science) comprises of three core subjects viz. Computer Science, Electronics and Mathematics. Each core has two theory and one practical paper. In addition, a student has to study two AECC courses in each semester.

c. In the third year of B.Sc. (Computer Science), a student is offered three DSEC courses and two SECC courses each semester. Every DSEC consists of three subjects. Each SECC has two elective subjects out of which a student has to select only one.

d. Each theory lecture session shall be of 50 minutes duration for F.Y, S.Y and T.Y.

e. Each practical session for F.Y. shall be of 195 minutes duration.

f. Each practical session for S.Y. and T.Y shall be of 260 minutes duration

g. Semester wise structure of B.Sc. (Computer Science) program:

F.Y.B.Sc. (Computer Science) Semester I:

Course Type	**Paper Code**	**Title of the Paper**	**Credits**		**Lectures per Week**		**Evaluation**		
			T	**P**	**T**	**P**	**CIA**	**SEE**	**Total**
CC – I	CS11301	Computer Theory Paper I - Problem solving using Computers and 'C' Programming I	2	-	3	-	15	35	50
CC – II	CS11302	Computer Theory Paper II - Fundamentals of Databases I	2	-	3	-	15	35	50
CC – III	CS11303	Computer Science Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – IV	MT11321	Mathematics Theory I – Discrete Maths	2	-	3	-	15	35	50
CC – V	MT11322	Mathematics Theory II – Algebra	2	-	3	-	15	35	50
CC – VI	MT11323	Mathematics Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – VII	EL11331	Electronics Theory I - Semiconductor Devices and Basic Applications	2	-	3	-	15	35	50
CC – VIII	EL11332	Electronics Theory II - Digital Logic and Combinational Circuits	2	-	3	-	15	35	50
CC – IX	EL11333	Electronics Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – X	ST11341	Statistics Theory I - Notion of the Statistical Data Analysis Part I	2	-	3	-	15	35	50
CC – XI	ST11342	Statistics Theory II - Basic Probability Theory and Discrete Probability Distribution	2	-	3	-	15	35	50
CC – XII	ST11343	Statistics Practical	-	1.5	-	3hrs 15 min	15	35	50
		Total	16	06	24	13 hours	180	420	600

F.Y.B.Sc. (Computer Science) Semester II:

Course Type	Paper Code	Title of the Paper	Credits		Lectures per Week		Evaluation		
			T	P	T	P	CIE	SEE	Total
CC – I	CS12301	Computer Theory Paper I - Problem solving using Computers and 'C' Programming II	2	-	3	-	15	35	50
CC – II	CS12302	Computer Theory Paper II - Fundamentals of Databases II	2	-	3	-	15	35	50
CC – III	CS12303	Computer Science Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – IV	MT12321	Mathematics Theory I – Graph Theory	2	-	3	-	15	35	50
CC – V	MT12322	Mathematics Theory II – Calculus	2	-	3	-	15	35	50
CC – VI	MT12323	Mathematics Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – VII	EL12331	Electronics Theory I - Basics of Analog Instrumentation Systems	2	-	3	-	15	35	50
CC – VIII	EL12332	Electronics Theory II - Fundamentals of Computer Organization	2	-	3	-	15	35	50
CC – IX	EL12333	Electronics Practical	-	1.5	-	3hrs 15 min	15	35	50
CC – X	ST12341	Statistics Paper I - Notion of the Statistical Data Analysis Part II	2	-	3	-	15	35	50
CC – XI	ST12342	Statistics Paper II - Continuous Probability Distributions and Inference	2	-	3	-	15	35	50
CC – XII	ST12343	Computer Theory Paper I - Problem solving using Computers and 'C' Programming II	-	1.5	-	3hrs 15 min	15	35	50
Total			16	06	24	13 hours	180	420	600

S.Y.B.Sc. (Computer Science) Semester III:

