VIGNAN'S
Foundation for Science, Technology & Research
(Deemed to be UNIVERSITY)
-Estd. u/s 3 of UGC Act 1956

R22 Academic Regulations

In Compliance with NEP 2020

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PREFACE

'You are born to Blossom' – What an inspiring title the book authored by APJ Abdul Kalam and Arun K Tiwari carries. The journey to blossom has got to be heralded by education. The purpose of education is to ensure that the 'Life Blossoms'. Earning a degree and getting a placement should be the just happening things, and should not become the only celebrated goals for education. In the book cited above, Honourable Kalam, Former President of India, underscores that "The scheme of civil society depends on Educating young people to become enlightened citizens and adults who are responsible, thoughtful and enterprising"

VIGNAN aims to seed these concepts in every learner who transits through this temple of learning. The doctrine of VIGNAN entitled R-22 contains the principles of policies laid down by the University, to realize the spirit of "Blossoming the lives" providing a foundation-strong professional education on the ethos of 'Creative learning for Critical thinking and Critically analysing for Creative decision making'. Certainly, our University is one of the earliest Universities, in fact the University is a trend setting one in completely internalising the concepts of the policies brought out in National Education Policy (New Educational Policy) NEP-2020, and inculcating the spirit in R-22. The R-22 document articulates the Academic Regulations of the University, which is being presented now and shall be inforce with immediate effect from the academic year 2022-23, not only for those who have joined in 2022, also the aspirants of 2021-22 are enabled into the navigation.

R-22 presents a novel design for the academic pursuit, making an exploratory cross disciplinary traversal for a learner who should find learning both holistic and experiential. The learner is ensured to enjoy the continuity in learning and the learner is supported to align and realign, enroute utilising the benefits of constructive feedbacks that s/he receives because of continuous assessment. S/he will be empowered to enjoy the opportunities to explore, experiment and experience.

R-22 eliminates the melancholy of examinations. The expected severity of breakdown due to the anxiety of examination system is replaced by an affectionate assessment system, increasing the effectiveness in accomplishing the outcomes.

In brief, NEP-2020 compliant revised academic regulation of the University – the R-22, is VIGNAN's commitment to alleviate the acuteness in the present educational practices. It intends to provide a strategic solution to the critical observation made by Bharat ratna awardee, Professor. CNR Rao – "India has exam system, not education system. When will young people stop taking exams and do something worthwhile?" (Thought for the Day, Times of India 13.08.2022)

Here is R-22, which assures that the learners at VIGNAN are bound to do something worthwhile – very much worthwhile.

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R22 BCA
3 YEAR
DEGREE PROGRAMME

REGULATIONS - TABLE OF CONTENTS

R22 BCA
3 YEAR
DEGREE PROGRAMME

BCA R22 - Academic Regulations, Curriculum and Course Contents

(Applicable for the students admitted into first year from the academic year 2022-23 onwards)

R22 BCA 3 YEAR DEGREE PROGRAMME

EXECUTIVE ABSTRACT

The Document R22 Academic regulations, Curriculum and course contents, is an articulation of the VFSTR deemed to be University's commitment towards NEP-2020, with a view that it enables student(s) to maintain the spirit of continuous learning and continuous assessment to replace the normal tendency of preparing just before a test or an examination. The proposed framework accomplishes multi-disciplinary holistic education, continuous assessment along with multiple honorable exit options if a student falls short to complete the requirements to earn the degree within the stipulated period including the permissible spill over period.

R22 is in sync with NEP-2020, with higher weight given to continuous / formative assessment, in an Integrated learning frame work which comprises of Learning – Thinking – Understanding – Skilling – Applying – Creating. Emphasis on continuous formative assessment with a creative summative assessment will facilitate the candidate to "Move away from high stake examinations – towards more continuous and comprehensive evaluation".

The BCA degree offered will be of three years (6 semesters) duration with multiple exit options within this period, with suitable certifications that will enable the candidate to have a professional career and as well as serve as a reminder to return and update his / her qualification in the future. Following one year of study and completion of required credits an undergraduate certificate will be conferred. Following two years of study and the completion of the required credits, an undergraduate diploma will be conferred. However, the intention of the learners is not to join for the award of the undergraduate certificate / diploma but to acquire a BCA degree.

SALIENT FEATURES OF THE REGULATION

- Continuous learning
- Continuous assessment
- Honorable exit options
- Sabbatical Semester option to pursue innovation, incubation, entrepreneurial and advanced exploratory activities and subsequent re-entry.
- Onward continuation to MCA

1. INTRODUCTION

This document contains the academic regulations, scheme of assessments, curriculum, detailed syllabi, course contents with text / reference books recommended, course outcomes, skills acquired and the projects / assignments that are to be performed for each course for the conduct of 3-year BCA degree programme.

1.1 Definition

For the purpose of R22 regulation, definitions as follows shall apply:

- **"Degree"** shall refer to the BCA Degree Program.
- **"Course"** shall refer to such Course(s) for which a student shall earn Credits after due assessment as per the laid provisions. Each Course shall comprise of Lecture (L), Tutorial (T) and Practical (P) Sessions. A Course may have either or all the three Components. Project is also treated as a Course.

R22 BCA 3 YEAR DEGREE PROGRAMME

- **"Academic activities"** shall refer to the activities like Lecture (Physical Lecture Session), Tutorial (Participatory discussion / Self-Study / Desk Work / Quiz / Technical Seminar Presentation, etc activities that make the student absorb & assimilate, the delivered contents effectively) and Practical / Practice sessions (includes Hands-on-Experience / Computing practices / Field Studies / Case Studies etc activities that enable the student to acquire the requisite skill).
- **"Continuous Assessment"** shall refer to the evaluation of the student spread over the entire semester on the various constituent components of the prescribed course.
- **"Semester"** shall refer to a period covering the two assessment periods viz Formative and Summative Assessment Exams period. A semester would generally be spread over twenty weeks.
- **"Course Drop"** shall refer to a student having to undertake a repeat of the Course(s) not being able to complete the Credit requirements of the Course(s), under the conditions stipulated in the regulation.
- **"Supplementary Examinations"** shall refer to the examination(s) conducted to allow the student to appear in the un-cleared / underscored Semester - End summative assessment component, with a view to accord him an additional opportunity to improve upon his previous score.
- **"Blank Semester"** shall refer to a Semester in which a student either does not register for any course at the beginning of the Semester OR chooses to DROP all courses OR is so compelled to DROP all the courses, as the case may be.
- **"Semester Drop"** shall refer to availing a blank semester. However, if drop is availed to pursue a creative extension activity, then it is defined as semester sabbatical.
- **"Spill Over Semester"** shall refer to the additional semester(s) beyond the completion of prescribed normal semesters.
- **"AAA Section"** shall refer to the Academics, Assessment and Award Section of the Institute.
- **"Attendance"** refers to the Physical personal presence in an academic activity session.
- **"Summer Semester"** refers to a Semester that is decided to be held during the intervening period of Even and Odd Semester (i.e. Summer Vacations period).
- **"Grade Point"** refers to the quantification of the performance of a candidate in a particular course as defined herein.
- **"Honorable Exit Option"** refers to the Exit Options available to students, when they are unable to complete the prescribed three-year BCA Degree program in five successive years.
- **"SGPA"** refers to the Semester Grade Point Average and is calculated as detailed in the regulations subsequently.
- **"CGPA"** refers to the Cumulative Grade Point Average and is calculated as detailed in the regulations subsequently.
- **"Division"** refers to the Division awarded to the student as per the mechanism detailed in the regulations subsequently.
- **"Department"** refer to a division of institute dealing with a specific area of discipline/ study.
- **"HoD"** refers to the Head of the respective Department, where the student is enrolled for his / her Branch of Study
- **"Internship"** refers to onsite Practical Training offered by reputed companies / Institutions, in India or abroad. To be undertaken only upon prior approval of the respective HoD.
- **"Project"** refers to a course executed by a candidate on a specific research problem at VFSTR / any organization of repute. To be undertaken only upon prior approval of the respective HoD.
- **"Credit equivalence and credit transfer committee"** refers to the committee designated to look into for credit equivalence and credit transfer

R22 BCA 3 YEAR DEGREE PROGRAMME

1.2 Academic Administration

The academic programmes of VFSTR are governed by the rules and regulations approved by the Academic Council from time to time. The various academic activities are conducted following a fixed time schedule duly approved by the Academic Council in line with the UGC regulations. The academic activities of VFSTR are followed meticulously as specified in the academic calendar as approved by the Academic Council. This academic calendar is shared with all the stake holders well before the beginning of the respective academic year. The curriculum and the course contents of all the programmes are discussed by the respective Board of Studies (BoS), analyzed and recommended for implementation. The Academic Council, being the highest statutory body, chaired by the Vice-Chancellor, meets at least twice or thrice a year and discusses, suggests and approves all the important academic matters related to curriculum and course contents in particular including the recommendations of BoS. The revised regulations (R22) was approved in its 31st Academic Council meeting on 30-07-2022.

1.3 Program Duration

For the BCA program the regular courses including theory and practical are offered over a period of three years in six semesters. The normal duration to complete the BCA program is three years. However, a student can avail the benefit of spill over period of 2 years, that is the maximum duration of five years can be availed by a candidate to complete the BCA programme in a slower pace if he / she desires. The candidate failing to complete the requirements will be considered for the honorable exit as applicable.

1.4 Courses and Credits

The term course is used in a broader sense to refer to so called papers such as 'theory subject', 'Computing practice', 'technical seminar', 'socially relevant project using design thinking', 'project' etc. A course can be of theoretical and / or of practical nature, and certain number of credits are allotted to it depending on the number of hours of instruction per semester. For a course offered in a semester, one hour of lecture (L) instructions carried out in a week is considered equivalent to one credit, whereas two hours of practical (P) sessions done in a week are considered equivalent to one credit respectively. Depending on the course two hours of tutorial (T) sessions may be considered equivalent to one credit. A student earns these credits when he / she successfully completes the course. Credits can also be obtained by successful completion of other recognized co-curricular and extra-curricular activities such as NCC, NSS. etc. The details of credits of such activities will be provided by the respective course coordinators and assessment of student performance in the activities will be carried out objectively by the constituted committees appointed by the Dean AAA. The criteria of assessment for these activities will include aspects like regular attendance in the programme and satisfactory completion of it through tests conducted at University level or by participation / performance at university level events, state level or national level participation etc.

1.4.1 Content Delivery of a Course

Content delivery of a Course in the BCA Degree Program shall be through, either or all of the following Methods:

i. **Lecture** - refers to Lecture Session(s) through classroom contact session wherein students will learn by listening. Denoted by "L".

ii. **Tutorial** - refers to transaction(s) consisting of Participatory discussion / Self-study / Desk work / Brief presentations by students along with such other novel methods that enable a student to efficiently & effectively absorb and assimilate the contents delivered in the lecture sessions. Denoted by "T".

iii. **Practice** - refers to Practice / Practical sessions and it consists of Hands-on- Experience / Computing practices / Field Studies / Case Studies / Social relevant project / Major Project, that equip the students to acquire the much required skill component. Denoted by "P".

R22 BCA 3 YEAR DEGREE PROGRAMME

1.5 BCA Degree

All students formally and conventionally enroll for BCA degree programme. They have to earn **120** credits for the award of degree as specified in the Curriculum.

1.5.1 A provision is also created for a candidate who is enrolled for BCA degree to further continue his / her course of study to MCA degree after completing the credit requirement of BCA. Annexure-2 provides the supplement regulations for onward continuation to MCA degree programme.

The consolidated transcript will contain the credits and grade details of all courses.

1.6 Composition of an Academic year

An academic year is composed of an Odd semester (20 – 22 weeks), an Even semester (20 – 22 weeks) and a Summer semester (6 – 8 weeks). The regular semester that begins in July / August is known as odd /first semester and the one that begins in December / January is known as even / second semester (Figure 1). The instructional days for a regular semester shall be a minimum of 90 working days exclusive of days earmarked for summative assessment.

YEAR OF 12 MONTHS											
1	**2**	**3**	**4**	**5**	6	7	8	9	**10**	**11**	**12**
July/ Aug.	Aug./ Sept.	Sept./ Oct.	Oct./ Nov.	Nov./ Dec.	Dec./ Jan.	Jan./ Feb.	Feb./ Mar.	Mar./ Apr.	Apr./ May	May/ June	June/ July
ODD SEM/ FIRST SEM					EVEN SEM/ SECOND SEM					SUMMER SEM	

Figure 1: Distribution of semesters during an Academic Year.

1.6.1 Before the commencement of the semester, a candidate has to pay the stipulated tuition fee and submit an application detailing the courses he/ she intended to register, valid for that respective Odd / Even semester. The maximum number of credits per semester will be 25 credits inclusive add-on credits. The intended semester wise coverage will be as presented in the curriculum.

1.6.2 Summer semester is a short duration semester program that will be generally conducted during the semester break between even semester and odd semester. The students having 'R' (Repeat grade) courses may register for the course work during this semester to get a chance for successfully completing the 'R' courses. In general, supplementary assessments are conducted in the later part of the summer semester. However, the courses offered in summer semester and the number of courses a student can register are subjected to academic and administrative convenience. A student may register up to a max. of 16 credits in a summer semester.

1.6.3 Exception to the routine practice of registering for 'R' courses in summer semester, a student can register in a course offered by a visiting expert during the summer vacation which may be equivalent to a department elective or an Add-on-course. The candidates can register for such courses within the scope of 16 credits. Candidate may also avail summer semester for summer internship opportunities, which may be considered as Add-on credits.

1.7 Semester wise provisions

A student may register for a max of 25 credits per semester as prescribed or otherwise he / she may include the Repeat courses in the event of having not successfully completed a course or courses in the earlier semester. However, a student may also opt to go in a slower pace to earn the credits less than the prescribed max of 25, including even 'Dropping' a semester for special reasons.

It should be clearly underscored that a candidate should on priority register for Repeat (R) credits if any, during a regular semester, within the said scope of 25 credits; in case he / she cannot be sure of completing the 'R' credits in Summer semester.

1.7.1 During the first three years from the date of admission to BCA, a candidate has to pay the semester / annual fees as prescribed irrespective of the less number of credits that he / she would register or even opt to Drop a semester.

1.7.2 If a candidate gets into spillover semester beyond three years up to a maximum of five years he / she has to pay semester fee proportional to the credits that he / she registered in that spill over semester as prescribed from time to time.

1.7.3 A candidate has to pay additional fee proportional to the number of credits for registering in a summer semester as prescribed from time to time.

2. CURRICULUM

The Department prescribes semester-wise curriculum encompassing different courses. Every course offered will be designated in a L-T-P structure. The theory courses comprise of L (and / or T & P hours) whereas the practical courses include computing practice instructions (T) and practical sessions (P). Amalgamation of theory courses with practical sessions is predominantly seen in this curriculum.

2.1 Distribution of credits

The overall distribution of credits for various categories of courses in the curriculum of BCA programme is represented in Table (1) as given below.

Table 1: Credits Distribution for Various categories of courses

Category of Courses	Number of Credits	Percentage of Credits
Professional Core	62	51.66%
Dept. Electives	14	11.66%
Humanities and Management	16	13.33%
Basic Sciences	8	6.66%
Physical Fitness and Orientation	6	5%
Projects	14	11.66%
Total	**120**	**100%**

2.2 Organization of course contents

Courses offered in the program is composed of two modules covering all the course contents required for a candidate to obtain knowledge and skill. Any contents in each module is further distributed among two units; wherein Unit-1 contains 'Fundamentals and Broad perceptive' of the module. Unit-2 comprises of the extension / advanced topics of Unit-1 as well as necessary practice models for validation / applying the knowledge gained during L / T sessions. The modular period is about 8 weeks. The first unit in a module may be covered in 3 to 4 weeks and the second unit of the module maybe of 4 to 5 weeks (Figure 2). By the end of each module a candidate must be in a position to translate his / her L-based knowledge into P-based skill as prescribed in the curriculum. Individual formative assessment shall be in place for each module and a single semester-end summative assessment for the course composed of both the modules.

YEAR OF 12 MONTHS											
1	**2**	**3**	**4**	**5**	6	7	8	9	**10**	**11**	**12**
July / Aug.	Aug. / Sept.	Sept. / Oct.	Oct. / Nov.	Nov. / Dec.	Dec. / Jan.	Jan. / Feb.	Feb. / Mar.	Mar. / Apr.	Apr. / May	May / June	June / July
ODD SEM / FIRST SEM					EVEN SEM / SECOND SEM					SUMMER SEM	

Module- I		**Module- II**			**Module- I**		**Module- II**			
U1	**U2**	U1	U2		U1	U2	U1	U2		

Figure 2: Unit-wise distribution of course contents in a module and their mapping with Academic Calendar; U= Unit

R22 BCA
3 YEAR
DEGREE PROGRAMME

3. CHOICE BASED CREDIT SYSTEM

The BCA programme comprises of a set of courses - Basic sciences, Humanities and Management, Professional core and Elective courses. VFSTR offers flexibility for students to choose courses of their choice and obtain the credits satisfying the minimum credits criterion.

3.1 Basic Sciences, Humanities and Management

Basic science courses are included to offer the knowledge of scientific theories that form the foundation for all computer science related courses for 8 credits. Courses of Humanities and Management are also offered for 16 credits. The main purpose of offering Management courses is to impart Management skills to students so that they would pursue allied career opportunities.

3.2 Professional Core

Professional core courses are mandatory courses (62 credits). These are designed to offer the essential fundamental knowledge and skills required for the BCA Programme.

3.3 Electives

A candidate has a choice to choose the elective courses (14 credits). A list of elective courses is pooled together, enabling a candidate to choose the electives from a pool so that he / she can focus to a specific theme. Otherwise also he / she can exercise the choice to choose electives from across the pools. There may be courses which may not be listed under any pool, which are called 'Free elective courses'. Elective courses are spread over two semesters from fifth to sixth semester, to enable students earn credits from a chosen pool or otherwise.

3.4 Socially Relevant Project using Design Thinking

These projects are designed and executed by students during the third year of their program. Design thinking is a creative problem-solving approach that focuses identifying new products / processes by joining both human & social capital. It ensures that products, services and processes are rooted in the needs of people, communities and / or end users with an emphasis on solutions creating social and environmental value. The supervision of Socially Relevant Project using Design Thinking will be done by faculty of department who serve as supervisors. The minimum duration of the project is 64 hours including writing of project report and submission for assessment. A batch of 2-3 students can take part in the project. Performance will also be assessed in the modular framework for formative and semester-end summative, successful completion will earn 2 credits.

3.5 Technical Seminar

Technical seminars are offered in IV semester with a motive to encourage students understand the technical advancements in their chosen areas of interest. This is aimed at honing their communication skills as well enhancing their technical knowledge in their interested area.

3.6 Project

Students shall take up project work in VFSTR itself. Each candidate has to submit interim reports and a final report which are mandatory requirements towards the partial fulfillment of project credits requirements. It bears a weightage of 12 credits with a duration of 90 working days. During the semester the student under the guidance of a faculty member(s) will involve in an innovative design / research through the application of his / her knowledge gained in various courses studied. He / she is therefore expected to present a survey of literature on the topic, work out a project plan and carry it out through modelling / simulation / computation. Through such a project work, the student is expected to demonstrate system analysis, design, presentation and execution skills. Performance in the project will be assessed in the modular framework for formative and semester-end summative.

3.7 Binary Graded courses

3.7.1 Physical Fitness

As physical fitness contributes to physical, mental and social development, it is offered to students. The credits are spread across 2 semesters in I year with 1 credit per semester. Students are imparted training through physical exercises.

R22 BCA 3 YEAR DEGREE PROGRAMME

3.7.2 Orientation course

Course content covers cross-cutting issues of the society like Gender Equality, Human Values, Professional Ethics, Moral and Ethical Values. Orientation course is offered for I year BCA students and successful completion earns 3 credits. All the students have to register during the first year and mandatorily obtain successful completion grade.