Course Type	Course Code	Title of the Course	Credits		Lectures per Week		Evaluation		
			T	P	T	P	CIE	SEE	Total
CC – I	CS23301	Computer Sci. Theory Paper I	2	-	3	-	15	35	50
CC – II	CS23302	Computer Sci. Theory Paper II	2	-	3	-	15	35	50
CC – III	CS23303	Computer Sci. Practical Paper	-	2	-	4 hrs 20 min	15	35	50
CC – IV	MT23321	Mathematics Theory I	2	-	3	-	15	35	50
CC – V	MT23322	Mathematics Theory II	2	-	3	-	15	35	50
CC – VI	MT23323	Mathematics Practical Paper	-	2	-	4 hrs 20 min	15	35	50
CC – VII	EL23331	Electronics Theory I	2	-	3	-	15	35	50
CC – VIII	EL23332	Electronics Theory II	2	-	3	-	15	35	50
CC – IX	EL23333	Electronics Practical Paper	-	2	-	4 hrs 20 min	15	35	50
AECC – I	TE23351	AECC Paper I	2	-	3	-	15	35	50
AECC – II	EV23361	AECC Paper II	2	-	3	-	15	35	50
Total			16	06	24	13 hours	165	385	550

S.Y.B.Sc. (Computer Science) Semester IV:

Course Type	Course Code	Title of the Course	Credits		Lectures per Week		Evaluation		
			T	P	T	P	CIE	SEE	Total
CC – I	CS24301	Computer Sci. Theory Paper I	2	-	3	-	15	35	50
CC – II	CS24302	Computer Sci. Theory Paper II	2	-	3	-	15	35	50
CC – III	CS24303	Computer Science Practical Paper	-	2	-	4 hrs 20 min	15	35	50
CC – IV	MT24321	Mathematics Theory I	2	-	3	-	15	35	50
CC – V	MT24322	Mathematics Theory II	2	-	3	-	15	35	50
CC – VI	MT24323	Mathematics Practical Paper	-	2	-	4 hrs 20 min	15	35	50
CC – VII	EL24331	Electronics Theory I	2	-	3	-	15	35	50
CC – VIII	EL24332	Electronics Theory II	2	-	3	-	15	35	50
CC – IX	EL24333	Electronics Practical Paper	-	2	-	4 hrs 20 min	15	35	50
AECC – III	TE24351	AECC Paper III	2	-	3	-	15	35	50
AECC – IV	EV24361	AECC Paper IV	2	-	3	-	15	35	50

Total	16	06	24	13 hours	165	385	550

T.Y.B.Sc (Computer Science) Semester V:

Course Type	Course Code	Title of the Course	Credits		Lectures per Week		Evaluation		
			T	P	T	P	CIE	SEE	Total
DSEC – I	CS35301	Computer Sci. Paper I	2	-	3	-	15	35	50
	CS35302	Computer Sci. Paper II	2	-	3	-	15	35	50
	CS35303	Computer Sci. Practical I	-	2	-	4 hrs 20 min	15	35	50
DSEC – II	CS35304	Computer Sci. Paper III	2	-	3	-	15	35	50
	CS35305	Computer Sci. Paper IV	2	-	3	-	15	35	50
	CS35306	Computer Sci. Practical II	-	2	-	4 hrs 20 min	15	35	50
DSEC – II	CS35307	Computer Sci. Paper V	2	-	3	-	15	35	50
	CS35308	Computer Sci. Paper VI	2	-	3	-	15	35	50
	CS35309	Computer Sci. Practical III	-	2	-	4 hrs 20 min	15	35	50
SECC – III	SK35371	Skill Enhancement Paper I	1	1	1.5	2 hrs 10 min	15	35	50
SECC – IV	SK35372	Skill Enhancement Paper II	1	1	1.5	2 hrs 10 min	15	35	50
Total			14	8	21	15 hrs 10 min	165	385	550

T.Y.B.Sc (Computer Science) Semester VI:

Course Type	Course Code	Title of the Course	Credits		Lectures per Week		Evaluation		
			T	P	T	P	CIE	SEE	Total
DSEC – IV	CS36301	Computer Sci. Paper VII	2	-	3	-	15	35	50
	CS36302	Computer Sci. Paper VIII	2	-	3	-	15	35	50
	CS36303	Computer Sci. Practical IV	-	2	-	4 hrs 20 min	15	35	50
DSEC – V	CS36304	Computer Sci. Paper IX	2	-	3	-	15	35	50
	CS36305	Computer Sci. Paper X	2	-	3	-	15	35	50
	CS36306	Computer Sci. Practical V	-	2	-	4 hrs 20 min	15	35	50
DSEC – VI	CS36307	Computer Sci. Paper IX	2	-	3	-	15	35	50
	CS36308	Computer Sci. Paper X	2	-	3	-	15	35	50
	CS36309	Computer Sci. Practical V	-	2	-	4 hrs 20 min	15	35	50
SECC – III	SK36371	Skill Enhancement Paper III	1	1	1.5	2 hrs 10 min	15	35	50
SECC – IV	SK36372	Skill Enhancement Paper IV	1	1	1.5	2 hrs 10 min	15	35	50
Total			14	8	21	15 hrs 10 min	165	385	550

Non-CGPA credit points

In addition to credits above, students have to earn eight additional credits (Non-CGPA) from following groups.

Group no	Activity	Sem	Credits
1 (Compulsory)	Physical Education	I II	1 1
2	Sports College level University /state/National level/ International Level	I-VI	 1 2
3	NSS (Participation in camp) NCC (participation in annual camp) NCC (B or C certificate) NSS/NCC(RD parade)	I-VI	1 1 2 4
4	Avishkar Participation - College level University level/State level Winner at state level Extension activity Participation Cultural activity Participation	I-VI	 1 2 4 1 1
5	Research paper presentation at State/National level conference/ seminar International level conference/ seminar Software Project	I-VI	 1 2 2
6	Participation in Summer school (minimum one week) or Short term course (minimum one week)	I-VI	3 3
7	Scientific survey /Societal survey	I-VI	2
8	Field visit/study tour/Industrial visit/curricular competition/co-curricular competition	I-VI	1
9	Online Certificate course/MOOCS/Career advancement course (10hrs/credit)/Internship (60 hrs)	I-VI	Up to 4 credits

10. Scheme of examination:

All the credits taken together of a particular course will be evaluated in two parts - CIE and SEE. Weightage for CIE would be 15 marks internal assessment and 35 marks for SEE.

The CIE towards 15 marks will be a continuous activity with one written test. The CIE evaluation pattern is given below.

Evaluation for Theory Paper for the subject of Computer Science

Internal CIE: 15 Marks

Sr. No.	Particulars	Marks
1	Internal Examination (Duration : 40 Minutes)	10
2	Active Participation in Course Work, Compulsory Assignments (as per the list given by the college: Journal/Lecture/Library notes, Short Quizzes, Seminar presentation, Assignments, Extension Work, An Open Book Test (book to be decided by the concerned teacher), Mini Research Project by an individual student or a group of students, Participation in Avishkar, Presentation of paper or poster in national / international journal / conference etc.)	5
	Total	**15**

External Examination (SEE): 35 marks

Format of Theory Paper

Duration: 2 Hours

Question No.	**Total number of questions**		**Marks**			**Question Pattern**
	Total	**Compulsory**	**Each question**	**With Option**	**Total**	
1	7	7	1	7	07	Theory
2	5	3	4	20	12	Problems
3	3	2	4	12	08	Theory
4	3	2	4	12	08	Problems / Theory
			Total Marks	**51**	**35**	

Evaluation for Practical Paper for the subject of Computer Science

Internal Continuous Assessment: 15 Marks

Sr. No.	Particulars	Marks

1	Work book	10
2	Active Participation	5
	Total	15

External Assessment: 35 marks
Format of Semester end Practical Exam
Duration: 3 Hours

Sr. No.	Particulars	Total Marks
1	Section I	15
2	Section II	15
3	Viva	5
	Total	35

11. Standard Of Passing:

- Student must pass 50% of the core subjects opted for the semester.
- Minimum marks required to pass an examination is 40%. Out of that student must obtain minimum 30% marks in CIE and 40% marks in SEE for all subjects. For example, for a course of 2 credits, a student must obtain minimum 20 marks provided he/she secures minimum 5 marks in CIE and 14 marks in SEE. It means there is separate passing for CIE and SEE.
- Students who fail in CIE of any odd semester can reappear for the same only in next odd semester and vice-versa. For eg. students who fail in the 1st semester can reappear in 3rd semester only and students who fail in the 2nd semester can reappear in 4th semester only.
- If the student does not secure 40% in the total assessment but has secured the minimum passing requirement i.e. 30% marks in CIE and minimum 40% marks in SEE, he/she would be permitted to appear for anyone of or both of CIE and SEE.