3.7.3 Courses with floating credits

With a view to imbibing social responsibility and all round development students are encouraged to participate in NCC / NSS / Students Activity Council (SAC) / Entrepreneurship cell (E-cell) / Student Mentoring / Social activities. Such activities lead to awarding 1 credit which shall be earned in IV Semester.

In case the candidate does not successfully complete the Physical Fitness, they will be placed under 'R' category. However, such R should be completed in regular Odd / Even semester whenever these courses are offered. In special cases provision of summer semester may be provided.

4 ATTENDANCE

It is mandatory for the student to attend the course work in each semester as per the academic schedule of that semester. VFSTR expects 100% attendance. However, the attendance in each course shall not be less than 75 % of the aggregate of all L, T, P sessions conducted in that course.

a) The attendance calculations will be periodically reviewed at the end of every 4 weeks. The details of attendance status will be shared with the Parent / Guardian. The final status of attendance will be reported at end of 15th week granting the advantage of the attendance for the 16th week for the purpose of attendance shortage calculations.

b) The shortage of attendance may be condoned up to 10% on the ground of ill-health, social obligations, participating / representing in sports / cultural events, placement activities etc.

c) Documentary evidence like medical reports and certificates issued by concerned bodies is to be produced on time as support for the attendance shortage due to ill-health. These cases are subjected to the scrutiny of a committee constituted for this purpose by the Vice-Chancellor. The decision of the committee shall be final.

d) Prior approval has to be taken from the HoDs for the other types of leaves.

e) The courses where the student shortage of attendance was not condoned shall be considered as 'Repeat' category courses and will be under 'R' grade in the student's semester transcript. Student should re-register for these courses during the summer semester or whenever the course is offered next time during regular semesters. These re-registrations are subjected to the regulations at the time of re-registration. In case of core courses, the same core has got to be re-registered. However, in case of an elective a candidate may exercise a choice of choosing different elective in place of 'R' graded elective.

The students who are put into 'R' grade will not be allowed to take up the summative assessment in that semester.

5 ASSESSMENT

Teaching-Learning and Assessment should go hand in hand and complement each other. Continuous assessment plays a vital role to enable the student to get synchronized with the teaching-learning process. Assessment mechanism adopted in the institute is aimed at testing the learning outcomes in tune with the outcome based model of education. The focus, is thus on assessing whether the outcomes are realized by the end of the course.

The performance of a student in each course is assessed on a continuous basis during the semester through various in-semester and end-semester assessment models. The marks awarded through continuous assessment are referred to as Formative assessment marks. The marks awarded through end-semester tests are referred to as Summative assessment marks (Figure 3). Both the formative and summative assessment marks are considered for awarding the final marks and the grade point in a particular course.

R22 BCA
3 YEAR
DEGREE PROGRAMME

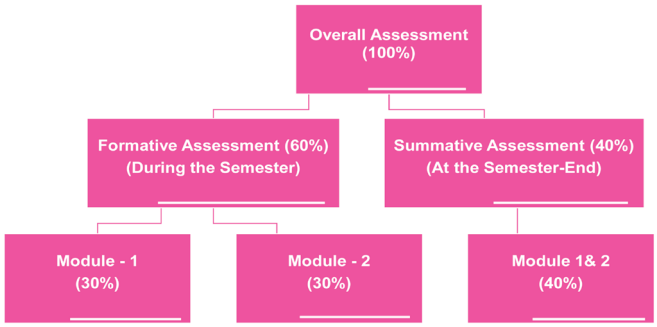

Figure 3: Categories of Assessments in place for R22

5.1 Marks distribution

For each course, the maximum sum of formative and summative assessment marks put together is 100, in the ratio of 60:40 respectively.

5.2 Qualifying criteria

To be declared successful in a course, a student must secure at least a grade 4.0 in a scale of 10 based on the total maximum marks which is inclusive of formative and summative assessment. The students should also get 35% from the maximum marks allotted for formative and summative assessments individually.

The hierarchy of qualifying criteria is as follows:

i. Attendance compliance should be 75% or within condonable range; else the candidate is put into 'R' grade

ii. In formative assessment, a candidate should secure a minimum of 35% ie. 21 marks out of 60; else the candidate is put into 'R' grade

iii. In summative assessment, a candidate should secure a minimum of 35% ie. 14 marks out of 40; else the candidate is put into 'I' (Incomplete) grade.

iv. Collectively the candidate should secure a min. grade of 4.0 in a scale of 10 after relative grading (section 7); else the candidate has to choose either 'R' or 'I' grade duly being counselled

v. A candidate who has secured grade <5 in a course may be permitted (optional) to volunteer to improve his / her grade by opting suitably 'R'or 'I' in that course.

The candidates with 'R' grade should re-register for 'R' courses either in Summer semester or in a regular semester as and when the courses are offered. The candidates in 'I' grade are allowed to appear for supplementary summative assessment whenever the semester-end assessments are conducted.

To assess Physical Fitness / special projects / courses, not fitting into the categories described here, a suitable assessment procedure will be evolved in consultation with experts of that area and adjudicated by the committee constituted for that purpose. The decision given by the committee will be final. The appended assessment scheme shall be announced by the course coordinator during the commencement of course.

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ODD SEM/ FIRST SEM					EVEN SEM/ SECOND SEM					SUMMER SEM	

Module- I		**Module- II**			**Module- I**		**Module- II**			
U1	**U2**	**U1**	**U2**		**U1**	**U2**	**U1**	**U2**		
Formative Assessment				SA	Formative Assessment				SA	

Figure 4: Schedules of formative and summative assessments in line with Academic calendar. SA = Summative assessment

5.3 L-based courses integrated with P/T

5.3.1 Formative Assessment

The scheme of formative assessment is designed to promote the continuous learning. Scheme consists of assessments planned at institute level and assessment that may be scheduled by the course instructor (Figure 4). Institute level assessments shall be scheduled by the office of AAA. Respective Faculty Member(s) shall declare the schedule of Continuous Practice Assessments (CPA), Quiz, Tutorials, Assignments, Seminars, Discussions, etc. Some of the components may also however take place in an unscheduled manner like Surprise Tests. However, students shall be made aware of the assessment modalities that are going to be followed in a course by the faculty, under information to the HoD.

To monitor the progress of students, continuous assessment comprising of five targets (T1, T2, T3, T4 and T5) is advocated in each module for a maximum of 60 marks. For a class (or section) of 60 to 70 students, formative assessment commences by the announcement of module bank containing 10 problems for each module in a course. Nature of problems in the module bank shall be at the level of creative / exploratory / design / thought provoking covering the complete syllabus of a module at somewhat advanced / challenging level.

The purpose of creating module bank of 10 problems is to assign one problem each to 2 batches of 3 - 4 members. The batches are composed of randomly picked up candidates. These batches remain same for all courses and also for the P-sessions in the courses in that semester and are created in the beginning of that semester.

The purpose of assigning one problem to two batches is to create a healthy competitive spirit between the two batches.

The modality of evaluation of five targets is listed here under:

a) **T1:** During 5th or 6th week of each module a classroom test shall be conducted. T1 consists of two parts: A and B.

Part A consists of one random problem from the module bank and vary from batch to batch. All the questions in the module bank shall be distributed among students and students shall know the question to be answered only on the day of test in the examination hall.

Part B consists of one common problem at fairly application / advanced level (not at all prior notified) from outside the module bank for all the students.

T1 shall be paper based and proctored test for a period of 60 Min (Maximum) which shall be assessed for 30 marks and downscaled to 10 marks.

For the students who for justifiable reasons could not attend the classroom test on the scheduled day, a re-test maybe conducted. However, Part-B will contain a new question and Part-B will have higher weightage than part-A or full weightage could even be allotted for Part-B in such an event.

b) **T2:** Immediately follows T1. Students in a specified batch who now have received the same question during T1 will work further on that problem for T2.

T2 is primarily an extension of problem received in T1 for carrying out validation study: Case studies / Simulations / Computing exercise. Each batch shall interact with the course instructor to finalize the nature of validation and expected to complete the exercise within 10 to 15 days after T1.

Course instructor should ensure assigning a different case study / a different scope for validation study for each batch in case the same problem is assigned to two batches.

Course instructor shall assess every student in a batch for a max. of 10 marks based on his observation, interaction and / or based on at least 2 reviews.

c) **T3:** T3 shall be conducted during the last week of each module. Student batches are expected to submit a report, clearly documenting the work executed during T2. The

report should be in IEEE format and additionally a voice in-built PPT should be prepared and submitted.

The report and presentation shall be assessed by the course instructor for 10 marks for every student. In certain cases, a course instructor can call for a physical presentation also by a batch.

d) **T4:** T4 is a comprehensive module test, conducted for 30 min. comprising of 20 multiple choice questions (MCQs) covering the holistic content of module. T4 shall be evaluated for a max. of 10 marks @ ½ mark for each question. T4 will be conducted in ON-LINE mode

There shall be two tests in each course in a day and the best performance of the tests shall be considered for awarding the marks.

Two sets of question papers each containing 20 questions should be set. The theme of the questions could be similar across the sets. When the test is administered online, every student receives the questions in shuffled sequence and also the choices in shuffled sequence. Therefore, the choice like both 'a' & 'b' above. Neither of 'a' and 'b', all the three a, b, c will not be set.

e) **T5:** T5 assessment is based on Practice or Tutorial assignments. Implementation, Report presentation and Discussion shall happen in a continuous mode throughout the module period.

At least 4 such continuous practice assessments (CPA) / assignments per module shall be conducted by course instructor. The marks will be @ 5 marks per assignment totaling up to 20 per module.

The results of the tests are to be normally announced within three working days on completion of the assessment and the performance is to be discussed in the class.

f) The total marks per module is 60 - T1 (out of 10), T2 (out of 10), T3 (out of 10), T4 (out of 10) and T5 (out of 20).

g) Total marks for both the modules from formative assessment will be added up to 120, which will be suitably mapped down to a max. of 60 marks. The mapping policy should be decided by the lead instructor / instructors in consultation with the HoD. The mapping policy should be shared with Dean AAA for the purpose of documentation.

h) The marks scored in Module-1 for a max. of 60 should be entered / submitted latest by 9th week and of Module-2 latest by 17th week of the semester. Consolidated score of for a max. of 120 suitably mapped down to a max. of 60 marks should be submitted latest by 18th week of semester enabling the declaration of 'R'- grade before the commencement of summative assessment.

i) A candidate put under 'R' will not be permitted to take up the summative assessment.

5.3.2 Summative Assessment

a) An instructor may choose one of the two formats for conducting summative assessment for L-based courses integrated with T / P

   i. 15 + 25 marks format or 20 + 20 marks format (following b, c, d below)

   ii. 40 marks format (following c, d below)

b) If summative assessment is in two parts format:

   i. Part-I will be the assessment of capstone project which is pre-assigned during the module-2 period or will be the exploratory review assessment of all course practice assignments.

   ii. Part-II will be based on a written examination for a max. marks of 80, as in c & d below, which is suitably mapped down to 25 or 20 based on the selected pattern of format.

   iii. A candidate should attend both the parts of summative assessments; else he will be put into I grade.

c) For each L-based course integrated with T / P, the summative assessment shall be conducted by the Institute for a duration of 150 min. and for a maximum of 80 marks. Contents for summative assessment shall cover the breadth and depth of the complete syllabus that is mentioned in the two modules of a course.

d) The question paper for end-semester theory examination consists of two parts as given in Table (2).

Table 2: Theory Examination Question Paper Pattern

Part No.	No. of Questions	Marks for each Question	Marks	Choice
A	4	10	40	No
B	2	20	40	No
Total Marks			**80**	

e) The questions will be comprehensive covering the entire course syllabus and any single question should not necessarily be limited to any particular unit / module.

f) The marks scored out of 80 is suitably mapped down into a score out of 25 or 20 based on the format.

g) Total marks of summative assessment will be for a max. of 40 irrespective of format of evaluation.

h) The award of 'I' grade is solely based on marks scored in summative assessment out of 40, if he / she does not score a min. 14 out of 40 (35%).

5.4 P-based Courses

The detailed information consisting of computing practices, batch formations, practicing session schedules, etc., will be displayed / informed to the student in the first week of the semester so that the student come prepared for the practice sessions. Copies of the practice manual will be made available to the students along with the schedule. The practice manual will consist of the detailed procedure to solve the problem, format for record writing, outcomes for each practice exercise and possible set of short questions to help students gain critical understanding.

5.4.1 Formative Assessment

During practice sessions, a brief viva-voce is conducted for each student on the task he / she is carrying out on that day. Some of the parameters that could be included in the Continuous Practice Assessment (CPA) are given in Table (3). The set of parameters may slightly differ from one course to the other, and will be announced before the commencement of the practice session. These parameters are assessed for each practice session.

Table 3: Suggested parameters for Continuous Practice Assessment (CPA)

S. No	Component	Marks
1	Report of about 1 page on proposed design layout and background theory before the start of practice session	4
2	Viva and interaction to evaluate understanding of concepts	4
3	Validation of results	4
4	Analysis of results and interpretation	4
5	Finalized report submitted on the next week	4
	Total	**20**

This assessment is carried out for each practical session and the total marks of all practical sessions will be suitably mapped down to a max. of 60.

R22 BCA 3 YEAR DEGREE PROGRAMME

5.4.2 Summative Assessment

End semester examination for each practical course is conducted jointly by two examiners. The examiners are appointed by Dean, AAA from the panel of examiners suggested by the respective Heads of the Department. In some cases, one of the examiner may be from outside the institution and will be identified as external examiner. The scheme of assessment may vary depending on the nature of course, which shall be shared with student by the course instructor. The summative assessment will be conducted for a max. marks of 40. The general scheme of assessment is given in Table (4).

Table 4: Suggested end-semester summative assessment pattern for P-based courses

Component	Marks		
	Examiner 1	Examiner 2	Total
Objective & Procedure write up including outcomes	4	4	08
Preparation of algorithmic lay out	4	4	08
Computation of results	4	4	08
Analysis of results and Interpretation	4	4	08
Viva Voce	0	8	08
Total Marks	**16**	**24**	**40**

5.5 Socially Relevant Project using Design Thinking

Socially Relevant Project using Design Thinking is undertaken in the 5th semester for earning 2 credits by each candidate.

5.5.1 Formative Assessment

The assessment will be carried in four reviews in a systematic way wherein; first two reviews are conducted in Module-1 and remaining two reviews in Module-2 of 5th semester.

Reviews will be conducted by a team of two senior faculty members appointed by the Head of the department.

The detailed assessment guidelines and scheme are to be announced along with the assessment schedule as mentioned in the Table (5).

Table 5: Schedule and parameters followed for formative assessment

Module	Schedule	Review number	Points to be considered	Max. Marks
Module-1	4th week	First review	• Identification of specific area out of broad areas under the supervisor • Identification of outcomes in line with programme objectives. • Feasibility of contributing to the attainment of outcomes • Identification of software tools / training needs / etc..	15
	8th week	Second review	• Understanding by individual students on the overall aspect of the project. • Completion of literature survey • Design of work flow chart • Acquisition / learning of the tool required • Readiness of about 25% documentation	15

Module-2	12th week	Third review	• Progress review as per mechanism / schedule identified • Evaluation or validation techniques of the project • Structure of project report • Individual student contribution in above activities.	15
	16th week	Fourth review	• Presentation of results, analyses and conclusions • Meeting of objectives defined in first review • Preparation of report • Understanding by individual students on the overall project	15

5.5.2 Summative Assessment

Summative assessment will be done by two examiners one is from VFSTR as internal examiner and the other may be from other dept / institution as external examiner. These examiners will be appointed by Dean-AAA from the panel of examiners suggested by the respective Head of the Department. The scheme of assessment will be report (15 marks), presentation (10 marks) and demonstration (15 marks) respectively. Points to be considered during the review.

a) Presentation of results, analysis and conclusions
b) Meeting of objectives defined in first review
c) Preparation of report
d) Understanding by individual students on the overall project
e) Individual student contribution
f) Progress of project as per schedule

5.6 Technical Seminar

Technical Seminar is undertaken in the 4th semester for earning 1 credit by each candidate.

5.6.1 Formative Assessment

The assessment will be carried in two reviews in a systematic way wherein; first review is conducted in Module-1 and other review in Module-2.

Reviews will be conducted by a team of two senior faculty members appointed by the Head of the department.

The detailed assessment guidelines and assessment scheme are to be announced along with the assessment schedule. The assessment parameters given in Table (6) may be followed.

Table 6: Parameters of Assessment

S. No	Component	Marks
1	Report	10
2	Area of Relevance & Novelty	15
3	Presentation	15
4	Viva	10
	Total	**50**

This assessment is carried out for each review and the total marks of two reviews will be for 100 Marks.

5.7 Project

The students will carry out their major project at VFSTR and submit their report which is a mandatory requirement for the award of degree. These projects are usually done in groups (not exceeding 2 students in a group), during the VI semester, under the guidance of a faculty member. Every student, in consultation with the guide, should define the project and also

the probable procedure of carrying it out and submit the same to a committee consisting of 2 to 3 faculty members appointed by Head of the Department. This is to avoid the repetition and also to come up with a roadmap for completion of the project within the time stipulated. The students are encouraged to select topics related to ongoing research and consultancy projects. The students are expected to carry out and present a survey of literature on the topic, work out a project plan and its implementation through simulation / computation. They are also expected to exhibit system analysis, design, and presentation and evaluation skills. The entire process of grouping of student batches, and identification of respective guides etc., is to be completed by the end of V semester, so that students can start of their project work immediately after V semester.

5.7.1 Formative Assessment

The progress of project is reviewed twice in a module by the "Project Review Committee (PRC)" and formative assessment marks are awarded based on these reviews. The Project review committee consists of

a) Head of Department or his / her nominee – Chair person

b) A senior faculty member identified by the HoD – member

c) Project supervisor – member

Review schedules of PRC are to be announced by the department immediately after the commencement of class work. The review presentations are open to all the students of that section and attendance is compulsory. The first review should be of 15 minutes / batch; the remaining reviews should be around 30 minutes / batch. Before every review the batches should submit their PPT along with a brief report of not exceeding two pages. It is to be expected by the committee that student communicates / publishes research article based on the project work prior to graduation. The following aspects may be considered by the committee for assessment Table (7).

Table 7: Schedule and suggested parameters to be considered for formative assessment

Module	Schedule	Review number	Points to be considered	Max. Marks
Module -1	4th week	First review	• Identification of specific area out of broad areas. • Identification of outcomes in line with programme objectives • Feasibility of contributing to the attainment of outcomes	15
	8th week	Second review	• Identification of tools/training needs / etc.. • Understanding by individual students on the overall aspect of the project • Completion of literature survey • Design of project set up	15
Module -2	12th week	Third review	• Acquisition / learning of the tool required • Readiness of the layout of the project report • Progress review as per mechanism / schedule identified • Individual student contribution in above activities	15
	16th week	Fourth review	• Presentation of results and conclusions • Meeting of objectives defined in first review • Submission of draft report • Understanding by individual students on the overall project • Individual student contribution • Progress of project as per schedule	15

5.7.2 Summative Assessment

At the end of the semester, during 18th to 20th week of the semester the summative assessment will be conducted in two phases

Phase –I (during 18th -19th week): this is an evaluation for a max of 20 marks. A committee of two members comprising of HoD's nominee and Guide will assess the project work which will involve going through the project report (6 marks), project presentation (7 marks) and demonstration of the project (7 marks).

Phase –II (during 20th week): A final presentation and defense assessment for a max. of 20 marks will be carried out by one-man committee composed of an external expert who is chosen by the Dean AAA from a panel of examiners suggested by the HoD. The format for evaluation will involve going through the project report's quality (6 marks), presentation (6 marks) and interaction and defense (8 marks).

The qualifying marks will be finalized considering the marks scored in both the phases (I & II) of summative assessment.

In case the candidate is placed in 'I' grade, he / she has to appear for both Phase-I and Phase-II assessments, which will be held within the 15 days after declaration of results. In the consecutive assessment also if the candidate fails to secure min. required score then he / she will be placed in 'R' grade.