12. Rules for A.T.K.T

- Minimum number of credits required to take admission to S. Y. B. Sc. (Computer Sci.) are 22 (50% of the total credits for F. Y. B. Sc. (Computer Sci.))
- Minimum number of credits required to take admission to T. Y. B. Sc. (Computer Sci.) are 44 credits (100% credits) from F. Y. B. Sc. (Computer Sci.) and at least 22 credits from S. Y. B. Sc. (Computer Sci.) (50% credits from S. Y. B. Sc. (Computer Sci.))

13. Verification And Revaluation:

A candidate may apply for verification and revaluation of result, which will be done by the college as per ordinance framed in that behalf**.**

14. Detail Syllabus with Recommended Books:

F.Y.B.Sc Computer Science Theory Paper I

SEMESTER I

- **Title of the Paper**: Problem solving using Computers and 'C' Programming I (CORE)
- **Subject Code**: CS11301
- **Number of Credits**: 2
- **Total number of Lectures**: 36
- **Lecture Duration**: 50 minutes
- **Description**:
  - Use of C programming language to implement the algorithms.
  - The course is designed to teach basic principles of problem solving using algorithms and flowcharts
  - The course uses C programming language construct to apply the above principles to solve simple as well as complex problems
  - The first semester concentrates on teaching simple C constructs along with functions
  - The second semester introduces data structures and file handling for manipulating data.
- **Objectives:**
  - To develop Problem Solving abilities
  - To apply problem solving capabilities using basic principles of programming
  - To use 'C' as a problem solving tool
  - By learning the basic programming constructs students can easily switch over to any other programming language in the future

- **Contents:**

Unit No	Unit Contents	Total No of Lectures	Text Books
1	**Problem Solving using Computers and Programming languages –** Problem-Solving, Programming Languages as Tools, Writing Algorithms and drawing Flowcharts, Programming languages - Machine language, Assembly language, High level languages, Compilers and Interpreters	8	T1, T2
2	**Introduction to 'C' –** History, structure of 'C' program, Sample 'C' programs, Application areas	3	T1
3	**'C' Tokens and IO -** Keywords, Identifiers, Variables, Constants – character, integer, float, string, escape sequences Data Types – built-in and user defined Streams, printf and scanf Operators and Expressions: Operator types(arithmetic, relational, logical, assignment, bitwise, conditional, increment & decrement operators, &, *, . (dot), -> & sizeof), precedence and associativity rules Simple programs using all the above operators. Character input and output, String input and output, Formatted input and output	10	T1, T2
4	**Control Structures –** Decision making structures If, if-else, switch, Loop Control structures While, do-while, for, Nested structures, break and continue	7	T2
5	**Functions in C –** What is a function, Advantages of Functions, Standard library functions, User defined functions: Declaration, definition, function call, parameter passing (by value), return keyword, Scope of variables / storage classes, Recursion	8	T2

- **Learning Outcomes**:

  - The student will be able to solve simple problems using algorithm and flowchart
  - The student will be able to write C programs using simple constructs
  - The student will be able to solve the problems in a modular way using the knowledge of functions

- **Learning Resources**
  - **Text Books:**
    1) A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India, ISBN:9788131500941
    2) Programming in ANSI C, E. Balagurusamy,ISBN:9781259004612,Tata McGraw Hill Publishing Co.Ltd.-New Delhi

  - **References:**
    1) The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, PHI Learning , ISBN:9788120305960

2) How to Solve it by Computer, R.G. Dromey, Pearson Education, ISBN:9788131705629
3) Using The GNU Compiler Collection, Richard M. Stallman; The GCC Developer Community Pothi.com
4) Using the GNU Compiler Collection, Richard M. Stallman, GCC Developer community , Createspace ISBN:9781441412768

F.Y.B.Sc Computer Science Theory Paper I

SEMESTER II

- **Title of the Paper**: Problem solving using Computers and 'C' Programming II (CORE)
- **Subject Code**:CS12301
- **Number of Credits**: 2
- **Total number of Lectures**: 36
- **Lecture Duration:** 50 minutes
- **Description**:
  Using advance C Concepts to solve advance algorithms and real life problems
- **Pre-requisites**:
  Knowledge of Basic 'C' Programming
- **Objectives**:
  - The students will be taught advanced C constructs such as Arrays, Structures, Pointers, File handling etc.
  - The students will be taught usage of advanced constructs to solve complex problems
  - The students will be taught to use modular programming approach to solve complex problems
- **Contents**:

Unit No	Unit Contents	Total No of Lectures	Text Book
1	**Arrays -**Array declaration, initialization, Types – one, two and multidimensional, Passing arrays to functions, Searching in an array – linear search, Sorting an array – Bubble sort	7	T1,T2
2	**Pointers -** Pointer declaration, initialization, Dereferencing pointers, Pointer arithmetic, Arrays and pointers, Passing pointers to functions	9	T2
3	**Strings -** Declaration and initialization, format specifiers, Standard library functions, Strings and pointers, Array of strings, Formatted string I/O, Command line arguments	6	T2

4	**Structures and Unions -** Creating structures, Accessing structure members (dot Operator), Structure initialization, Array of structures, Passing structures to functions(without pointers), Nested structures, Unions, Difference between structures and unions	6	T2
5	**File Handling -** Types of Files, Operations on files, Random access to files	6	T1, T2
6	**C Preprocessor -** Format of Preprocessor directive, File Inclusion directive, Macro substitution, nested macro, argumented macro	2	T1

- **Learning Outcomes**:
  - The students will be able to apply the knowledge of advanced C constructs to solve complex problems.
  - The students will be able to implement modular programming skills learnt to solve complex problems
  - The students will be able to develop solutions that are more user friendly

- **Learning Resources:**
  - **Text Books:**

1) A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India, ISBN:9788131500941
2) Programming in ANSI C, E. Balagurusamy, Tata McGraw Hill Publishing Co.Ltd. -New Delhi, ISBN:9781259004612

  - **References:**

1) The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie , PHI Learning, ISBN:9788120305960
2) How to Solve it by Computer, R.G. Dromey, Pearson Education, ISBN:9788131705629
3) Using The GNU Compiler Collection, Richard M. Stallman;The GCC Developer Community Pothi.com
4) Using the GNU Compiler Collection, Richard M. Stallman, GCC Developer community , Createspace ,ISBN:9781441412768

F.Y.B.Sc Computer Science Theory Paper II

SEMESTER I

- **Title of the Paper:** Fundamentals of Databases I (CORE)
- **Subject Code**: CS11302
- **Number of Credits**: 2
- **Total number of Lectures**: 36
- **Lecture Duration**: 50 minutes
- **Description**:

  In today's era, database is a backbone of all major applications – financial, healthcare, supermarket, and social media and many more. Structured Database Management Systems are based on relational and other models. This course introduces relational data models, entity-relationship model, SQL, data normalization, database design, transaction and crash recovery. It will also introduce query coding practices. The prime focus is on development of databases in theory and practice.

- **Objectives**:
  - The course is designed to teach data processing using computers to students.
  - The course introduces principles of databases.
  - The students are taught the conversion of ER model into relational tables
  - The course teaches the basic concepts of data model, entity relationship model, database design
  - The course is designed to teach creation, manipulation, querying of data in databases and relational algebra.
  - The course introduces PostgreSQL for manipulating the data

- **Contents:**

Unit No	Unit Contents	Total No of Lectures	Text Books
1	**Introduction of DBMS -** Overview, File system Vs. DBMS, Describing & storing data (Data models (relational, hierarchical, network)), Levels of abstraction, Data independence, Structure of DBMS, Users of DBMS, Advantages of DBMS	5	T1
2	**Conceptual Design (E-R model) -** Overview of DB design, ER data model (entities , attributes, entity sets, relations, relationship sets), Additional constraints (Key constraints, Mapping constraints, Strong & Weak entities, aggregation / generalization),Conceptual design using ER modelling (entities vs. attributes, Entity vs. relationship, binary vs. ternary),Case studies	12	T1, T2