6 SEMESTER-END ASSESSMENT ACTIVITES

6.1 Setting of semester-end summative assessment question papers will be coordinated by the lead instructor assigned for a particular course. Two sets of question papers will be submitted latest by 12th week of the semester.

6.2 There shall be 'Summative Assessment Question Paper Scrutiny Committee' which would be constituted with external experts. Experts are empowered to modify / rephrase the questions to maintain a high standard of the semester-end assessment. The review should be completed by the 14th week of the semester. The review process will be coordinated by a committee of School Dean, HoDs and external experts.

6.3 The question wise marks scored in the summative assessment out of a total of 80 will be made available online within two weeks from the last date of examination and would be kept active for 24 hours. Latest by the end of 48 hours from the instant of notification any candidate can submit an appeal online providing question wise claim.

6.4 Claims for re-assessment on P-based courses are not allowed.

6.5 The appeals will be attended within next three working days. Fees for appeal, as decided from time to time, has to be remitted online along with the appeal.

6.6 Final results and grades will be computed as explained in the next section

6.7 Final results and grades shall be announced within four weeks of completion of the last examination of the summative assessment (within two weeks from the last date of appeal). Grades are published on the University website, and also informed to the parents and students through SMS.

6.8 Provisional Grade cards will be issued within two weeks after the announcement of grades. Grade card will contain three parts. Part 1: details of successfully completed courses. Part 2: Details of 'I' grade courses. Part 3: Details of 'R' grade courses

7 COMPUTATION OF GRADING

7.1 Formative assessment decides the list of 'R'- candidates. Therefore, these candidates will not be considered for grading computation. Summative assessments decide the list of 'I' candidates. Therefore, these candidates will not be considered for grading computation

7.2 The candidates who have successfully completed both formative and summative assessments will be considered for computation of relative grading.

7.3 Threshold value (Th) for relative grading in each course is arrived after studying the marks distribution in that course by a committee constituted by Dean, AAA. The threshold value is decided by the upper bound marks of the major chunk of the class keeping the top outlier scores away from consideration (the least upper bound). The threshold value will be slightly greater than upper bound marks or may be equal to the upper bound marks.

R22 BCA 3 YEAR DEGREE PROGRAMME

7.4 The total marks M = marks scored in the formative assessment + marks scored in the summative assessment is transformed into relative grade expressed accurate to two decimal places as follows:

Relative grade point (P) = (M / Th) X 10 [and limited to 10]

7.5 If students require course wise percentage equivalence, then the calculation will be based on the following

Course wise percentage equivalence = (M / Th) X100 [truncated to two-digit integer and limited to 100]

7.6 After relative grading, a student is assigned a 'Letter Grade (G)' for each course as per Table (8). The grade and the corresponding letter grade represent the outcomes and assessments of a student's performance in a course.

Table 8: Grading information

Relative Grading Range (P)	Category	Grade (G)
≥ 9.50	Outstanding	O
≥ 8.50 to 9.49	Excellent	S
≥ 7.00 to 8.49	Very good	A
≥ 6.00 to 6.99	Good	B
≥ 5.00 to 5.99	Fair	C
≥ 4.00 to 4.99	Marginal	D
Transitional Grade	Repeat	R
Transitional Grade	Incomplete	I

8 SUPPLEMENTARY EXAMINATIONS

8.1 The supplementary examinations shall be conducted once in summer semester. Notifications will be released by the examination section informing the students about registration procedures, details of fee and timetables. Apart from these examinations the students who have courses with 'I'-grade can also write the supplementary examinations along with regular semester-end examinations of that academic (Odd / Even) semester.

8.2 Whenever a candidate clears courses with 'I' grade in a supplementary examination that are conducted during a regular semester, the Threshold value for computing his / her grade will be obtained from the same batch in which he / she had completed his/ her formative assessment.

8.3 Whenever a candidate clears courses with 'R' / 'I' grade in a summer semester, the Threshold value for computing his / her grade will be carry forwarded from the preceding Odd / Even semester for the respective courses.

8.4 Whenever a candidate clears courses with a 'R' grade in a regular semester along with his / her junior batch then for this candidate the Threshold value will be corresponding to his / her junior batch for computing grade.

9 GRADE POINT AVERAGE

The Academic Performance of a student is indicated every semester by the Semester Grade Point Average (SGPA) and finally by Cumulative Grade Point Average (CGPA).

9.1 SGPA

The Semester Grade Point Average (SGPA) shall be computed using the formula given below:

$$SGPA = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where

n = number of courses a student successfully completed in the semester under consideration

Pi = Grade points secured for the ith course registered in the semester under consideration.

Ci = the number of credits assigned to ith course registered in the semester under consideration

9.2 CGPA

The Cumulative Grade Point Average (CGPA) shall be computed after successful completion of BCA programme.

The computations will be as below:

$$\text{CGPA} = \frac{\sum_{j=1}^{m} C_j P_j}{\sum_{j=1}^{m} C_j}$$

where

m = total number of courses prescribed for the completion of the programme

Cj = the number of credits assigned to the jth course

Pj = grade points secured in the jth course.

and ∑ Cj = 120

Percentage equivalence of SGPA & CGPA = (SGPA or CGPA) X10

10 AWARD OF CLASS

The students who have become eligible for award of degree shall be classified based on their CGPA secured, as per the Table (9) given below:

Table 9: Class / Division information

S. No.	CGPA	Class / Division
1	8.0 and above	First Class with Distinction
2	6.5 and above but less than 8.0	First Class
3	6.0 and above but less than 6.5	Second Class
4	Less than 6.0	Pass Class

a) For the purpose of rewarding the accomplishers with ranks and awards, toppers in each branch discipline are identified, based on their academic performance (CGPA) in the BCA Programme.

b) In addition, the 'Chairman's gold medal' and other 'Endowment Awards' are awarded to the 'outstanding students' based on the overall performance which includes academic, co-curricular and extra-curricular activities, campus placements and competitive examinations. A committee appointed by the Vice-Chancellor will recommend the eligible student for the award, selected from the nominations received from the departments.

c) In addition, the institution may recognize exceptional performance such as music, dance, sports etc. and display of exceptional bravery from time to time

d) The candidates who complete required number of credits (120 credits) in the first 6 successive semesters shall be eligible to receive awards/ranks

e) The candidates availing spill over semesters will not be eligible for the award of merit scholarships

11 AWARD OF DEGREE

On successful completion of prescribed requirements of the programme, the degree shall be conferred during the convocation of the VFSTR.

For the conferment of degree, the student has to fulfill the following requirements:

a) a bonafide student and undergone the course work of not less than three academic years and not more than five academic years from the date of joining.

b) successfully completed all the courses as prescribed in the respective curriculum.

c) acquired a minimum eligible credits i.e. 120 credits for the award of BCA degree

d) obtained no due certificates as prescribed by VFSTR.

e) no in-disciplinary proceedings pending against him /her

Consequent upon being convinced, following an enquiry, the Academic council may resolve to withdraw the degree/ diploma/ any other certification provided by the institute. The aggrieved

R22 BCA 3 YEAR DEGREE PROGRAMME

may however prefer for a review of such decision by the Academic Council, citing cogent reasons for review or go in for an appeal to the, BoM of the institute

12 LATERAL EXIT OPTIONS

12.1 Honourable exit with suitable Certificate / Diploma

In line with NEP-2020, an optional exit is provided for a candidate who has earned a minimum number of credits and has completed all the requirements up to the end of respective years of study.

Under Graduate certification will be awarded for a candidate who has earned a minimum of 40 credits and completed all the requirements up to the end of second semester.

Under Graduate diploma will be awarded for a candidate who has earned a minimum of 80 credits and completed all the requirements up to the end of fourth semester.

Semester-wise transcript and a consolidated transcript will be given to the candidates during their exit from the registered program.

The candidate who has exited can seek re-entry to complete BCA by surrendering the Undergraduate certification/Undergraduate Diploma. A committee constituted by Vice-Chancellor will scrutiny all such re-entry requests and recommend the plan of action. However, the max. duration of programme should be limited to five years and further extension beyond the stipulated max. duration of study has to be approved by Academic Council, if the candidate appeals for an extension.

12.2 Volunteer 'Drop' with Sabbatical Semester

A candidate may exercise his option to exit from BCA Degree programme temporarily for a semester, utilizing the DROP option.

The DROP can be exercised to take up Internship / Innovation / Exploratory / Entrepreneurship / Advanced research / Start-up and such related activities. Under such circumstances a candidate can normally avail DROP over two successive semesters. Such drop semester will be identified as sabbatical semester.

However, such a candidate has to pay the regular semester fee if such a Drop option is utilized during the first 6 semesters of BCA, and has to pay a nominal semester maintenance fee during the spillover period, if a candidate has not yet completed the credit requirements.

Upon returning from such a temporary exit, a candidate may continue his BCA studies utilizing the provision of spillover period. A candidate may also submit a claim for Credit equivalence for the activities undertaken during the DROP period. The equivalence committee would evaluate and assess the academic equivalence of the work carried out and would recommend the credit equivalence and credit transfer to be granted together with the grades that could be attributed, if applicable. However, the max. duration of programme should be limited to five years and further extension beyond the stipulated max. duration of study has to be approved by Academic Council, if the candidate appeals for an extension.

12. 3 Volunteer 'Drop' of a Semester Drop option

A candidate may exercise his option to voluntarily exit from BCA programme temporarily for a semester during the BCA programme, utilizing the DROP option to meet the family/ personal exigencies. All the norms mentioned in the section 12.2 shall be applicable for the candidates utilizing semester drop option.

13 INTERPRETATION OF RULES

a) The academic rules and regulations should be read as a whole for the purpose of any interpretation.

b) For the matter(s) NOT covered herein above or for unforeseen circumstances, but arising during the course of the implementation of the above regulations. The Vice-Chancellor shall be authorized to remove the difficulties and decide upon the matters. The same shall be reported in the next meeting of Academic Council for ratification and subsequently informed to BoM.

c) The Institution may change or amend the academic rules and regulations or curriculum at any time, and the changes or amendments made shall be applicable to all the students with effect from the dates, notified by the Institution.

d) Procedure and explanation to any section can be floated by the office of Dean AAA as applicable from time to time with due approval by the chairman of Academic Council.

R22 BCA 3 YEAR DEGREE PROGRAMME

ANNEXURE -1

BCA COURSE STRUCTURE (R22)

I Year I Semester

Course Code	Course Title	L	T	P	C
22BC101	Digital Computer Fundamentals	2	2	-	3
22BC102	Programming for Problem Solving	3	-	2	4
22BC103	Technical English Communication	2	-	2	3
22BC104	Web Technologies	3	-	2	4
22BC105	Mathematical Foundations for Computer Science	2	2	-	3
22BC106	IT workshop & Tools	-	-	4	2
22BC107	Physical Fitness, Sports & Games – I	-	-	3	1
	Total	**12**	**4**	**13**	**20**
		29 hrs			

I year I / II Semester

Course Code	Course Title	L	T	P	C
22BC116	Orientation Session	-	-	6	3

I year II Semester

Course Code	Course Title	L	T	P	C
22BC108	Python Programming	2	-	2	3
22BC109	Data Structures	3	-	2	4
22BC110	Probability and Statistics	2	2	-	3
22BC111	Environmental studies	1	2	-	2
22BC112	Fundamentals of Network Security	1	2	-	2
22BC113	Data visualization Laboratory	-	-	4	2
22BC114	Soft skills laboratory	-	-	4	2
22BC115	Physical Fitness, Sports & Games – II	-	-	2	1
	Total	**9**	**6**	**16**	**19**
		31 hrs			

R22 BCA 3 YEAR DEGREE PROGRAMME

II year I Semester

Course Code	Course Title	L	T	P	C
22BC201	Object oriented Programming	3	-	2	4
22BC202	Database Systems	3	-	2	4
22BC203	Data Communications	2	2	-	3
22BC204	Operating systems	3	-	2	4
22BC205	Management Science	2	2	-	3
22BC206	Professional Communication Lab	-	-	4	2
	NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities. These credits maybe earned on or before the end of IV semester	-	-	-	-
	Total	**13**	**4**	**10**	**20**
		27 hrs			

II year II Semester

Course Code	Course Title	L	T	P	C
22BC207	Software Engineering	3	-	2	4
22BC208	Computer Networks	3	-	2	4
22BC209	Web Application Development	3	-	2	4
22BC210	Organization behavior	2	-	-	3
22BC211	Quantitative Aptitude and Logical Reasoning	2	2	-	3
22BC212	Technical Seminar	0	-	2	1
22BC213	NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities. These credits maybe earned on or before the end of IV semester	-	-	-	1
	Total	**13**	**4**	**8**	**20**
		25 hrs			

III Year I Semester

Course Code	Course Title	L	T	P	C
22BC301	Internet of Things	3	-	2	4
22BC302	Data Mining	3	-	2	4
	Elective – I	3	-	2	4
	Elective – II	2	2	0	3
22BC303	Competitive coding	-	-	4	2
22BC304	Socially Relevant Project using Design Thinking	-	-	4	2
	Total	**11**	**2**	**14**	**19**
		27 hrs			

III Year II Semester

Course Code	Course Title	L	T	P	C
	Elective – III	3	-	2	4
	Elective – IV	2	2	-	3
22BC305	Project work	-	-	18	12
	Total	**5**	**2**	**20**	**19**
		27 hrs			

List of Department Elective Courses

DATA SCIENCE					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
22BC801	Data Science using Python	3	-	2	4
22BC802	Statistical Methods for Data visualization	3	-	2	4
22BC803	Big data Analytics	3	-	2	4
22BC804	Natural Language Processing	3	-	2	4

AI & ML					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
22BC805	Introduction to Artificial Intelligence	3	-	2	4
22BC806	Machine Learning	3	-	2	4
22BC807	Artificial Neural Networks	3	-	2	4
22BC808	Deep Learning	3	-	2	4

APPLICATION DEVELOPMENT					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
22BC809	Open Source Web Technologies	3	-	2	4
22BC810	Mobile Application Development	3	-	2	4
22BC811	Cloud Computing	3	-	2	4
22BC812	Full Stack Technologies	3	-	2	4

R22 BCA 3 YEAR DEGREE PROGRAMME

ANNEXURE – 2

SUPPLEMENT REGULATION FOR ONWARD CONTINUATION TO MCA DEGREE

The proposal to institute onward continuation to MCA degree after BCA is designed in line with the practices in Institutions of National Importance, is to elevate the Gross Qualification Index (GQI) of India, and specifically to enhance the technological / engineering competency of the Technocrats.

In order to attract the committed learners towards earning MCA immediately after BCA the following scheme is proposed:

1. He / she should be a candidate maintaining his studentship through proper registration process of his BCA program and fulfills all the credit requirements of BCA.
2. He / she has to appear for an aptitude test / interaction and the corresponding committee of experts constituted for the purpose, has to recommended his / her name.
3. The regulations that were in force during that Academic year will be applicable for this continuation MCA program.
4. The candidate should earn all the credits of the BCA program before commencing the MCA program. The program structure designed for MCA will be followed from VII semester onwards
   - BCA degree = 120 credits
   - MCA degree = 80 credits
5. Honourable exit option:
   - Candidate who has earned all the credit requirements till first year (48 credits) of MCA can exercise his / her option to exit the program with a BCA honours degree for candidates earned BCA credits from VFSTR. Knowledge and skill set of such candidates will be equivalent to the candidates graduated with B. Tech (CSE / IT) programme. Because Basic Engineering and GATE relevant courses are covered during their first year of MCA study.
   - In case he / she wishes to continue his / her study after returning, an option is given to the candidate to select their course of study

   a) 4 semesters study to earn 64 credits shall be awarded with M.Tech degree.

   b) 2 semesters study to earn remaining 32 credits shall be awarded with MCA degree. In such case he / she has to surrender their BCA Honours degree.

   However, candidates awarded BCA degree from other institutes can also exit with PG diploma certification.

Credits distribution for 2 year MCA programme

S.No.	Year / Semester	Credits
1	I / I	24
2	I /II	24
3	II / I	20
4	II / II	12
	Total credits	**80**

FOREWORD

Bachelor in Computer Application (BCA) is an undergraduate degree programme in computer applications. The demand for computer professionals is rising daily as a result of India's booming IT sector. Many options for computer graduates have been made possible by the IT sector's rapid expansion.

Bachelor in Computer Application (BCA) is one of the popular programme among the students who want to make their career in the IT (Information Technology) field other than B. Tech (CSE/IT). It is also popular among students who have completed their +2 in biological sciences. The duration of the course is 3 years and divided into 6 semesters. It comprises of the subjects like database, networking, data structure, core programming languages like 'C', 'java' and 'python'. This programme provides a lot of opportunities to the students who are interested in computer field and wants to work in the IT sector as programmer or software developer.

R22 curriculum comprises of:

- Revision in tune with National Education Policy 2020.
- Various exit options.
- Introduced socially relevant projects using design thinking
- Focus on communication skills and Analytical skills
- More emphasis on Problem solving skills.
- Enhanced skill based courses for improving employment opportunities.
- Advanced courses like Artificial Intelligence, Machine learning, Artificial Neural Networks, Deep Learning, Cloud Computing, Big Data Analytics and Internet of Things.
- Practice sessions embedded into as many courses as possible.

In R22 curriculum, every care has been taken to accommodate the knowledge and skill requirements of industry through practicing of proper activities. While making the graduates work ready, it also enables them to be successful in competitive examinations.

The Board of Studies consisting eminent personalities along with experienced faculty membersof the university have designed the curriculum to offer knowledge and skill of informationtechnology on the above mentioned areas. The curriculum includes concepts with skill basedtasks through integrated laboratory and activities combined with theory. The department aims tomake graduates ready for the industrial needs.

External BoS Members:

1. Dr.C.Raghavendra Rao, Professor, University of Hyderabad, Hyderabad
2. Dr. R.B.V. Subramaanyam, Professor & HOD, Department of CSE, NIT Warangal
3. Dr. B. Ramesh Babu, Sr. Asst. Professor. Department of CSE, MNIT Jaipur.

I thank all the BOS Members, Academic Council Members and University authorities especially Dean AAA and honourable Vice Chancellor for encouraging and supporting us in designing this innovative curriculum for BCA students.

Dr. K. V. Krishna Kishore
Head, Department of IT
VFSTR Deemed to be University

VIGNAN'S
Foundation for Science, Technology & Research
(Deemed to be University)
-Estd. u/s 3 of UGC Act 1956

VISION

To evolve into a Centre of Excellence in Science &Technology through creative and innovative practices in teaching-learning, towards promoting academic achievement and research excellence to produce internationality accepted, competitive and world class professionals who are psychologically strong & emotionality balanced, imbued with social consciousness & ethical values.

MISSION

To Provide high quality academic programmes, training activities, research facilities and opportunities supported by continuous industry-institute interaction aimed at promoting employability, entrepreneurship, leadership and research aptitude among students and contribute to the economic and technological development of the region, state, and nation.

Department of INFORMATION TECHNOLOGY

VISION

To become centre of excellence in technical and knowledge-based education utilizing the potential of emerging technologies in field of Information Technology with a deep passion of wisdom, culture, and values.

MISSION

M1: Impart modern teaching methodologies to provide quality education to the students

M2: Produce employable engineers based on skills required for industry

M3: Enable students and faculty members in research to develop IT based solutions to meet societal and industry requirements.

BACHELOR OF COMPUTER APPLICATOINS

Program Educational Objectives (PEOs)

Graduates of Bachelor of Computer Applications should be able to,

PEO1: pursue successful career in Computer Applications and related fields

PEO2: Expose to emerging tools and techniques of Computer Science

PEO3 Demonstrate professionalism, ethics, communication skills, teamwork, and the ability to relate IT issues to social issues.

Program Specific Outcomes (PSOs)

BCA Graduates will be able to:

PSO1: Proficiency in analytical and logical skills for the design, development, testing and maintenance of software.

PSO2: Apply cutting-edge technologies for devising cost-effective solutions.

Program Outcomes (POs)

PO1. Application knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and to the solution of complex programming problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent

responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

R22 CURRICULIM

(Applicable for students admitted into First year from academic year 2022-23)

BACHELOR OF COMPUTER APPLICATIONS

I YEAR I SEMESTER

S.No.	Course code	Course Title	L	T	P	C
1	22BC101	Digital Computer Fundamentals	2	2	-	3
2	22BC102	Programming for Problem Solving	3	-	2	4
3	22BC103	Technical English Communication	2	-	2	3
4	22BC104	Web Technologies	3	-	2	4
5	22BC105	Mathematical Foundations for Computer Science	2	2	-	3
6	22BC106	IT workshop & Tools	-	-	4	2
7	22BC107	Physical Fitness, Sports & Games – I	-	-	3	1
		Total	**12**	**4**	**13**	**20**
			29 hrs			

I YEAR I/II SEMESTER

Sl. No.		Course Title	L	T	P	C
1	22BC116	Orientation Session	-	-	6	**3**

I YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C
1	22BC108	Python Programming	2	-	2	3
2	22BC109	Data Structures	3	-	2	4
3	22BC110	Probability and Statistics	2	2	-	3
4	22BC111	Environmental studies	1	2	-	2
5	22BC112	Fundamentals of Network Security	1	2	-	2
6	22BC113	Data visualization Laboratory	-	-	4	2
7	22BC114	Soft skills laboratory	-	-	4	2
8	22BC115	Physical Fitness, Sports & Games – II	-	-	2	1
		Total	**9**	**6**	**16**	**19**
			31 hrs			

R22 CURRICULIM

(Applicable for students admitted into First year from academic year 2022-23)

BACHELOR OF COMPUTER APPLICATIONS

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	C
1	22BC201	Object oriented Programming	3	-	2	4
2	22BC202	Database Systems	3	-	2	4
3	22BC203	Data Communications	2	2	-	3
4	22BC204	Operating systems	3	-	2	4
5	22BC205	Management Science	2	2	-	3
6	22BC206	Professional Communication Lab	-	-	4	2
7		NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities. These credits maybe earned on or before the end of IV semester	-	-	-	
		Total	**13**	**4**	**10**	**20**
			27 hrs			

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C
1	22BC207	Software Engineering	3	-	2	4
2	22BC208	Computer Networks	3	-	2	4
3	22BC209	Web Application Development	3	-	2	4
4	22BC210	Organization behaviour	2	2	-	3
5	22BC211	Quantitative Aptitude and Logical Reasoning	2	2	-	3
6	22BC212	Technical Seminar	-	-	2	1
7	22BC213	NCC/ NSS/ SAC/ E-cell/ Student Mentoring/ Social activities. These credits maybe earned on or before the end of IV semester	-	-	-	1
		Total	**13**	**4**	**8**	**20**
			25 hrs			

R22 CURRICULIM

(Applicable for students admitted into First year from academic year 2022-23)

BACHELOR OF COMPUTER APPLICATIONS

III YEAR I SEMESTER

S.No.	Course	Course Title	L	T	P	C
1	22BC301	Internet of Things	3	-	2	4
2	22BC302	Data Mining	3	-	2	4
3		Elective – I	3	-	2	4
4		Elective – II	2	2	-	3
5	22BC303	Competitive coding	-	-	4	2
6	22BC304	Socially Relevant Project using Design Thinking	-	-	4	2
		Total	**11**	**2**	**14**	**19**
			27 hrs			

III YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C
1		Elective – III	3	-	2	4
2		Elective – IV	2	2	-	3
3	22BC305	Project work	-	-	18	12
		Total	**5**	**2**	**20**	**19**
			27 hrs			

R22 CURRICULIM

(Applicable for students admitted into First year from academic year 2022-23)

BACHELOR OF COMPUTER APPLICATIONS

ELECTIVES

ELECTIVES FOR BCA PROGRAMME (DATA SCIENCE)						
S.No.	**Course**	**Course Title**	**L**	**T**	**P**	**C**
1	22BC801	Data Science using Python	3	-	2	4
2	22BC802	Statistical Methods for Data visualization	3	-	2	4
3	22BC803	Big data Analytics	3	-	2	4
4	22BC804	Natural Language Processing	3	-	2	4

ELECTIVES FOR BCA PROGRAMME (AI & ML)						
S.No.	**Course**	**Course Title**	**L**	**T**	**P**	**C**
1	22BC805	Introduction to Artificial Intelligence	3	-	2	4
2	22BC806	Machine Learning	3	-	2	4
3	22BC807	Artificial Neural Networks	3	-	2	4
4	22BC808	Deep Learning	3	-	2	4

ELECTIVES FOR BCA PROGRAMME (Application Development)						
S.No.	**Course**	**Course Title**	**L**	**T**	**P**	**C**
1	22BC809	Open Source Web Technologies	3	-	2	4
2	22BC810	Mobile Application Development	3	-	2	4
3	22BC811	Cloud Computing	3	-	2	4
4	22BC812	Full Stack Technologies	3	-	2	4

22BC101-DIGITAL COMPUTER FUNDAMENTALS

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Mathematics

COURSE DESCRIPTION AND OBJECTIVES:

The course addresses the concepts, principles and techniques of designing digital systems. The objective of this course is to offer the knowledge and skill of conversions between different number systems, design of logical gates, minimization of switching functions, design of combinational and sequential circuits, effective memory utilization and design of synchronous and asynchronous counters.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

NUMBER SYSTEMS

Number systems, complements of numbers, Binary codes, Basic theorems and Properties of Booean Algebra, Boolean functions, Canonical and standard forms, Digial logic gates, The Map Method, Don't care conditions.

UNIT-2 **10L+10T+0P=20 Hours**

SIMPLIFICATION OF BOOLEAN FUNCTIONS

Number base conversions, Simplification of Boolean expressions using Boolean algebra. optimal gate-level implementation of the Boolean functions using K-Map method, Gate implementation of Boolean functions using NAND and NOR.

PRACTICES:

- Number base conversions
- Find r's complement and r-1's complements for the given numbers
- Perform Subtraction using 2's complement
- Convert gray to binary and binary to gray
- Perform BCD subtraction
- Simplify Boolean expressions using Boolean algebraic laws.
- Convert between canonical forms
- Simplification of Boolean expressions using K-Map method
- Solve problems on Don't care combinations

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

COMBINATIONAL & SEQUENTIAL CIRCUITS

Combinational circuits, Analysis and design procedure, Binary adder– subtractor, Decimal adder, Binary multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers, De-mutliplexers. Latches, Flip-flops, Analysis of clocked sequential circuits, Registers, Counters.

UNIT-2 **8L+8T+0P=16 Hours**

COUNTERS

Design of code converters, realization of combinational circuits using decoders, multiplexers. Flip-flop conversions, Design of various types of synchronous and asynchronous counters, RAM and types of RAM, ROM, Types of ROM.

PRACTICES:

- Design the combinational circuits based on requirements using logic gates
- Design the code converters (Binary to Gray…)
- Realize the Boolean expressions using NAND and NOR gates.
- Perform flip-flop conversions.
- Design the Asynchronous counters and Synchronous counters.
- Realize the Boolean functions using PROM, and PLA

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Determine philosophy of number systems and binary codes	Apply	1	1, 2, 12
2	Analyze different simplification methods for Boolean functions.	Apply	1	1, 2, 5, 12
3	Realize the combinational and sequential logic circuits by using various logical blocks	Apply	2	1, 2, 3, 5, 12
4	Design synchronous counters and develop sequential circuit applications using flip flop and registers.	Create	2	1, 2, 12
5	Realize the Boolean functions using Programmable Logic Devices	Analyze	2	1, 2

TEXT BOOK:

1. M Morris Mano and Michael D. Ciletti, “Digital Design”, 5th edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. H Taub and D Schilling, “Digital Integrated Electronics”, 2nd edition, TataMcGraw-Hill, 2004.
2. Z. Kohavi, “Switching and Finite Automata Theory”, 2nd edition, Tata McGraw-Hill, 2008

22BC102 - PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basics of Computers

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed to impart knowledge on basic concepts of C programming language and problem solving through programming. It covers basic structure of C program, data types, operators, decision making statements, loops, functions, strings, pointers, and also file manipulations. At the end of this course, students will be able to design, implement, test and debug the complex problems using features of C.

MODULE- 1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO ALGORITHMS AND PROGRAMMING LANGUAGES

Basics of algorithms; Flow charts; Generations of programming languages. Introduction to C: Structure of a C program - pre-processor statement, inline comments, variable declaration statements, executable statements; C Tokens - C character set, identifiers and keywords, type qualifiers, type modifiers, variables, constants, punctuations and operators.

Data Types and Operators: Basic data types; Storage classes; Scope of a variable; Formatted I/O; Reading and writing characters; Operators - assignment, arithmetic, relational, logical, bitwise, ternary, address, indirection, sizeof, dot, arrow, parentheses operators; Expressions - operator precedence, associative rules.

Control Statements: Introduction to category of control statements; Conditional branching statements - if, if– else, nested-if, if – else ladder, switch case; Iterative statements - for, while, do - while, nested loops; Jump statements - break, jump, goto and continue.

UNIT-2 **12L+0T+8P=20 Hours**

ARRAYS

Introduction; Types of arrays; Single dimensional array - declaration, initialization, usage, reading, writing, accessing, memory representation, operations; Multidimensional arrays.

Strings: Character array, Reading string from the standard input device, Displaying strings on the standard output device, Importance of terminating a string, Standard string library functions.

PRACTICE QUESTIONS ON DATA HANDLING – LEVEL 1

- Write a program to accept 2 numbers from the user as input and print their sum
- Write a program to accept a number as input from the user which denotes the temperature in Celsius, convert it to Fahrenheit reading and print it
- Write a program to accept a number as input from the user which denotes the radius and print the area of the circle
- Write a program to accept a character as input from the user and print it's corresponding ASCII value.

PRACTICE QUESTIONS ON CONTROL STATEMENTS - LOOPING – LEVEL 1

- Write a C program to print the first N natural numbers, where N is given as input by the user.
- Write a C program to print all the odd numbers between 1 and N where N is given as input by the user.
- Write a C program to print all the even numbers between I and N where N is given as input by the user.

PRACTICE QUESTIONS ON CONTROL STATEMENTS – DECISION MAKING – LEVEL 1

- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number
- Write a program to accept a number as input and check if it is positive, negative or zero.

PRACTICE QUESTIONS ON PATTERNS – LEVEL 1

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

  *
  **
  ***
  ****
  *****

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

  1
  12
  123
  1234
  12345

- Write a program to accept a number N as input from the user and print the following pattern. Sample N = 5.

  54321
  4321
  321
  21
  1

PRACTICE QUESTIONS ON NUMBER CRUNCHING – LEVEL 1

- Write a program to accept a number as input and print the number of digits in the number
- Write a program to accept a number as input print the sum of its digits
- Write a program to accept a number as input, reverse the number and print it
- Write a program to accept a number as input and check if it is an Armstrong number
- Write a program to accept a number as input and check if is a prime number

PRACTICE QUESTIONS ON ARRAYS – LEVEL 1

- Find the sum of the elements of an array
- Find the maximum element in an unsorted array
- Find the minimum element in an unsorted array
- Find the repeated elements in a sorted array

PRACTICE QUESTIONS NUMBER CRUNCHING – LEVEL 2

- Write a program to accept a number as input and check if it is a palindrome
- Write a program to accept a number as input and print the frequency of occurrence of each digit
- Write a program to accept a number as input and check if is a strong number

PRACTICE QUESTIONS ARRAYS – LEVEL 2

- Write a program to find the second largest element in an unsorted array
- Write a program to find the second smallest element in an unsorted array
- Write a program to print the number of odd and even numbers in an unsorted array

PRACTICE QUESTIONS ON STRINGS – LEVEL 1

- Write a program to accept a string as input and print it
- Write a program to accept a string as input and count the number of vowels in it
- Write a program to accept a string as input and count the number of consonants in it
- Write a program to accept a string as input and print its length
- Write a program to accept a string as input and print the reversed string
- Write a program to accept 2 strings as input and check if they are the same
- Write a program to accept a string as input and copy the contents into a second string and print the second string
- Write a program to accept a string as input and check if it is a palindrome

PRACTICE QUESTIONS ON STRINGS – LEVEL 2

- Implement the string length function
- Implement the string copy function
- Implement the string concatenate function
- Implement the string compare function
- Implement the string reverse function
- Implement the strstr function.

MODULE-2

UNIT- 1 **12L+0T+8P=20 Hours**

FUNCTIONS

User-defined functions; Function declaration - definition, header of a function, body of a function, function invocation; Call by value; Call by address; Passing arrays to functions; Command line arguments; Recursion; Library Functions.

Pointers: Declaration, Initialization, Multiple indirection, Pointer arithmetic, Relationship between arrays and pointers, Scaling up - array of arrays, Array of pointers, Pointer to a pointer and pointer to an array; Dynamic memory allocation functions.

UNIT-2 **12L+0T+8P=20 Hours**

STRUCTURES

Defining a structure, Declaring structure variable, Operations on structures, Pointers to structure - declaring pointer to a structure, accessing structure members using pointer; Array of structures, Nested structures, Passing structures to functions - passing each member of a structure as a separate argument,

passing structure variable by value, passing structure variable by reference/ address; Typedef and structures.

Unions: Defining a union - declaring union variable, operations on union; Pointers to union - declaring pointer to a union, accessing union members using pointer; Array of union, Nested union, Typedef and union, Enumerations, Bit-fields.

Files: Introduction to files, Streams, I/O using streams – opening a stream, closing stream; Character input, Character output, File position indicator, End of file and errors, Line input and line output, Formatted I/O, Block input and output, File type, Files and command line arguments.

PRACTICE QUESTIONS ON STRINGS – LEVEL 3

- Write a program to swap two given strings and print the swapped strings
- Return the maximum occurring character in the string
- Write a program to print the character in the string with the count where count is the occurrence of the character
- Write a program to remove the duplicate characters in the given string
- Write a program to remove the vowels from a given string

PRACTICE QUESTIONS ON 2D ARRAYS – LEVEL 1

- Find and print the maximum element along with its position in a matrix
- Find and print the minimum element along with its position in a matrix

PRACTICE QUESTIONS ON 2D ARRAYS – LEVEL 2

- Find and print the maximum element of each row of a matrix
- Find and print the minimum element of each column of a matrix
- Write a program to find the row with the maximum number of 1's in a matrix consisting of only 0's and 1's.
- Write a program to search a given element in a row-wise and column-wise sorted 2D array

PRACTICE QUESTIONS ON 2D ARRAYS – LEVEL 3

- Write a program to find the Kth smallest element in the given matrix.
- Write a program to find the Kth largest element in the given matrix.
- Write a program to check whether the given two two-dimensional array of same dimensions are equal or not.
- Write a program to add the given two two-dimensional array of same dimensions.
- Write a program to subtract the given two two-dimensional array of same dimensions.
- Write a program to multiply the given two two-dimensional array of same dimensions.
- Write a program to sort each row of a matrix.

PRACTICE QUESTIONS ON FILES, STRUCTURES & UNIONS:

- Write a C program to create a struct, named Student, representing the student's details as follows: first_name, last_name, Age and standard.

  Example

  Read student data
  john
  carmack
  15
  10

Display the data in the following format
First Name: john
Last Name: carmack
Age: 15
Standard: 10

- Bob and Alice both are friends. Bob asked Alice how to store the information of the books using Structures. Then Alice written a c program to store the information of books using book structure by taking different attributes like book_name, author, book_id, price. Write a C program to read and display the attributes of the books using structures.

  Sample Input:
  Enter number of books: 1
  Enter the book name: c Programming
  Enter the author name: balaguruswamy
  Enter the book ID: 23413
  Enter the book price: 500

  Sample Output:
  The details of the book are:
  The book name is: c Programming
  The author name is: balaguruswamy
  The book ID is: 23413
  The book price is: 500.00

- Customer Payment Details is a structure with members as customers_name, address, account_number, payment_status(paid(1)/ not_paid(0)), due_date, and amount. In this example, payment_date is another structure with month, day and year as integer members. So, every customer record can be considered as an array of structures.
- Write a C program that displays the amount to be paid by each customer along with their names. If payment_status is 1, display NIL for such customers.
  Input Format:
  First line of input contains ‘n’ number of customers, followed by 8 lines of input for each customer. Each line represents (customers_name, address, account_number, amount payment_status(paid(1)/ not_paid(0)), and due_date).
  Output Format: First line of output is Amount to be paid by each customer as on date: followedby n lines of output. Each line contains name of the customer followed by tab space, and amountto be paid.
  Hint: Use nested structure to represent date.

- Write a 'C' program to accept customer details such as: Account_no, Name, Balance using structure. Assume 3 customers in the bank. Write a function to print the account no. and name of each customer whose balance < 100 Rs.
- Write a C program to accept details of 'n' employee(eno, ename, salary) and display the details of employee having highest salary. Use array of structure.

- Write a C program to print the bill details of ‘N’ number of customers with the following data: meter number, customer name, no of units consumed, bill date, last date to deposit and city. The bill is to be calculated according to the following conditions:

No. of units	Charges
For first 100 units	Rs.0.75 per unit
For the next 200 units	Rs.1.80 per unit
For the next 200 units	Rs.2.75 per unit

Sample Input

Enter no. of customers
1
Enter Meter Number AP01213
Enter Customer Name: Karthik
Enter No. of units consumed: 200
Enter Bill date:22/01/2021
Enter Last date: 12/2/2021
Enter City: Guntur

Sample Output

Meter Number AP01213
Customer Name: Karthik
No. of units consumed: 200
Bill date:22/01/2021
Last date: 12/2/2021
City: Guntur
Total Amount: 255.000000

- Write a C program that creates a student file containing {Roll No, Student Name, Address, Stream}, where the data will be inserted and display the list of students who are in CSE (Stream=CSE).
  Input: A file name
  Output: The attributes such as Roll_No, Student_Name, Stream, Address.

  Sample Input

  201fa4200 Raja CSE Guntur
  201fa4201 Bala IT Tenali

  Sample Output

  201fa4200 Raja CSE Guntur

ACTIVITIES:

- Design of algorithm/solution for a given problem.
- Identify suitable data types for operands.
- Apply suitable control statements for decision making.
- Design of non-recursive and recursive functions to perform different tasks.

SKILLS:

- Analysis of the problem to be solved.
- Select static or dynamic data structures for a given problem and manipulation of data items.
- Application of various file operations effectively in solving real world problems.
- Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

CO No.	Course Outcome	Blooms Level	Module No.	Mapping with POs
1	Understand how to write simple, but complete, C programs	Understand	1	1
2	Identify suitable data type for operands and design of expressions having right precedence	Apply	1	1
3	Apply decision making and iterative features of C Programming language effectively	Apply	1	1
4	Select problem specific data structures and suitable accessing methods	Analyze	2	1,2
5	Design and develop non- recursive and recursive functions and their usage to build large modular programs and also able to design string manipulation functions	Design	2	3
6	Develop C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt	Implement	1,2	3,4

TEXT BOOKS:

1. Behrouz A. Forouzan, Richard F.Gilberg, "Programming for Problem Solving", 1st Edition, Cengage publications, 2019.
2. Ajay Mittal, "Programming in C - A Practical Approach", 1st Edition, Pearson Education, India, 2010.

REFERENCE BOOKS:

1. ReemaThareja, "Computer Fundamentals and Programming in C", 1st Edition, Oxford University Press, India, 2013.
2. Herbert Schildt, "C: The Complete Reference", 4th Edition, Tata McGraw-Hill, 2017.
3. Byron S Gottfried, "Programming with C", 4th Edition, Tata McGraw-Hill, 2018.

22BC103--TECHNICAL ENGLISH COMMUNICATION

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic sentence formation,Understanding contextual meanings, Basic writing skills and Moderate fluency in English.