3	**Relational data model -** Structure of Relational Databases (concepts of a table, a row, a relation, a Tuple and a key in a relational database),Conversion of ER to Relational model, Integrity constraints (primary key, referential integrity, unique constraint, Null constraint, Check constraint)	5	T1, T2
4	**SQL -** Introduction, Basic structure, Aggregate functions, Null values, Modifications to Database, DDL commands with examples, SQL mechanisms for joining relations (inner joins, outer joins and their types), Views, Introduction to Relational Algebra (selection, projection, set operations, renaming joins)	14	T3

- **Learning Outcomes**:

Upon successful completion of this course, students will be able to:

- describe the fundamental elements of relational database management systems
- analyse database requirements and identify the entities involved in the system along with their relationship to one another.
- apply the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- convert the ER-model to relational tables, design a relational database and develop SQL queries on data using PostgreSQL

- **Learning Resources:**

- **Text Books:**

1) Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan, Tata McGraw-Hill Education, ISBN:9780071289597
2) Fundamentals of Relational Database Management Systems - S. Sumathi & S. Esakkirajan, Springer Berlin Heidelberg New York, ISBN-13 978-3-540-48397-7
3) Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, Apress, Second Edition, ISBN: 9781590594780

- **References**

1) Database Management Systems ,Raghu Ramakrishna, McGraw-Hill, Second Edition, ISBN:9780071254342
2) Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON, ISBN:9780132144988
3) An introduction to Database systems, Bipin C Desai, Galgotia Publications
4) PostgreSQL, Korry Douglas, SAMS, Second Edition, ISBN:9780672327568
5) PostgreSQL Introduction and Concepts by Bruce Momjian, Addison Wesley ISBN 0-201-70331-9
6) Practical Postgresql , By Joshua D. Drake, John C Worsley , O'Reilly ISBN 1-56592-846-6

F.Y.B.Sc Computer Science Theory Paper II

SEMESTER II

- **Title of the Paper:** Fundamentals of Databases II (CORE)
- **Subject Code**: CS12302
- **Number of Credits**: 2
- **Total number of Lectures**: 36
- **Lecture Duration**: 50 minutes
- **Description**:

  This course introduces the advanced concepts of databases such as data normalization, handling concurrent transactions, ACID properties and crash recovery methods.

- **Pre-requisites**:

  Basic database concepts

- **Objectives:**

  - The course teaches different normalization methods to model a database
  - To course teaches basic transactions processes
  - The course teaches various concurrency methods
  - The course teaches crash recovery processes in database

- **Contents:**

Unit No	Unit Contents	Total No of Lectures	Text Books
1	**Relational Database Design -** Pitfalls in Relational-Database Design (undesirable properties of a RDB design like repetition, inability to represent certain information), Functional dependencies (Basic concepts, F+, Closure of an Attribute set, Concept of a Super Key and a primary key (Algorithm to derive a Primary Key for a relation), Canonical cover, Concept of Decomposition, Desirable Properties of Decomposition (Lossless join & Dependency preservation), Concept of Normalization, Normal forms (only definitions) 1NF, 2NF, 3NF, BCNF, Examples on Normalization	14	T1
2	**Transaction Concepts and concurrency control -** Describe a transaction, properties of transaction, state of the transaction, Executing transactions concurrently associated problem in concurrent execution, Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability, Ensuring	13	T1, T2, T3

	Serializability by locks, different lock modes, 2PL and its variations, Basic timestamp method for concurrency, Thomas Write Rule, Locks with multiple granularity, dynamic database concurrency (Phantom Problem), Timestamps versus locking, Concept of deadlock		
3	**Crash Recovery -** Failure classification, Recovery concepts, Log base recovery techniques (Deferred and Immediate update), Checkpoints, Recovery with concurrent transactions (Rollback, checkpoints, commit), Database backup and recovery from catastrophic failure	9	T1, T2, T3

- **Learning Outcomes**:

Upon successful completion of this course, students will be able to:

- Apply database design techniques and tools to create a database schema and database instance for a database related software application.
- Apply the knowledge of Transaction processing
- Apply the concepts of Concurrency control
- Apply the concepts of crash recovery on databases

- **Learning Resources:**

- **Text Books:**
  1) Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan, Tata McGraw-Hill, ISBN:9780071289597
  2) Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON, ISBN:978013214498
  3) Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, Apress, Second Edition, ISBN: 9781590594780

- **References:**
  1) Database Management Systems, Raghu Ramakrishna, McGraw-Hill, Second Edition, ISBN:9780071254342
  2) An introduction to Database systems, Bipin C Desai, Galgotia Publications

F.Y.B.Sc Computer Science Practical I

SEMESTER I

- **Title of the Paper** : Computer Science Practical (PCORE)
- **Subject Code**: CS11303
- **Number of Credits**: 1.5
- **Total number of practical**: 14
- **Practical Duration**: 3 hours 15 min per week
- **Description**:

  This course is a practical course based on course CS11301 and CS11302. It is absolutely necessary and essential that all the practical's be conducted on Free and Open Source Operating System like Linux.

- **Objectives**:
  - Use basic Linux commands
  - To compile, debug and execute C programs on Linux
  - Write programs to solve simple problems
  - To create simple tables
  - To create table with various constraints
  - To use aggregate functions and perform set operations
  - Implement single table queries

Assignments based on Computer Science Theory Paper I (CS11301)

Sr. No.	Topic	No. of practical
	Introduction to Linux	1
1	To demonstrate use of data types, simple operators (expressions)	1
2	To demonstrate decision making statements (if and if-else, nested structures)	1
3	To demonstrate decision making statements (switch case) and menu driven program	1
4	To demonstrate use of simple loops	1
5	To demonstrate use of nested loops	1
6	To demonstrate writing C programs in modular way (use of user defined functions)	1
7	To demonstrate recursive functions.	1

Assignments based on Computer Science Theory Paper II (CS11302)

Sr. No.	Topic	No. of practical
1	To create simple tables, with only the primary key constraint	1
2	To create more than one table, with various constraints like referential integrity constraint, PK constraint, Check constraint, Unique constraint and Not null constraint	1
3	To drop a table from the database, to alter the schema of a table in the Database.	1
4	To insert, update and delete records using tables created in previous Assignments.	1
5	Queries using Aggregate function, Group by clause, Order by clause, Having clause and queries on join	1
6	Queries using set operations (union, intersect)	1

- **Learning Outcomes**:

  At the end of this course the student will be able to:
  - Use the Linux operating system
  - Solve simple problems using C programs
  - Create and manipulate simple tables
  - Insert and manipulate data in tables

F.Y.B.Sc Computer Science Practical

SEMESTER II

- **Title of the Paper**: Computer Science Practical (PCORE)
- **Course Code**: CS12303
- **Number of Credits**: 1.5
- **Total number of practical**: 14
- **Practical Duration**: 3 hours 15 min per week
- **Description**:

  This course is a practical course based on CS12301 and CS12302.

- **Pre-requisites**:

  Basic knowledge of Linux commands, C programming and PostgreSQL

- **Objectives**:
  - Use advanced C constructs
  - To solve complex problems using modular programming
  - Use files to store and retrieve data from secondary device
  - to implement joins
  - to create views of multiple tables
  - to implement transaction concepts practically
  - to handle functions, cursors, trigger and exceptions

Assignments based on Computer Science Theory Paper I (CS12301)

Sr. No.	Topic	No. of Practical
1	To demonstrate use of arrays (1-d arrays) and functions	1
2	To demonstrate use of multidimensional array(2-d arrays) and functions	1
3	To demonstrate use of pointers	1
4	To demonstrate concept of strings and array of strings	1
5	To demonstrate string operations using pointers	1
6	To demonstrate use of bitwise operators.	1
7	To demonstrate structures, nested structures and union	1
8	To demonstrate command line arguments and pre-processor directives	1
9	To demonstrate file handling (text files)	1

Assignments based on Computer Science Theory Paper II (CS12302)

Sr. No.	Topic	No. of Practicals
1	Views	1
2	Transactions	
3	Functions	1
4	Cursors	1
5	Triggers	1
6	Exception handling	1

- **Learning Outcomes**:

  At the end of this course the student will be able to:
  - use advanced C constructs to solve complex problems
  - use files to store and retrieve data from secondary device
  - implement joins and create view in multiple tables
  - handle functions, cursors, trigger and exceptions