COURSE DESCRIPTION AND OBJECTIVES:

In this course students will read, analyze, and interpret material from technical and general fields, and practice reading, writing, listening and speaking skills to gain exposure and functional English on a variety of contemporary topics.

- To provide English for Specific Purposes(ESP) instruction to enhance students' reading,writing, listening and speaking skills through a practice in the language.
- To build students' confidence and motivation through exposure to academic skills like Note making/taking, Paraphrasing, Summarizing, Report Writing, Making Presentations etc., so as to generate interest in the language from an ESP perspective.
- To enable students to gain key strategies and expression for communicating with professionals and non-specialists

MODULE-1

UNIT–1 **8L+0T+8P=16 Hours**

GENETICS

Reading: Reading for **Note Making**Sub skills: Reading for global understanding (skimming), specific information (scanning), understanding main ideas and supporting ideas, guessing contextual meanings from the text. -**Vocabulary building:** commonly used roots, prefixes, and suffixes.

Writing: Note making, organising main points and sub points, numbering and sequencing, suggesting titles, paraphrasing and summarising. **Functional grammar:**Common Errors in Articles and Prepositions (Handout)

Listening: Listening for **Note Taking**: top down and bottom up approach, listening for main ideas and supporting points.

Speaking: Presentation in teams - ideas on the topic summarised, making a PPT, effective introductions and conclusions, logical organisation of content, using appropriate structure and cohesive devices

UNIT–2 **8L+0T+8P=16 Hours**

ALIENS

Reading: Reading: predicting, skimming, scanning, reading for inference, extrapolative reading

Vocabulary building: Academic vocabulary from the text: synonyms, antonyms, Words often confused

Writing: Paragraph writing; writing a topic sentence, supporting sentences, effective introductions and conclusions, use of cohesive devices. Types of Paragraphs: Descriptive, narrative, argumentative and expository. **Functional grammar**: Common Errors inVerb forms and Conditional sentences (Handout)

Listening: Listening for identifying parts from a description, listening to and sorting information, listening for specific information.

Speaking:Narrating/Retelling an incident,using suitable cohesive devices/discourse markers Speaking of past and present habits/ activities/events - Speaking of future plans

EXPECTED PRACTICES:

- Note making
- Summarizing
- Paragraph Writing
- Error correction and Restructuring
- Vocabulary building
- Listening comprehension
- Note taking

MODULE-2

UNIT–1 **8L+0T+8P=16 Hours**

SOCIAL MEDIA – HEALTH AND NUTRITION

Reading: Reading for factual information researching for supporting evidence - skimming, scanning,

Vocabulary Building: One-word substitutes.

Writing: Letter Writing- E-mail writing – New age communication – Format, protocol, and style- WhatsApp, Facebook and Twitter **Functional grammar:**Common Errors in Sub-Verb Agreement and Modals

Listening: Listening to a **Business Presentation**: Listening for deducing information, for abstract details and specific details, listening for taking a message.

Speaking: Making a presentation with a PPT on a topic assigned- organising the presentation using appropriate discourse markers - presenting a point of view - Extempore.

UNIT–2 **8L+0T+8P=16 Hours**

FASHION

Reading: Reading for data interpretation and information transfer from graphical aids to text reports (pictograms. tables, graphs, pie charts, flow charts), deducing specific information and general information - **Vocabulary building:**business vocabulary, collocations**,** idioms and phrasal verbs.

Writing: Writing a **Report**:Drafting general and factual reports - **w**riting an overview - an effective introduction - organising information into paragraphs (Stages of writing: planning /organising /writing /editing /rewriting) **-Functional grammar:**transformations and miscellaneous common errors

Listening: Listening to a Ted talk and sorting information – taking notes from a discussion.

Speaking: Group Discussion – prerequisites -generating content - initiating a discussion - expressing one's opinion ~leading a discussion - agreeing/ disagreeing to someone's view - cutting into a speech - body language and voice modulation.

EXPECTED PRACTICES:

- E-mail writing
- Letter writing
- Report writing
- Messaging in Social media
- Extempore
- Making PPTs

SKILLS:

- Apply different sub skills like skimming, scanning, reading for information, reading for inference etc. to understand different kinds of text.
- Apply different sub skills like top down, bottom up approaches to listening.
- Use functional vocabulary relevant to engineering and technology to express ideas lucidly.
- Use appropriate sentence structure, cohesive devices to construct simple text in regular correspondence like e-mails and letters.

ACTIVITIES:

- Team Presentation with PPTs
- Individual Presentations
- Group Discussion
- Role Play
- Social Media messaging

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Understand** and interpret professional writing and material on technology	Understand	1	6, 7, 8, 10, 12
2	**Apply** a variety of strategies to interpret and comprehend spoken and written texts using contextual clues	Apply	1	6, 7, 8, 10, 12
3	have the functional language, grammar and skills of organisation to express clearly both in speaking and writing	Apply	1, 2	6, 7, 8, 10, 12
4	possess an **ability** to write clearly on topics relate technology and workplace communication	Analyze	2	6, 7, 8, 10, 12
5	be able to participate in discussions and make short presentations on general and technical topics	Evaluate	2	6, 7, 8, 10, 12

LANGUAGE LAB ACTIVITIES:

Session – 1: Dictionary Skills

Session – 2: Introduction to Phonetics and Identifying Phonemes

Session – 3: Pronunciation Practice (Commonly mispronounced words)

Session – 4: Rosetta Stone (Exercises on LSRW)

Session – 5: Listening Comprehension (Summarising exercise on a Ted Talk)

Session – 6: Technical Presentations (Individual)

Session – 7: Technical Presentations (Team)

Session – 8: TOEFL Mastery

TEXT BOOK:

1. N P Sudharshana& C Savitha, English For Technical Communication, Cambridge University Press, 2016.

REFERENCE BOOKS:

1. Balasubramanian T, A Text book of Phonetics for Indian Students. Orient Longman, New Delhi, 1989.
2. Krishnaswamy, N and Sriraman, T, Current English for Colleges. Trinity publications, 2016.
3. Mohan Krishna and Meera Banerjee, Developing Communication Skills. Macmillan India Ltd. New Delhi, 1990.
4. Ashraf Rizvi M, Effective Technical Communication, 2nd Edition, McGraw Hill Education, 2017.
5. Narayanaswamy V R, Strengthen your Writing. Third Edition Orient Black Swan, New Delhi, 2005.
6. Naterop, Jean, B. and Rod Revell, Telephoning in English. Cambridge University Press, Cambridge, 1997.

22BC104-WEB TECHNOLOGIES

PREREQUISITE KNOWLEDGE: Basic Computer Programming

L	T	P	C
3	0	2	4

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the basic concepts used to develop static web pages and it also provides knowledge of Internet programming concepts. Further, this course is to build web applications using HTML, CSS, and client side script technologies that span multiple domains.

MODULE-1

UNIT-1 **8L+0T+8P=16Hours**

HTML BASICS

Coding Basics: HTML Syntax, html, head, title, and body tags, Headings, paragraphs and lists, The strong and em tags, The doctype, The lang attribute, The meta tag, and the Unicode character set.

Coding Links: Absolute & Relative URLs: Anchor tags and hrefs, Linking to other websites, Linking to pages within a website, Opening a link in a new browser window/tab.

Adding Images: The break tag, The image tag, and source attribute, Using the width, height, and alt attributes, Using horizontal rules, tables, forms, and frames.

UNIT-2 **8L+0T+8P=16 Hours**

CASCADING STYLE SHEETS & DIV TAGS

Cascading Style Sheets (CSS): The style tag, Tag selectors, font size, font family, color, & line-height properties, and Hexadecimal color codes.

CSS Properties: Text, background, border, list and font.

CSS Class Selectors: The class attribute, CSS class selectors, The span tag, CSS opacity.

Div Tags, ID Selectors, & Basic Page Formatting: Dividing up content with the div tag, Assigning IDs to divs, Setting width & max-width, CSS background color, Adding padding inside a div, Centering content, CSS borders, CSS shorthand & the DRY principle.

PRACTICES:

- Practice Basic HTML tags
- Create links on same page and other pages
- Insert images on a web page
- Create lists on a web page
- Create Tables on a web page
- Create forms such as login form and registration form etc.
- Working with Frames
- Add different types of CSS to web pages
- Usage of div tag in the web page
- Create a personal website using HTML and CSS.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

JAVA SCRIPT

Java Script: Introduction, Document Object Model, Language Syntax, Variable declaration, Operators, Control Statements, Understanding Arrays, Function Declaration.

Built-in Functions: Standard Date and Time, String, Array and Math.

UNIT-2 **8L+0T+8P=16 Hours**

HTML FORM VALIDATIONS

HTML Form Validations: HTML Document Object Model, Working with HTML form and its elements.

Working with Objects and Classes: Working with Objects, Call method in JavaScript, Inheritance in JavaScript using prototype.

Java script Events: Keyboard events, mouse events, form events.

PRACTICES:

- Practice basic JavaScript programs such as the variable declaration and operators
- Usage of Control Statements in JavaScript
- Creating and accessing arrays in JavaScript
- Working with functions in JavaScript
- Perform validations on HTML forms using JavaScript
- Working with Cookies
- Create JavaScript Objects and Classes
- Apply JavaScript on HTML and CSS webpages

SKILLS:

- Apply the CSS and JavaScript on HTML web pages.
- Develop static web pages.
- Create dynamic websites.

ACTIVITIES:

- Installing different IDEs.
- Developing and debugging programs in different IDEs.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiar with HTML Tags	Apply	1	1, 2, 3, 4, 5, 9, 10, 12
2	Create static web pages using forms	Apply	1	1, 2, 3, 4, 5, 9, 10, 12
3	Apply Cascading Style Sheets and Div Tags to HTML static webpages	Apply	1	1, 2, 3,4,9,10,12
4	Familiar with JavaScript functions and form validations.	Analyze	2	1, 2, 3,4, 5, 9, 10, 12
5	Design and develop dynamic websites	Evaluate	2	1, 2, 3,4, 5, 9, 10, 12

TEXT BOOKS:

1. Jon Duckett, "Beginning Web Programming with HTML, XHTML, and CSS", 2nd Edition, Wiley India Pvt. Ltd, 2008.
2. Julie C. Meloni , "HTML, CSS, and JavaScript All in One", Sams Teach Yourself, 3rd Edition, Pearson, 2015.

REFERENCE BOOKS:

1. Chris Bates, "Web Programming, Building Internet Applications", 3rd Edition, Wiley Dream Tech, 2006.
2. Jon Duckett, "HTML & CSS: Design and Build Websites", 1st Edition, John Wiley & Sons, 2011.
3. Uttam K Roy, "Web Technologies", 2nd Edition, Oxford University Press, 2010.
4. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, "Mastering Html, CSS & JavaScript Web Publishing", 7th edition, BPB Publications, 2015.

22BC105-MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Mathematics

COURSE DESCRIPTION AND OBJECTIVES:

Discrete Mathematical structures course introduces mathematical foundations require for any computer science and information technology student. In addition, this course introduces mathematical facts and their applications with logical and mathematical thinking.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

PROPOSITIONAL LOGIC

Propositional logic - applications of propositional logic, propositional equivalences. Normal Forms.

UNIT-2 **8L+8T+0P=16 Hours**

PREDICATES AND QUANTIFIERS

Predicates and quantifiers, nested quantifiers; Rules of inference –Introduction to proofs, methods of proof.

PRACTICES:

- Problems to Check whether the given Proposition is Tautology / Contradiction / Contingent
- Problems on DNF / CNF
- Applying Predicate logic to prove the arguments
- Problems on Methods of Proof

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

RELATIONS

Relation: Computer representation of Set, Properties, Cartesian product, Inclusion-Exclusion, Relation, Applications, Representation of Relation, Closure of Relation, Equivalence Relation, Partial Order Relation, Hasse Diagrams

UNIT-2 **8L+8T+0P=16 Hours**

RECURRENCE RELATIONS

Recurrence Relation: Applications, Linear Homogeneous Recurrence Relation with Constant Coefficients, Non-Homogeneous Linear Recurrence Relations, Using Generating Functions to Solve Recurrence Relations.

PRACTICES:

- Problems on Properties of Relation
- Problem to check whether given relation is Equivalence Relation / Partial Order Relation
- Finding closure of a relation
- Drawing Hasse Diagram
- Applications of Recurrence Relations
- Solving Homogeneous and Non Homogeneous Recurrence Relations

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Develops** Mathematical reasoning to read, analyze, and build arguments in mathematics.	Apply	1	1, 2, 9, 10, 12
2	**Make use of** mathematical logic, Methods of proof to construct proofs.	Apply	1	1, 2, 5, 9, 10 12
3	**Application of** Relations recurrently to find the solutions	Analyze	2	1, 2, 3, 5, 9, 10, 12
4	**Understands** various types of Relations and their application in Data structures, DBMS, Design of Algorithms etc.,	Analyze	2	1, 2, 9, 10, 12

TEXT BOOK:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications with Combinatorics and Graph Theory", 7th Edition, MGH, 2012.

REFERENCE BOOKS:

1. Thomas Koshy, "Discrete Mathematics with Applications", 1st Edition, Elsevier, 2003.
2. Tremblay J. P. and Manohar R., "Discrete Mathematical Structures", MGH, 1997.
3. BernandKolman, Roberty C. Busby and Sharn Cutter Ross, "Discrete Mathematical Structures", 2nd Edition, Pearson Education/Prentice Hall India, 2013.
4. Garry Haggard, "Discrete Mathematics for Computer science", 1st Edition, Thomson, 2007.
5. J.L. Mott, A. Kandel and T.P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2nd Edition, Prentice Hall India, 2009.
6. Grass Man and Trembley, "Logic and Discrete Mathematics", 2nd Edition, Pearson Education/Prentice Hall India, 2013

22BC106-IT WORKSHOP & TOOLS

L	T	P	C
0	0	4	2

PREREQUISITE KNOWLEDGE: Computer Knowledge

COURSE DESCRIPTION AND OBJECTIVES:

This course exploresthe students towards the computer anatomy, office tools like word, excel, power point presentation and basics of computer networks. Make the student to prepare the reports and documents for the assignments, home tests and projects which will be carried out during their academic activities. In addition, it aims to make the student to create and develop documents and power point presentation using latex also.

MODULE-1

UNIT-1 **0L+6T+10P=16 Hours**

INTRODUCTION TO COMPUTER COMPONENT AND COMPUTER NETWORKS

Computer Components and MS Office: Introduction to Computers, Basic Components of PC, Network Essentials, System Security, Networking basics,Uses of network, Types of computer networks, Network hardware.

UNIT-2 **0L+6T+10P=16 Hours**

COMPUTER NETWORKS AND MS-OFFICE

Computer Networks: Layers of networks, Devices of computer networks.

MS Word: Design Certificate and Resume, Creating a Newsletter, Preparation of a single column Report, IEEE format and Springer format.

MS Excel: Prepare invoice and purchase order for the M & M Pvt.Ltd., Calculating GPA marksheet report.

MS PowerPoint: Prepare a PowerPoint template for department facilities, Create a Business Agenda Slide in a PowerPoint presentation, Create Animation and Transitions based company profile presentation slide

PRACTICES:

- Create a network using different devices.
- Design a certificate for cricket sport.
- Creation of projects and Newsletter using MS Word
- Create a single column document for any topic regrading concert subject.
- Prepare an IEEE format using following.
    - Insert a multiple types of tables
    - Insert a Figures
    - Insert an Equations
- Prepare a Springer format using following.
    - Insert a horizontal and vertical tables
    - Insert multiple figures in column wise
    - Insert multiple figures in a row wise
    - Insert multiple figures in both row and column wise
    - Insert an Equations

- Spreadsheet basics, modifying worksheets, formatting cells, formulas and functions, sorting and filtering, charts using MS Excel.
- Prepare invoice and purchase order for the M & M Pvt. Ltd.
- Calculating CGPA mark sheet report in bar chart, pie chart.
- Create PowerPoint presentations for any concept using power point screen, working with slides, add content, work with text, working with tables, graphics, slide animation, reordering slides, adding sound to a presentation using MS PPT.

MODULE-2

UNIT-1 **0L+6T+10P=16Hours**

LATEX

Introduction to Latex:Introduction, Scope of Latex, Overview of Overleaf: Different types of the files.

Latex Installation and Demonstration: Texstudio and Textlive/Miktex.

UNIT-2 **0L+6T+10P=16 Hours**

LATEX DOCUMENT PREPARATION

Preparation of document structure, create mathematics equation, add tables, figures; header and footer, bibliographyfor article, creating a newsletter, preparation of a single column report, IEEE format, springer format and Presentation with beamer package.

PRACTICES:

- Install TexLive software and supporting files.
- Create sample document in Overleaf.
- Create sample document file in in Latex desktop software.
- Creation of projects and Newsletter using LaTeX.
- Create a single column document for any topic regrading concert subject in latex.
- Prepare an IEEE format using following in latex.
    - Insert a multiple types of tables
    - Insert a Figures
    - Insert an Equations
- Prepare a Springer format using following in latex.
    - Insert a horizontal and vertical tables
    - Insert multiple figures in column wise
    - Insert multiple figures in a row wise
    - Insert multiple figures in both row and column wise
    - Insert an equation
- Prepare a Springer format using following in latex.
    - Insert references
    - Insert multiple figures in column wise
    - Insert multiple figures in a row wise
    - Insert multiple figures in both row and column wise
    - Insert an equation
- Create PowerPoint for any topic using Latex.

SKILLS:

- Basicsof computer components and computer networks.
- Installation of operating system and secure the system.
- Hands on text processing and typesetting software, simple data analysis and data presentationtools.
- Create reports and article in proper format.

ACTIVITIES:

- Design and developing of MS Office and Latex documents.
- Design IEEE and Springer formats.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Design** and code the documents and presentations using typesetting system Latex.	Apply	1, 2	1,2,3,5,9,10,12
2	**Apply** to IEEE and Springerdocuments.	Apply	2	1,2,3,5,9,10,12
3	**Analyse** various types of networks, types of services and devices used to transfer data over the networks.	Analyse	1	1,2,3,5,9,10,12
4	**Analyse** Spreadsheets	Analyse	2	1,2,3,5,9,10,12
5	**Create** word documents, presentations, spread sheets by applying required features.	Create	2	1,2,3,5,9,10,12

TEXT BOOKS:

1. Priti Sinha and Pradeep K. Sinha, "Computer Fundamentals: Concepts, Systems and Applications", 8th Edition, BPB Publications, 2004
2. Stefan Kottwitz, "LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX", 2nd Edition, Kindle, 2021.

REFERENCE BOOKS:

1. Michael R. Miller," Computer Basics Absolute Beginner's Guide, Windows 8 Edition", 6th Edition, Kindle Edition,2012.
2. Satish Jain, Shalini Jain and M.Geetha, " Basic Computer Course Made Simple" PBS Publications, 2016.
3. John MonyjokMaluth, "Basic Computer Knowledge", 5th Edition, Kindle, 2016.
4. Antoni Diller, "LaTeX: Line by Line: Tips and Techniques for Document Processing", 2nd Edition, Wiley, 1998.

22BC108-PYTHON PROGRAMMING

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Computer Programming

COURSE DESCRIPTION AND OBJECTIVES:

This course offers sufficient knowledge required to understand the fundamental concepts of Python programming language. This course enables students to choose appropriate data structures like lists, dictionaries, tuples, sets, strings for the given problem. In addition, the students will be able to create reliable, modular and reusable applications using Object- Oriented Programming approaches.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

PYTHON BASICS

Python Installation and Working of it, get familiar with python variables and data types, Operator understanding and its usage, detail study of python blocks, Hands on with conditional blocks using if, else and else if

UNIT-2 **10L+0T+10P=20 Hours**

WORKING WITH VARIETIES OF DATA

Hands on string handling and looping with range, list, Tuples, Sets and dictionaries. hands on to organize python code with function, modular approach in python.

PRACTICES:

- Installation of python and relevant packages in windows.
- Installation of python and relevant packages in Linux.
- Practice Execution of python statements in REPL(shell).
- Implement a python program to display all the python keywords and display each of them in separate lines.
- Develop a python program to read two integers and perform all possible arithmetic operations on those two numbers.
- Develop a program to accept three numbers as command line arguments and find biggest, smallest and average of those three numbers.
- Implement a python program to find first n Prime Numbers.
- Implement a program that prints the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/n.
- Implement a python program to read n and find sum of even and odd numbers.
- Write python code to achieve the following
- to remove vowels in the given string using control transfer statements.
- to count number of uppercase and lowercase letters in the given string.
- to remove all punctuation characters from given string.
- Implement python code to illustrate the following on Lists and Tuples
- Creation b) Accessing elements c) apply operators d) Usage of different methods
- Implement python code to illustrate the following on Sets and Dictionary
- Creation b) Accessing elements c) apply operators d) Usage of different methods
- a) Implement python code to illustrate the following
- Positional arguments ii) Keyword arguments iii) Default arguments iv) Variable length arguments
- Implement a function to find nth Fibonacci number.
- Develop a recursive function to find the factorial of a given number.
- Implement function to compute GCD, LCM of two numbers (use Lambda function)

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

EXCEPTION AND FILE HANDLING

Handling and helping file operations, coding with the exceptional handling

UNIT-2 **8L+0T+8P=16 Hours**

OBJECT-ORIENTED PROGRAMMING

Object-Oriented Programming, Classes and working with instances, Method overloading, Polymorphism

PRACTICES:

- Develop a python code to handle the following built-in exceptions
- ValueError ii) ZeroDivisionError iii) TypeError iv) NameErrror
- Implement python code to handle multiple exceptions.
- Implement Python code to raise an exception.
- Implement python code to read contents of a file and write the contents to another file.
- Create a class called Student and perform operations such as display, Calculate percentage, add, delete and modify student data.
- Design python code to depict the following oops concepts: i) Datahiding ii) Inheritance iii) Overriding
- Develop python code to calculate the following statistical parameters using python 'numpy'.
- Mean b) Hormonic Mean c) Meadian d) Mode e) Standard Deviation f) Variance g) Percentile
- Design python code to illustrate the following plots using 'matplotlib' package
- Line plot b) Bar plot c) Histogram d) Scatter Plot
- Implement python program for the following problems on Pandas DataFrame
- Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels. Sample Python dictionary data and list labels:
- exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],
  'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
- 'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
  'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
- labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']
- Write a Pandas program to select the 'name' and 'score' columns from the following DataFrame.
- Write a Pandas program to select the specified columns and rows from a given data frame.
- Write a Pandas program to select the rows where the number of attempts in the examination is greater than 2.
- Write a Pandas program to count the number of rows and columns of a DataFrame.
- Write a Pandas program to change the name 'James' to 'Adhvik' in name column of the DataFrame.

SKILLS:

- Identify suitable data types and data structures required for an application
- Design structured and Object oriented programming solutions
- Design reliable applications for a given problem.

ACTIVITIES:

- **Recruit New Members**

Description:

Suppose you are a manager as a big firm and now are looking for new members for your team. You sent out an advertisement and have received a few applications. You have a habit of scoring people on a scale of 100. You have given scores to all the members of your team and the new applications. The process of selection is going to be very straightforward if the applicant improves the average of the team then you hire the applicant to join the team or else reject the application. Remember the order of processing applications is going to be important here.

You may see this as an extension of the previous problem, which it is. You may use the code written in the previous question as a function to improve the code quality.

Input:

Two lists on two separate lines.
The first line will have the list of scores of current team members
The second line will have the list of scores of the applicants.

Output:

The list consisting of scores of the final team after hiring from the pool of applicants.

Sample input:

[23,45,34,76]
[70,34,94]

Sample output:

[23, 45, 34, 76, 70, 94]

- **Fenced Matrix**

Description:

You will be given two positive integers m and n. You have to make a list of lists (which can be visualised as a matrix) of size m*n, that is m sublists (rows), with each sublists having n integers (columns). The matrix should be such that it should have 1 on the border and 0 everywhere else. See sample input and output for more clarification.

Input:

Two integers separated by a space

Output:

A list of lists of size m*n printed like matrix as shown in the sample output.

Sample input:

3,3

Sample output:

[1, 1, 1]

[1, 0, 1]

[1, 1, 1]

- **Anagrams**

Description:

Two strings are anagrams of each other if you can rearrange the characters of one string to make the other string.
Given two strings, can you find if they are anagrams or no?

Input:
Two lines of input, each line will contain a string without space.
Output:
True or False based on whether the strings are anagrams or not.

Sample input:
thing
night
Sample output:
True

- **Cheapest Item**

Description:

You will be given a dictionary with keys as items and values as their prices. You have to print the cheapest item.

Sample input:
A single line non-empty dictionary
Sample output:
cheapest_item name: cheapest_item_cost

Sample input:
{'mobile1':10000, 'mobile2':11000, 'mobile3':13000, 'mobile4':9000, 'mobile5':15000, 'mobile6':16000, 'mobile7':17000, 'mobile8':18000, 'mobile9':19000}
Sample output:
mobile4: 9000

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Experiment with** the basic terminology used in computer programming to write, compile and debug programs in python language.	Apply	1	1,2,3,4,5,9,10,12
2	**Make use of** different data types to design programs involving decisions, loops, and functions. .	Apply	1	1,2,3,4,5,9,10,12
3	**Apply** functional, reliable and user-friendly python programs for a given problem application.	Apply	1	1,2,3,4,5,9,10,12
4	**Develop** solutions using the concepts of object oriented programming paradigm.	Apply	2	1,2,3,4,5,9,10,12
5	**Analyze** the usage of different data structures for practical and contemporary applications which uses data stored in files.	Analyze	1,2	1,2,3,4,5,9,10,12

TEXT BOOK:

1. ReemaThareja, "Python Programming: Using Problem Solving Approach", 1st Edition, Oxford University Press, 2017.

REFERENCE BOOKS:

1. EricMatthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 2ndEdition, No Starch Press, 2019.
2. John V. Guttag, "Introduction to Computation and Programming Using Python", 3rd Edition, The MIT Press, 2021
3. Allen B. Downey," Think Python", 2nd edition, O'rielly publishing, 2015.
4. VamsiKurama, "Python Programming: A Modern Approach", 1st Edition, Pearson Publishers, 2018.

22BC109-DATA STRUCTURES

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Computer Programming

COURSE DESCRIPTION & OBJECTIVES:

This course is aimed at offering fundamentals concepts of data structures and explains how to implement them. It begins with the basic concepts of data, data structures and then introduces the primitive and non-primitive data structures in detail. It forms the basis for understanding various ways of representing data and its usage in different computing applications.

MODULE -1

UNIT-1 **8L+0T+8P=16 Hours**

INTRODUCTION

Data Structures Basics: Basic terminology – data, information, datatype; Data Structures – Introduction, storage structures- sequential and linked storage representations; classification of data structures; Applications of data structures.

Searching: Linear Search and Binary Search

Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort.

UNIT-2 **8L+0T+8P=16 Hours**

LINKED LISTS, STACKS, QUEUES

Linked Lists: Introduction, Types of linked list – Singly linked list, doubly linked list and circular linked list, representation of linked list, Operations of linked list. Traverse forward/ reverse order, searching, insertion into, deletion for linked lists; Multi lists; Applications of linked lists.

Stacks & Queues: Stacks – Introduction, array and linked representations, implementation and their applications; Queues – Introduction, array and linked representations, implementation and their applications; Types – Linear, circular and doubly ended queues – operations; Applications of Queues.

PRACTICE PROBLEMS ON RECURSION – LEVEL 1

- Find the product of 2 numbers using recursion
- Find the sum of natural numbers using recursion
- Find the factorial of a number using recursion
- Find the Nth term of Fibonacci series using recursion
- Calculate the power using recursion
- Write a recursive program for checking if a given number is a prime number
- Given two integers write a function to sum the numbers without using any arithmetic operators
- Convert a decimal to binary using recursion
- Print all factors using recursion
- Find the maximum product of digits among numbers less than or equal to N

PRACTICE PROBLEMS RECURSION – LEVEL 2

- Implement insertion sort recursively
- Write a program to find the numbers less than N that are product of exactly 2 distinct prime numbers - using recursion
- Implement selection sort recursively
- Find the middle of a singly linked list using recursion
- Find the sum of even numbers of an array using recursion
- Check if a given array is in sorted order using recursion
- Print alternate nodes of a linked list using recursion
- Reverse a doubly linked list using recursion
- Write a recursive function that returns all permutations of a given list
- Implement bubble sort recursively

PRACTICE PROBLEMS ON SORTING AND SEARCHING – LEVEL 1

- Implement linear search function
- Implement binary search function
- Implement iterative search function
- Implement the insertion sort function
- Implement the bubble sort function
- Implement the quick sort function
- Implement the merge sort function
- Implement the quick sort function
- Implement the heap sort function
- Implement the radix sort function

PRACTICE PROBLEMS ON STACKS – LEVEL 1

- Implement two stacks using a single array
- Given an array replace every element with nearest greater element on the right
- Given a stack reverse the elements using only push and pop functions
- Postfix evaluation using stack
- Maximum sum in sliding window
- Balance symbols
- Find middle element in a stack
- Remove middle element from a stack
- Implement push and pop using linked list
- Given an array of characters with the middle marked by X, check if the string is a palindrome

PRACTICE PROBLEMS ON QUEUES – LEVEL 1

- Write a program to accept two numbers as input check if they are equal
- Write a program to accept two characters as input and check if they are equal
- Write a program to accept two numbers as input and print the greater of the 2 numbers
- Write a program to accept two numbers as input and print the lesser of the 2 numbers
- Write a program to accept 3 numbers as input and print the maximum of the 3
- Write a program to accept 3 numbers as input and print the minimum of the 3
- Write a program to accept a number as input and print EVEN if it is an even number and ODD if it is an odd number

- Write a program to accept a number as input and check if it is divisible by 3. If it is divisible by 3 print YES else print NO
- Write a program to accept a number as input and check if it is divisible by both 3 & 5. If it is divisible print YES else print NO
- Write a program to accept a number as input and check if it is positive, negative or zero.

PRACTICE PROBLEMS ON SLL – LEVEL 1

- Implement the insert function to insert nodes into a singly linked list (ascending order)
- Implement the insert function to insert nodes into a singly linked list (descending order)
- Implement the search node function
- Implement the delete node function
- Display forwards function
- Display backwards function
- Count the number of nodes in a singly linked list
- Swap alternate nodes of a singly linked list
- Move last node to the front of the linked list
- Move first node to the last of the linked list

PRACTICE PROBLEMS ON DLL – LEVEL 1

- Implement insert function
- Implement display forward function
- Implement display backward function
- Implement search function
- Implement delete function
- Reverse a doubly linked list from M to N
- Find the sum of the odd and even nodes
- Count odd keys of the linked list
- Merge two sorted lists
- Delete adjacent duplicate nodes

PRACTICE PROBLEMS ON CLL – LEVEL 1

- Insert function (circular doubly linked list)
- Search function
- Display forward
- Display backward
- Delete node (circular doubly linked list)
- Print the middle N nodes of a circular singly linked list
- Move the last node of a circular singly linked list to the beginning
- Delete adjacent duplicate nodes of a circular singly linked list
- Delete nodes greater than a value from a circular doubly linked list
- Find the sum of the nodes of a circular linked list

PRACTICE PROBLEMSON LINKED LIST – LEVEL 2

- Given 2 sorted linked lists, print the common elements
- Reverse a list (using Stack)
- Given a pointer to a node (not the last node), delete the node
- Reverse a list (Recursive)
- Reverse a list (Iterative)

- Reverse a singly linked list in pairs (recursive)
- Reverse a singly linked list in pairs (iterative)
- Check if a singly linked list is a palindrome or not
- Remove the loop if exists
- Given 2 linked lists with data in the ascending order, merge them into a single list

MODULE -2

UNIT -1 **8L+0T+8P=16 Hours**

TREES & HASHING

Trees: Introduction, Properties, Binary Tree – Introduction, properties, array and linked representations; Tree traversals and their implementation; Expression trees; BST – definition and operations, AVL trees – definition and construction; Applications of binary trees.

Hashing: Introduction, Different hash functions, collision-collision avoidance, handling methods

UNIT-2 **8L+0T+8P=16 Hours**

GRAPHS

Graphs: Introduction, Properties, Graphs representations – adjacency matric, adjacency list, set representation; Traversals - breath first search and depth first search; Applications of graphs.

PRACTICE PROBLEMS ON BST – LEVEL 1

- Insert function
- Insert function (recursive)
- Search function
- Pre order traversal
- Post order traversal
- In order traversal
- Level order traversal
- Delete child node
- Delete parent node
- Delete nodes greater than a value from a circular doubly linked list

PRACTICE PROBLEMS ON PRIORITY QUEUES – LEVEL 1

- Meeting rooms problem
- Ugly number
- Find median from data stream
- Find the top K frequent elements
- Find K Pairs with smallest sums
- Find the Kth smallest element in a sorted matrix
- Trapping Rain Water
- Rearrange String k distance apart
- Sort characters by frequency
- Solve the maze problem

PRACTICE PROBLEMS ON GRAPHS – LEVEL 1

- Implement Graph data structure
- Implement BFS - iterative solution
- Implement BFS - recursive solution

- Implement DFS - iterative solution
- Implement DFS - recursive solution
- Check if given graph is strongly connected or not
- Check if given graph is strongly connected or not - using DFS
- Given a graph find the arrival and departure time of its vertices in DFS. Arrival time is the time when the vertex was explored for the first time, and departure time is the time at which all the neighbours are explored and are ready to backtrack
- Given a directed acyclic graph and a source vertex, find the cost of the shortest path from source vertex to all other vertices present in the graph. If a vertex cannot be reached from given source vertex that distance may be printed as infinite
- Given an undirected graph, check if the graph is 2 edge connected or not

PRACTICE PROBLEMS ON HASHING – LEVEL 1

- Print a binary tree in vertical order
- Find whether an array is subset of another array
- Given an array A[] and a number x, check for pair in A [] with sum as x
- Minimum operation to make all elements equal in array
- Maximum distance between two occurrences of same element in array
- Check if a given array contains duplicate elements within k distance from each other
- Find duplicates in a given array when elements are not limited to a range
- Most frequent element in an array
- Smallest subarray with all occurrences of a most frequent element
- First element occurring k times in an array

PRACTICE PROBLEMS ON GRAPHS – LEVEL 2

- Find the shortest graph distances between every pair vertices in a given path. Assume that the graph does not have any negative edges
- Find the shortest graph distances between every pair of vertices in a given path. The graph can have negative edges
- Detect cycle in DFS
- Count the number of connected components of a graph represented in the adjacent matrix
- Count the number of connected components of a graph represented in the adjacent matrix - using DFS
- Find a spanning tree - not necessarily a minimum spanning tree
- Detect cycle in an undirected graph
- Given an undirected graph, find its depth
- Determine if a directed graph has a unique topological ordering
- Given a directed acyclic graph and two vertices v and w, find the lowest common ancestor

SKILLS:

- Experienced to Store data and various types of data to handle
- Ordering and sorting of data
- Indexing and Searching of required data from large data sequences
- Exposed to various characteristics such as Linear or non-linear, Homogeneous or heterogeneous and Static and Dynamic

ACTIVITIES:

- Analyze the data structures required for various applications
- Implement array or linked lists for a given scenario
- Describe pros and cons of each data structure
- Implementation of various trees and graphs for a given scenario

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

No.	Course Outcome	Blooms Level	PO
1	Understand the organization of several ADTs and the manipulation (searching, insertion, deletion, traversing) of data stored in various data structures.	Understand	1
2	Apply different data structures to solve a given problem.	Apply	1
3	Analyze the efficiency of using different data structures and choose the efficient data structure for solving a given problem.	Analyze	2
4	Develop new algorithms to solve various problems.	Implement	3,4

TEXT BOOK:

1. D Samantha, "Classic Data Structures", 2nd Edition, Eastern Economic Prentice hall private limited press, 2000.

REFERENCE BOOKS:

1. Ellis Horowitz and SartajSahni, "Fundamentals of Data Structures", illustrated edition, Computer Science Press, 2006.
2. Mark Allen Weiss, "Algorithms, Data Structures and Problem Solving with C++ illustrated", 2nd edition, Addison-Wesley publishing company, 2002.
3. R G Dromey and Pearson, "How to solve it by Computer", 2nd edition, Impression edition, 1998.

22BC110-PROBABILITY AND STATISTICS

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic knowledge in statistics and mathematics

COURSE DESCRIPTION AND OBJECTIVES:

To provide students with foundation in elementary topics of statistics and probability such as descriptive statistics, correlation, probability, random variables, correlation, regression, and testing of hypothesis. The course emphasizes statistics to solve engineering and management problems.

MODULE-I

UNIT-1 **4L+0T+8P = 12 Hours**

DESCRIPTIVE STATISTICS

Basic Definitions, Frequencies, Graphical Representation, Histogram, Ogive curves; Measures of Central tendency, Arithmetic mean, Median, Mode, Mean deviation, Standard deviation; Symmetry and Skewness, Karl Pearson's Coefficient of skewness.

UNIT-2 **4L+0T+14 = 18 Hours**

PROBABILITY AND RANDOM VARIABLES

Probability: Introduction, Definition (Classical and Axiomatic approach), Addition theorem, Conditional probability, Multiplication theorem and Bayes theorem.

Random Variables: Random variables, Discrete and Continuous variables and distribution function.

PRACTICES:

- Various graphical presentation techniques
- Measures of central tendency
- Skewness
- Karl Pearson's coefficient of skewness
- Definitions of probability
- Applications of addition theorem
- Applications of multiplication theorem
- Applications of conditional probability
- Random variables and types of random variables
- Distribution function

MODULE -II

UNIT-1 **4L+0T+8P = 12 Hours**

REGRESSION ANALYSIS AND DISTRIBUTIIONS

Correlation and regression: Correlation, Types, Pearson's Coefficient of correlation, Regression, Regression lines.

Distributions: Introduction to Distributions: Binomial, Poisson and Normal distributions with properties and applications.

UNIT-2 **4L+0T+14P = 18 Hours**

TESTING OF HYPOTHESIS

Testing large samples-one mean, two means, one proportion and two proportions. Testing small samples- one mean, two means (independent and paired samples), Chi square tests-goodness of fit and independence of attributes.

PRACTICES:

- Correlation
- Types of correlation
- Karl Pearson's coefficient of correlation
- Regression and regression lines
- Binomial distribution
- Poisson distribution
- Normal distribution
- Testing the large sample tests-one mean and two sample means
- One proportion and two proportion tests
- Testing small samples-one, two samples and paired tests
- Chi-square test for goodness of fit
- Chi-square test for independence of attributes

SKILLS:

- Collect the data from various data sources and evaluate mean, median, mode mean deviation and standard deviation
- Identify the areas which we can apply the probability theory

ACTIVITIES:

- Collection the data from various sources and evaluate the correlation between the variables
- Develop the regression model based on the collected data from the data.gov in or Kaggle or data world
- Identify the situations we can apply binomial, Poisson, and Normal distributions

COURSE OUTCOMES:

By the end of this course, it is expected that the student will be able to learn the following aspects:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Understand data using measures of central tendency, skewness, Karl Pearson's coefficient of skewness	Apply	1	1,2
2	Understand the probability theory and their applications	Apply	1	2
3	Study the relations between statistical variables and can fit the mathematical models for association	Analyze	2	3
4	Understand the large sample tests and their applications	Analyze	2	4
5	Understand the small sample tests and chi-square tests	**Analyze**	**2**	**5,6**

TEXT BOOKS:

1. Sheldon M. Ross, An Introduction to Probability and Statistics for Engineers and Scientists, 3rd Edition, Academic Press, Elsevier.
2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 2012.

REFERENCE BOOKS:

1. P. R. Vittal, "Mathematical Statistics", Margham Publications, Chennai, 2018.
2. Kishore S. Trivedi, "Probability and Statistics with Realiability, Queueing and Computer Science Applications", 2nd edition, Wiley Student edition, 2008.
3. A. Singaravelu, "Probability and Statistics", 22nd edition, Meenakshi Agency, 2015.

22BC111-ENVIRONMENTAL STUDIES

L	T	P	C
1	2	0	2

PREREQUISITE KNOWLEDGE: General awareness regarding environmental problems and importance of environmental protection.

COURSE DESCRIPTION AND OBJECTIVES:

It is a multidisciplinary subject where different aspects of society and environment are dealt using a holistic approach. Itis evolving to be the education for sustainable and ethical development both at a local and globallevel. It helps to prepare the next generation for planning appropriate strategies to address environmental issues. It identifies and creates solutions that conserve to manage ecosystem and biodiversity and helps to eliminate pollutants, toxicants, preserve air, water and soil quality. Environmental education recognizes impacts of global issues, enhances the public awareness and helps to takedecisions towards environmentally responsible actions.

MODULE-1

UNIT-1 **4L+8T+0P=12 Hours**

INTRODUCTION TO ENVIRONMENT: NATURAL RESOURCES, ECOSYSTEMS AND BIODIVERSITY

Environment and sustainable development; Natural resources- forest, water, energy and land resources; Ecosystem–basic structural components, function and interactions in ecosystem, ecological succession.

UNIT-2 **4L+8T+0P=12 Hours**

BIODIVERSITY AND CONSERVATION

Introduction to biodiversity, types of biodiversity- species, genetic and ecosystem diversity; Threats to biodiversity - natural and anthropogenic, species extinctions, man wildlife conflicts; Biodiversity conservation - principles and strategies; in-situ and ex-situ conservation.

PRACTICES:

- Visit to a Biogas plant, Solar Power plant
- Visit to a local area: river/pond/lake/forest / grassland / hill /mountain and study of different
- types of ecosystems, biodiversity study and documentation (herbarium sheet preparation).
- Set up an aquarium
- Case study: Renewable energy use

MODULE-2

UNIT-1 **4L+8T+0P=12 Hours**

ENVIRONMENTAL POLLUTION AND CLIMATE CHANGE

Air, water, soil, radioactive and noise pollution; Study of different pollutants (SO_x, NO_x, PAN, PAH etc.); Toxicity study; Climate change- greenhouse effect, acid rain, ozone layer depletion.

UNIT-2 **4L+8T+0P=12 Hours**

POLLUTION CONTROL DEVICES AND WASTEWATER TREATMENT TECHNOLOGIES

Air pollution control devices - Gravitational settling chambers, cyclonic separators, electrostatic precipitators, fabric filters and bio filters, Wastewater management.

PRACTICES:

- Visit to a sewage treatment plant and wastewater analysis
- Case study: Recycling Technologies
- Case study: Effects of contaminants on microorganisms
- Report writing: 12 principles of green chemistry for environmental sustainability
- Report writing: Environmental Impact Analysis, Local Disaster Management Plan.

SKILLS:

- Create a biodiversity map of any habitat/ecosystem
- Strategize different ways of using renewable energy resources
- Design novel strategies and approaches for pollution control and waste management

ACTIVITIES:

- Study of species interaction and biodiversity of any ecosystem.
- Study sustainable resource utilization methods.
- Study the effects of environmental contaminants on any ecosystem.
- Analyze local pollution control methods and waste management approaches.
- Create awareness campaigns for use of renewable resources and sustainable products.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic concepts of sustainable development, natural resource utilization and ecology for the purpose of environmental protection	Apply	1	1,6,7, 9, 10, 11, 12
2	Design remediation technologies for their abatement	Apply	2	1, 3,6,7, 9, 10, 11, 12
3	Analyze the biodiversity of different ecosystems and formulate various conservation approaches	Analyze	1	1, 7, 8, 9, 10, 11, 12
4	Analyze the presence of various environmental pollutants	Analyze	2	1, 6,7,9, 10, 11, 12
5	Recommend various waste management approaches and their implementation strategies	Evaluate	2	1,2, 7,8,9,10,11, 12

TEXT BOOKS:

1. Kaushik and C. P. Kaushik, “Perspectives in Environmental Studies”, 5th edition, New Age International Publishers, 2016.
2. Y. Anjaneyulu, “Introduction to Environmental Science”, B. S. Publications, 2015.

REFERENCE BOOKS:

1. B. Joseph, “Environmental Studies”, 2nd edition, Mc Graw Hill Education, 2015.
2. S. Subash Chandra, “Environmental Science”, New Central Book Agency, 2011.
3. MahuaBasu&S.Xavier, “Fundamentals of Environmental Studies”, Cambridge University Press, 2016.
4. K. Mukkanti, “A Textbook of Environmental Studies”, S. Chand Company Ltd., 2009.
5. M. Anji Reddy, “A Textbook of Environmental Science and Technology”, B. S. Publications, 2008.
6. K. Joseph and R. Nagendram, “Essentials of Environmental Studies”, Pearson Education Pvt. Ltd., 2007.
7. M. Chandrasekhar, “A Textbook of Environmental Studies”, Hi-tech Publications, 2006. 6.
8. C. S. Rao, “Environmental Pollution Control Engineering”, New Age International Publishers, 2001.

22BC112-FUNDAMENTALSOF NETWORKSECURITY

L	T	P	C
1	2	0	2

PREREQUISITE KNOWLEDGE: Computer Networks, Number theory and Computational Complexity

COURSE DESCRIPTION AND OBJECTIVES:

This Course focuses towards the introduction of network security using various cryptographic algorithms and understanding network security applications. It also focuses on the practical applications that have been implemented and are in use to provide email and web security.

MODULE-1

UNIT-1 **4L+8T+0P=12 Hours**

INRODUCTION AND CLASSICAL ENCRYTPION TECHNIQUES

Introduction:Securitytrends,Modelofnetworksecurity–Securityattacks, servicesandmechanisms–OSI securityarchitecture

ClassicalEncryptionTechniques: Substitutiontechniques,Transpositiontechniques,Steganography-Foundationsof modern cryptography

UNIT-2 **4L+8T+0P=12 Hours**

SYMMETRIC KEYCRYPTOGRAPHY

Symmetric KeyCryptography: SDES–Blockcipher Principlesof DES– StrengthofDES-Blockcipher designprinciples–Block ciphermode ofoperation–Evaluation criteriafor AES– Advanced Encryption Standard.

MODULE-2

UNIT-1 **4L+8T+0P=12 Hours**

PUBLIC KEY CRYPTOGRAPHY

Public Key Cryptography: RSAcryptosystem–Keydistribution –Keymanagement–DiffieHellmankeyexchange. MESSAGE AUTHENTICATION AND INTEGRITY: Authentication requirement Authenticationfunction–MAC–Hashfunction–SecurityofhashfunctionandMAC–SHA–Digital signature.

UNIT-2 **4L+8T+0P=12 Hours**

SECURITYPRACTICEANDSYSTEMSECURITY

SecurityPracticeandSystemSecurity:ElectronicMailsecurity–PGP,IPsecurity–WebSecurity-SystemSecurity:Intruders–Maliciousoftware–viruses–Firewalls.

SKILLS:

- Knowing of Classical encryption techniques.
- Analyze Block ciphers and the Data Encryption Standard, Basics of finite fields.

- Apply Message authentication, Hash functions and algorithms, Digital signatures and authentication protocols.

ACTIVITIES:

- Will develop their skills in: the programming of symmetric and/or asymmetric ciphers and their use in the networks.
- Will learn protocols used in Web Security and Transport Layer Security

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the different cryptographic operations of symmetric cryptographic algorithms	Apply	1	1,6,7, 9, 10, 11, 12
2	Apply the different cryptographic operations of public key cryptography	Apply	2	1, 3,6,7, 9, 10, 11, 12
3	Apply the various Authentication schemes to simulate different applications.	Apply	1	1, 7, 8, 9, 10, 11, 12
4	Analyzevarious Security practicesand System security standards	Analyze	2	1, 6,7,9, 10, 11, 12

TEXT BOOK:

1. WilliamStallings,CryptographyandNetworkSecurity:PrinciplesandPractice,PHI3rd Edition, 2006.

REFERENCE BOOKS:

1. CKShyamala,N HariniandDr.T RPadmanabhan:Cryptographyand NetworkSecurity, WileIndia Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and NetworkSecurity, Tata McGraw Hill2007.
3. CharlieKaufman, RadiaPerlman, and Mike Speciner, NetworkSecurity: PRIVATE Communication in a PUBLIC World, PrenticeHall, ISBN 0-13-046019-2

22BC113-DATA VISUALIZATION LABORATORY

L	T	P	C
-	-	4	2

PREREQUISITE KNOWLEDGE: IT Workshop and Tools

COURSE DESCRIPTION AND OBJECTIVES:

Thiscoursewillintroducethemainconceptsofvisualanalyticswithahands-ontutorialusing Tableau, aleadingself-servicedata visualization tool. Further, it aims at learningabouthowtocreateeffectivechartsandinteractivedashboardswillprovidethe student avery useful skill applicable in many business scenarios.

TASK-1: INTRODUCTION TO TABLEAU

- Courseintroduction
- Datavizbest practices
- Getting started with Tableau Desktop
- Connecting to thetutorial dataset
- Creating the first charts
- Filtering and sorting data

TASK-2: COMMONCHARTS

- Creating common visualizations (bar charts, linecharts etc.)
- Assembling a dashboard layout
- Using dashboard filters

TASK-3: TRANSFORMTHE DATA

- Datavizbest practices
- Creating simple calculations in Tableau
- Using table calculations

TASK-4: INTERACTIONS

- Interactivity with text and visual tooltips
- Interactivity with actions (filter,highlight, URL)
- Drilldown between dashboards

TASK-5: ADVANCEDVISUALIZATIONS

- Datavizbest practices
- Creating more advanced chart types
- Using multiple sourcetables

TASK-6: DATA STORYTELLING

- Intro to data storytelling
- Creating adata story inTableau
- Overview of theTableau ecosystem
- Further learning opportunities

SYSTEMREQUIREMENTS:

- System requirements are listed here under Tableau Desktop and Tableau Prep: https://www.tableau.com/products/techspecs
- ThelatestversionofTableauDesktopaswellasTableauPrepshouldbedownloadedand installed from here: https://www.tableau.com/tft/activation

SKILLS:

- How to recognize good (and bad) data visualizations
- How to interpret a data visualization
- Using shapes, colors, text and layout appropriately

ACTIVITIES:

- Identifying stories and insights in data
- Preparing data for visualization
- Creating several different charts using Tableau

COURSEOUTCOMES:

The student will be able to:

• Understand and describethe main concepts of data visualization

• Create ad-hocreports, data visualizations, and dashboards using TableauDesktop

• Publish the created visualizations to Tableau Server and Tableau Public

TEXTBOOK:

1. Visualization Analysis & Design by TamaraMunzner(2014)(ISBN 9781466508910)

REFERENCE BOOKS:

1. InteractiveDataVisualization forthe Web by ScottMurray 2nd Edition (2017)
2. D3.js in Action by Elijah Meeks 2nd Edition (2017)
3. Semiology of Graphics by Jacques Bertin (2010)
4. TheGrammar ofGraphics by Leland Wilkinson
5. ggplot2 Elegant GraphicsforDataAnalysis by Hadley Wickham

22BC114-SOFT SKILLS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE KNOWLEDGE: English Communication
COURSE OBJECTIVES:

- To impart employability skills like resume preparation and facing interviews
- To enable trainees to develop interpersonal and leadership skills
- To train them on work place skills like making presentations, participating in group discussions

MODULE-1

UNIT-1 **0L+0T+16P = 26 Hours**

PERSONALITY DEVELOPMENT

a) Soft Skills: Need for soft skills, professionalism, employability skills–

b) Communication: Need for effective communication - the process of communication, levels of communication, flow of communication, choice of diction and style with reference to setting (formal, semi-formal or informal) -communication networks, barriers to communication, miscommunication, noise and ways to overcome the barriers
Practice: Self Introduction

c) Career Planning:
- Job vs. career,
- SWOT analysis

Practice: Personal and Academic SWOC

d) Johari Window
Practice: Giving and taking opinions of Self Vs others and assessing oneself.

e) Goal setting
Practice: Short, Mid and Long Term goals planning the semester

f) Time management: four quadrant system
Practice: Stephen Covey Time Management Matrix planning a semester

g) Stress-management
Practice: Questionnaire to assess level of stress

UNIT-2 **0L+0T+16P = 26 Hours**

a) Vocabulary Building:Word etymology, roots, prefixes & suffixes, synonyms & antonyms, collocations, one-word substitutes, analogies, idioms and phrases, contextual guessing of unfamiliar words, task-oriented learning
Practice: (50 words) relating to resume preparation and Interviews, newly coined words

b) Reflects of language on Personality
- Gender sensitive language in MNCs
- Mind your language

Practice: Gender sensitive words and Words acceptable in Indian context and objectionable international context

c) Seven essential skills for a team player; attentive listening, intelligent questioning, gently persuading, respecting other's views, assisting others, sharing, participating actively

MODULE-2

UNIT-1 **0L+0T+16P = 26 Hours**

a) **Functional English:** Situational dialogues, Role plays (including small talk)
Practice: Opening and closing a telephonic conversation, making an appointment, making a query, Offering/Passing on information, communicating with superiors, expressing agreement/objection, opening bank account (combination of prepared and impromptu situations given to each student)

b) **Group Discussion:** Articulation and flow of oral presentation, dynamics of group discussion, intervention, summarizing and conclusion, voice modulation, content generation, Key Word Approach (KWA), Social, Political, Economic, Legal and Technical Approach (SPELT), View Point of Affected Part (VAP), language relevance, fluency and coherence – 11th and 12th weeks
Practice: Group Discussions on various topics

c) **Resume preparation:** Structure and presentation, defining career objective, projecting one's strengths and skill-sets, summarizing, formats and styles and covering letter-

d) **Statement of Purpose Practice:** Preparing one's SoP and Resume

UNIT-2 **0L+0T+16P = 26 Hours**

a) **Facing Interviews:**
Interview process, understanding employer expectations, pre-interview planning, opening strategies, impressive self-introduction, answering strategies, other critical aspects such as body language, grooming, other types of interviews such as stress-based interviews, tele- interviews, video interviews, frequently asked questions (FAQs) including behavioral and HR questions and the aspect looked at by corporate during interviews
Practice: Mock interviews on the FAQs including feedback

b) **Presentation Skills:** Selection of a topic, preparing an abstract, gathering information, organizing the information, drafting the paper, citing reference sources – writing striking introductions, discussing the methodology used, developing the argument, presentation style, language, presenting the paper and spontaneously answering audience questions
Practice: oral presentation with the help of technology (Preparing PPT and presenting)

Skills:

- Balance social and emotional intelligence quotients though SWOC, JOHARI etc. activities
- Prepare tailor made resume and face various job interviews with enriched personality traits
- Career planning with clear personal and professional goals
- Solve personal and professional life hiccups with confidence and maturity

Course Outcomes:

On successful completion of the course, the students will:

CO. No.	Course Outcomes	Blooms Level	Module No.	POs
1	Have the ability to introspect on individual strengths and weaknesses, and emerge as a balanced personality with improved self-awareness and self-worth	Understanding and Applying	1	12
2	Observe gender sensitive language and workplace etiquette in his professional life	Understanding	1	9
3	Be able to prepare a resume and gain the confidence to face an interview	Applying and creating	1&2	10
4	Possess the interpersonal skills to conduct himself/herself effectively in everyday professional and social contexts	Understanding and Appling	2	8
5	Be able to bring professionalism into his/her daily activities	Applying	2	8

REFERENCE BOOKS:

- Edward Holffman, **Ace the corporate personality**, McGraw Hill,2001
- Adrian Furnham, **Personality and intelligence at work**, Psychology Press, 2008.
- John Adair Kegan Page, "**Leadership for innovation"** 1st edition, Kogan, 2007.
- Krishna Mohan & NP Singh, "**Speaking English effectively"** 1st edition, Macmillan, 2008.
- Dr. S.P. Dhanvel**, English and Soft skills,** Orient Blackswan, 2011
- Rajiv K. Mishra, Personality **Development**, Rupa& Co. 2004.

22BC201-OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Computer Programming

COURSE DESCRIPTION AND OBJECTIVES:

This course is about the fundamentals of Object-Oriented Programming (OOP) Concept and OOP-based software development methodology. Java as a class-based and pure OOP language is used to demonstrate and implement appropriate concepts and techniques. The students are exposed to the concepts, fundamental syntax, and the thought processes behind object oriented programming. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

MODULE-1

UNIT-1 **16L+0T+8P=24 Hours**

BUILDING BLOCKS OF OOPS

Introduction: Java buzzwords, OOP principles, Data types, Operators, Control statements, Type conversion and casting, Arrays.

Classes and Methods: Introduction to classes and methods, objects,Constructors, Usage of static, Access control, String class, String Tokenizer.

UNIT-2 **8L+0T+8P=16 Hours**

INHERITANCE

Inheritance: Basics of Inheritance, Types of inheritance, Abstract classes, Interfaces, Usage of final, creating, defining and accessing Packages

PRACTICES:

- Reading different types of data from the user and display that data using Scanner class.
- Illustrating type conversions.
- Implementing different operators.
- Generating electricity bill
- Implementing different patterns.
- Implementing logical programs.
- Implementing Arrays.
- Implementing String class.
- Implementing String Tokenizer class.
- Implementing super keyword.
- Implementing forms of Inheritance

MODULE-2

UNIT-1 **14L+0T+8P=22 Hours**

OVERLOADING AND INTERFACES

Overloading: Overloading Methods and Constructors, this key word, Usage of super key word, Polymorphism, Method overriding

Interfaces: implementing interface, extending interfaces, accessing a package, importing packages.

PRACTICES:

- Implementing overloading and overriding.
- Implementing runtime polymorphism.
- Create an abstract class Media (id, description). Derive classes Book (page count) and CD (play time). Define parameterized constructors. Create one object of Book and CD each and display the details.
- Define an interface, operations which has method area (), volume (). Define a constant PI having value 3.14. Create class a Cylinder which implements this interface (member-id, height). Create one object and calculate area and volume.
- Implementing packages.

UNIT-2 **10L+0T+8P=18 Hours**

EXCEPTION HANDLING AND MULTITHREADING

Exception Handling: Concepts of exception handling, Types of exceptions, Built-in exceptions,Usage of try, catch, throw, throws and finally keywords

Multithreading: Concepts of Thread, Thread priorities,multithreading, Daemon thread, Synchronization

PRACTICES:

- Implementing Exception handling
- Implement java program which accepts withdraw amount from the user and throws an exception "In Sufficient Funds" when withdraw amount more than available amount.
- Creating Thread.
- Implementing multithreading.
- Create three threads and that displays "good morning", for every one second ,"hello" for every 2 seconds and "welcome" for every 3 seconds by using extending Thread class.

SKILLS:

- Analyze and develop algorithm for real life problems using Java.
- Able to develop multi-threaded applications.
- Able to create efficient software applications.

ACTIVITIES:

- Installing different IDE's and setting paths.
- Developing and debugging programs in different IDEs.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiar with Object oriented concepts and JVM	Apply	1	1,2,3,4,5,9,10, 12
2	Apply inheritance and polymorphism	Apply	1	1,2,3,4,5,9,10, 12
3	Apply packages and interfaces to develop real time applications	Apply	1	1,2,3,4,5,9,10, 12
4	Develop Interfaces and Packages.	Analyze	2	1,2,3,4,5,9,10, 12
5	Design and develop GUI based applications using applets and swings for internet and system based applications.	Evaluate	2	1,2,3,4,5,9,10, 12

TEXT BOOKS:

1. Herbert Scheldt, "Java the complete reference", 12th Edition, McGraw Hill, Education, 2021.
2. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", 3rd Edition, John Wiley & sons, 2008.
2. P. Radha Krishna, "Object Oriented Programming through Java", 1st Edition, Universities Press, 2007.
3. R. A. Johnson, "Java Programming and Object Oriented Application Development", 1st Edition, Cengage Learning, 2006.

22BC202-DATABASE SYSTEMS

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Computer Programming and Data Structures

COURSE DESCRIPTION AND OBJECTIVES:

This course presents an introduction to database management systems with an emphasis on how to organize, maintain and retrieve data efficiently from a relational database. It also focuses on requirements gathering and conceptual, logical, physical database design. The objective of the course is to enable the student to understand database design, expressing queries using SQL, transaction processing.

MODULE-1

UNIT-1 **16L+0T+6P=22 Hours**

DATA BASE DESIGN

Databases and Database Users: Introduction; Characteristics of the database approach; Actors on the scene; Advantages of using the DBMS approach.

Database System Concepts and Architecture: Data models, Schemas, and instances; Three-Schema architecture and data Independence; Database languages and interfaces; The database system environment; Centralized and Client-Server architectures for DBMS.

Conceptual Data Modeling and Database Design: Entity types, Entity sets, Attributes, and keys; Relationship types, Relationship Sets, Roles, and structural constraints; Weak entity types; Relationship types of degree higher than two.

TheRelational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and Relational database schemas

Basic SQL: SQL data definition and data types; Specifying constraints in SQL, Basic retrieval queries in SQL

UNIT-2 **8L+0T+10P=18 Hours**

MORE SQL

Complex Queries, Triggers, Views: More complex SQL retrieval queries; Views (virtual tables) in SQL, Introduction to PL/SQL Procedures, Functions Specifying constraints as assertions and actions as triggers;

PRACTICES:

- Design Conceptual database schema using ER Modeling Software Tools.
- Development of Relational Database schemas for Company/Student/Sailors/ using SQL and Perform the simple CURD Operations and create Database users give the permissions for access the database.
- Development of Relational Database schemas by specifying different types of Constraints for Company/Student/Sailors/Library perform Aggregate Functions expressing Nested queries using SQL and apply clauses like GROUP BY, HAVING and ORDER BY clauses of SQL.

- Design and Development of Company/Student/Sailors database and specifying queries using different types of JOINs.
- Creation and dropping of VIEWS for Company/Student/Sailors Data Bases.
- Implementation of PL/SQL programs with Control Structures.
- Implementation of Procedure for computes the square of value of a passed value.
- Implementation of Function for finding total number of students in class.
- Implementation of Triggers for updating employee salary details.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

BASICSOF FUNCTIONAL DEPENDENCIES AND NORMALIZATION FOR RELATIONAL DATABASES

Informal design guidelines for relation schemas; Functional dependencies-inference rules, equivalence and minimal cover; Normal forms based on primary keys; Boyce-Codd normal form; multivalued dependency and 4NF; Join dependencies and 5NF; Properties of relational decompositions.

PRACTICES:

Case study on Normalization:

UNIT-2 **12L+0T+8P=20 Hours**

INTRODUCTION TO TRANSACTION PROCESSING CONCEPTS AND THEORY

Introduction to transaction processing; Transaction and system concepts; Desirable properties of transactions; Characterizing schedules based on serializability.

Concurrency Control Techniques: Two-phase locking techniques for concurrency control; Concurrency control based on timestamp ordering.

PRACTICES:

- Implement the conversion of the database to first; second and third normal form is appropriate in a college environment.
- Implement the conversion of the database to first; second and third normal form is appropriate in a Library Management
- Implement the conversion of the database to first; second and third normal form is appropriate in a Car Insurance
- Implement the conversion of the database to first; second and third normal form is appropriate in a Hostel Management
- Implement the conversion of the database to first; second and third normal form is appropriate in a Hospital Management
- **Transactions & TPS Activities in Indian Railways**
  - **Passenger Reservation System**
    a) Checking current position on any train
    b) Make a reservation from any origin to any destination in India
    c) Pay for the ticket using any option like debit card, credit card, etc
    d) Changing/ Cancellation of bookings and getting money refund
  - **Freight Operation Information System**
    a) Checking real-time position of goods trains
    b) Checking number of rakes being used and number of idle rakes
    c) Volume and weight of goods being carried

- **Crew Management System**
  a) Monitoring of activities of crew members
  b) Checking the location, time of arrival and waiting time of crew members
  c) Maintaining records of payment schedule information, duty schedule, training schedule of the crew members
- **Integrated Coach Management System**
  a) Checking real-time location and movement of trains
  b) Scheduling trains movement near bottlenecks and heavy traffic zones
  c) Improving train arrival time accuracy

SKILLS:

- Conceptualize data using different data models
- Translate data models into relational table schema (DDLs)
- Single block SQL queries and correlated subqueries.
- Functional dependencies and their relationship to keys
- Find keys given a set of functional dependencies
- Identify tables that are not normalized
- Decompose un-normalized tables into BCNF and/or 3NF compliant tables
- Constraints are for and how to use them.
- Views, Triggers Procedures, Functions

ACTIVITIES:

- Design Conceptual database schema using ER Modeling Software Tools.
- Development of Relational Database schemas for Company/Student/Sailors/ using DDL constructs of SQL.
- Specifying various DML Commands such as select,insert, update etc. of SQL on Relational Database.
- Specifying various DCL and TCL constructs of SQL on Relational Database.
- Development of Relational Database schemas by specifying different types of Constraints
- Specifying queries using Relational Database operators (Arithmetic, Logical & comparison) and string matching constructs of SQL.
- Expressing queries using Aggregate Functions of SQL on Relational Database.
- Queries on Relational Database using GROUP BY, HAVING and ORDER BY clauses of SQL.
- Design and Development of company database and expressing Nested queries using SQL.
- Design and Development of sailors database and specifying queries using different types of JOINs.
- Creation and dropping of VIEWS.
- Implementation of PL/SQL programs with Control Structures.
- Implementation of PL/SQL programs with Procedures.
- Implementation of PL/SQL programs with Function.
- Implementation of PL/SQL programs with Triggers.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Devise queries using SQL Subsets.	Apply	1	1,2,3,4,5,9,10,12
2	Evaluating Transaction Techniques	Analyze	1,2	1,2,3,4,5,9,10,12
3	Express queries using database tools like Oracle, MYSQL.	Analyze	2	1,2,3,4,5,9,10,11
4	Develop an E-R model for real life applications	Create	1	1,2,3,4,5,9,10,11,12
5	Design and normalize databases for real time applications.	Create	1, 2	1,2,3,4,5,9,10,11,12

TEXT BOOKS:

1. Ramez, Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
2. Database Systems: The Complete Book 2nd Edition by HectorGarciaMolina, JeffreyUllman, Jennifer Widom

REFERENCE BOOKS:

1. Raghu Rama Krishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, Tata McGraw Hill, 2013.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2010

22BC203 DATA COMMUNICATIONS

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics of Computers, Computer Programming

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces theprinciples of data communication and the basic communication protocols.The course emphasizes design issues involved in the design and utilization communication protocols. including data link layer, network layer, Transport layer, Application Protocols.

MODULE-1

UNIT-1 **12L+T+6P=18 Hours**

BASICS OF PHYSICAL LAYER AND DATA LINK LAYER

Data and Signals, Performance metrics, Transmission modes, multiplexing and Spreading, Transmission media, switching, Error Detection and Correction, Data Link Control, Multiple Access, wired LAN, wireless LAN, Connecting Devices.

UNIT-2 **12L+0T+10P=22 Hours**

DATA LINK LAYER PROTOCOLS

Error Detection and Correction methods, Linear Block codes, check sum, Framing, simplex, stop and wait protocol, stop and wait ARQ, Goback n ARQ protocol, selective repeat ARQ, ALOHA, CSMA, CSMA/CD, CSMA/CA.

PRACTICES:

- Hamming Distance
- Check Sum
- Framing of Binary Stream
- Implementation of simplex, stop and wait protocols
- CSMA CD
- CSMA CA

MODULE-2

UNIT-1 **12L+T+6P=18 Hours**

NETWORK AND TRANSPORT LAYERS

Internet working, IPv4, Address mapping, ICMP, Error Reporting, IGMP, Routing protocols congestion control and quality of service, DNS

UNIT-2 **12L+10T+0P=22 Hours**

NETWORK AND TRANSPORT LAYERS PROTOCOLS

Fragmentation, checksum, dynamic routing, link state routing, multi cast routing, token bucket

PRACTICES:

- Fragmentation
- Routing algorithms
- Congestion control algorithms

SKILLS:

- Understand the working of Local Area Network and Networking Devices
- Learn different Error detection and correction methods
- Design a network for an office
- Understanding the network layer protocols

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Build** error detection and correction algorithms	Apply	1	1, 2, 3, 4, 5, 9, 10, 12
2	**Make use of** Networking devices and building a network	Apply	1	1, 2, 3, 4, 5, 9, 10, 12
3	**Apply** CSMA techniques in wireless lan	Apply	1	1, 2, 3, 4, 5, 9, 10, 12
4	**Develop** congestion algorithms	Analyze	2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOK:

1. Behrouz A.Forouzan, "Data Communications and networking ", 4th Edition, McGrahill, 2007.

REFERENCE BOOKS:

1. William stallings, "Data & Computer Communications", 8th Edition, Pearson Publishers, 2007
2. Jim kurose&Ross , "Computer Networking: A Top-Down Approach",8th Edition, Pearson Publishers, 2021

22BC204-OPERATING SYSTEMS

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Data structures, Programming, Computer Organization

COURSE DESCRIPTION AND OBJECTIVES:

This course aims at concepts and principles of Operating Systems, its overall responsibility in acting as an interface between the system's hardware components and the user/application software. Further, it also helps students to understand the different scheduling policies, process synchronization mechanisms, deadlock handling mechanisms, memory management techniques and file management system.

MODULE-1

UNIT-1 **12L+0T+6P=18 Hours**

PROCESS MANAGEMENT

What Operating System do, Operating System structure, Process concept - overview, process scheduling, operations on process, Threads, Inter-process communication, Process scheduling - scheduling criteria, scheduling algorithms, Multiple-Processor scheduling.

UNIT-2: **12L+0T+10P=22 Hours**

PROCESS SYNCHRONIZATION AND DEADLOCK

The critical-section problem, Peterson's solution, Synchronization hardware, Semaphores; Monitors, Classical problems of synchronization.

Deadlock characterization, Methods of handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery.

PRACTICES:

- Process creation, termination and managing the processes
- Thread creation, termination and managing the threads
- Simulation of CPU Scheduling algorithms
- Simulating the solutions of process synchronization
- Simulating banker's algorithm for given data and reporting the findings

MODULE-2

UNIT-1 **12L+0T+6P=18 Hours**

MEMROY MANAGEMENT

Continuous memory allocation, Paging, Structure of the page table,Segmentation, Demand paging, Page replacement algorithms.

UNIT-2 **12L+0T+10P=22 Hours**

FILE SYSTEM AND SECONDARY MEMORY MANAGEMENT

Overview of mass-storage structure, disk structure, disk scheduling; File Systems - file concept, access methods, directory structure, file system mounting, file sharing protection; File-system structure, file system implementation, directory implementation, allocation methods, free space management.

PRACTICES:

- Simulating the partition allocation methods
- Simulate the memory management techniques like paging, segmentation
- File, process, and disk management commands in linux/unix
- Simulate the file manipulation commands in programming
- Design and develop free space management techniques

SKILLS:

- Mange open source operating systems like Ubuntu, Fedora etc
- Understand the concepts of process scheduling and files systems
- Analyze the various algorithms used for memory management
- Identify various disk scheduling methodologies

ACTIVITIES:

- Install/remove an operating system in a computer
- Simulation and comparison of process scheduling
- Identification of safe state in the system based on resource allocation state

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	COURSE OUTCOMES	Blooms Level	Module No.	Mapping with POs
1	Design, implement and evaluate a program, thread, process for software requirements.	Apply	1	1,2,3,4,9,10,12
2	Apply the concepts of process scheduling algorithms and process synchronization techniques to derive the efficiency of resource utilization	Apply	1	1,2,3,4,9,10,12
3	Design the various memory management schemes and file system structure for a given scenario and	Analyze	2	1,2,3,4,9,10,12
4	Simulate the operating systems principles using programming	Create	1,2	1,23,4,5,9,10,12

TEXT BOOK:

1. Abraham Silberschatz Peter B. Galvin and Greg Gagne, “Operating System Concepts”, 8th Edition, Wiley, 2008.

REFERENCE BOOKS:

1. Garry. J. Nutt, “Operating Systems: A Modern Perspective”, 3rd Edition, Addison-Wesley, 2003.
2. Andrew S. Tanenbaum and Herbert Bros, “Modern Operating Systems”, 4th Edition, Pearson, 2015.
3. William Stallings, “Operating Systems: Internals and Design Principles”, 7th Edition, Prentice Hall of India, 2013.
4. Dhananjay M. Dhamdhere, “Operating Systems: A Concept-Based Approach”, 3rd Edition, Tata McGraw-Hill, 2017.

22BC205-MANAGEMENT SCIENCE

L	T	P	C
2	2	0	3

PRE-REQUISITE KNOWLEDGE: Reasoning and Analytical thinking

COURSE DESCRIPTION AND OBJECTIVES: By the end of this course it is expected that the student will be able to:

1. Analyze the nature and importance of management
2. Significance of operation management
3. Carry out production operations through work-study
4. Analyze the markets, customers, and competition
5. Plan and control the HR function effectively

MODULE-I

UNIT- 1 10L+10T=20HoursIntroduction to Management: Concepts of Management and organization- nature, importance and Functions of Management, Systems approach to Management - Taylor's Scientific Management Theory, Fayol's Principles of Management, Mayo's Hawthorne Experiments, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Leadership Styles, Social responsibilities of Management.

UNIT – 2 14L+6T=20Hours

Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement,Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records. Statistical Quality Control: control charts for variables and attributes (simple Problems), Acceptance Sampling

PRACTICES:

- Collect some examples with videos for types of production.
- Carry out production operations through work-study
- Practice problems with Inventory control methods and Quality Control charts

MODULE: II

UNIT-I 12L+8T=20Hours

Human Resources Management (HRM): Concepts of HRM, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

UNIT-II 12L+8T=20Hours

Marketing Management: Evolution of Marketing, Functions of Marketing Selling Vs Marketing, 4 P's of Marketing – Product Mix - Product Life Cycle – Place Mix – Channels of Distribution – Price Mix – Pricing Methods – Promotion Mix – Tools of Promotions.

PRACTICES:

- Select any Designation in an organization and try to describe its job description and job specifications
- How do you deal with grievances at your work
- Analyze marketing mix in various situations

SKILLS:

- To be an expert in managerial skills
- Able to maintain social relations
- Able to evaluate pricing strategies

ACTIVITIES:

- Case studies
- Assignments on the different product life cycles and their pricing strategies
- Presentations on promotional activities and HR activities

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the nature and importance of management	Analyze	1	1,2,4,6
2	Significance of Operations Management.	Analyze	1, 2	1,2,5
3	Carry out production operations through work-study	Apply	1, 2	1, 2, 3, 5
4	Analyze the markets, customers, and competition	Analyze	2	1,2,4,5,6
5	Plan and control the HR function effectively	Evaluate	1, 2	1,2,3,4,5,6

TEXT BOOKS:

1. Stoner, Freeman, Gilbert, *Management*, 6th Ed, Pearson Education, New Delhi, 2004.
2. P. Vijay Kumar, N. Appa Rao and Ashnab, Chnalill, Cengage Learning India, 2012.
3. Aryasri: *Management Science*, TMH, 2004.

REFERENCES :

1. Kotler Philip & Keller Kevin Lane: Marketing Mangement 12/e, PHI, 2005.
2. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
3. Thomas N. Duening& John M .IvancevichManagement — Principles and Guidelines, Biztantra, 2003.

22BC206-PROFESSIONAL COMMUNICATION LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITE KNOWLEDGE: English Communication

COURSE DESCRIPTION AND OBJECTIVES:

To improve the overall professional communication skills (LSRW) of students and prepare them for their profession as engineers and managers. To provide them exposure to convections of corporate communication and training them on how to function in the business world.

MODULE-1

UNIT-1 **0L+0T+8P=8Hours**

BASICS OF BUSINESS WRITING SKILLS, PRACTICING BUSINESS CORRESPONDENCE AND REPORT WRITING

Business English Vocabulary: Glossary of most commonly used words (formal and informal usage)
Elements of Technical Writing: Sentence structure, reducing verbosity, arranging ideas logically, building coherence, cohesive devices and transitional words.
Mechanics of Writing: elementary rules of grammar, choice of diction, elementary principles of composition, matters of form, punctuation, conventions of business communication, language and professional tone, code of conduct (not sending illegal, offensive, disparaging personal remarks or comments) in written business communication.

Practice: Basic grammar practice, framing paragraphs on topics allocated, paraphrasing an article or a video in your own words, finding topic sentences in newspaper articles, finding out new words from a professional viewpoint and understanding the meaning and its usage

Business Correspondence: E-mail: nature and scope, e-mail etiquette, clear call for action, common errors in composing e-mails, office communication such as meeting agenda and notice, circular and memo

Letter-Writing: Formal and informal letters, structure of formal letters, expressions of salutations, different types of letters [such as sales letter, complaint letter, response to the complaint letter (dispute resolution), letter of permission, letter of enquiring, claim letter – letter of apology etc], introductory and concluding paragraphs and clear call for action.

Professional Proposal/Report: Differentiating proposals and reports, Drafting formal business proposals, types of reports such as factual reports, feasibility reports and survey reports, parts of a report (such as title page, declaration, acknowledgements, table of contents, abstract, introduction, findings, conclusion and recommendations)

Practice: Perusing samples of well-prepared business emails, memo, letter writing and short proposals and reports, students will draft business correspondence writing tasks and different proposals/reports on topics assigned.
New Age Corporate Communication Media: Importance of social media communication and Etiquettes, form and structure, sharing texts through Twitter, Whatsapp, instgram etc.

UNIT-2 **0L+0T+8P=8 Hours**

PRACTICING COMMUNICATIVE LANGUAGE IN VARIOUS PROFESSIONAL CONTEXTS

Speaking: Speaking in business context, assertiveness, politeness, making requests, queries and questions, negotiations, asking for information, offering suggestions, conflict resolution, contacting clients, initiating, addressing delegates (in public), delivering the presentation effectively, telephone etiquettes, delivering seminar/proposal/report effectively, team meeting etiquettes (face to face and

conference call), making effective one minute presentations(JAM) and participating in Group Discussions.

PRACTICE

watching videos/listening to audios of business presentations, classroom activities of team and individual presentations, using PPTs, mock exercises for BEC speaking, agreeing, disagreeing politely, developing content, extended speaking in Group Discussion(s).

MODULE-2

UNIT-1 **0L+0T+8P=8 Hours**

READING AND COMPREHENDING BUSINESS DOCUMENTS

Reading: Reading and comprehending business documents, learning business register, regularizing the habit of reading business news, suitable vocabulary, skimming and scanning a text for effective and speedy reading and dealing with ideas from different sectors of corporate world in different business contexts

PRACTICE - Hand-outs; matching the statements with texts, finding missing appropriate sentence in the text from multiple choices, using right vocabulary as per the given context and editing a paragraph.

UNIT-2 **0L+0T+8P=8 Hours**

IMPARTING AND PRACTICING LISTENING SKILLS

Listening: Specific information in business context, listening to telephonic conversations/messages and understanding the correct intended meaning, understanding the questions asked in interviews or in professional settings, summarizing speaker's opinion or suggestion, enable active listening

Practice- Working out BEC/TOEFL/IELTS listening exercises with hand-outs; matching the statements with texts, finding missing appropriate sentence in the text from multiple choice- multiple choices, using right vocabulary in context-editing a paragraph, listening to a long conversation such as an interview and answer MCQ s based upon listening.

SKILLS:

- To enhance listening and spoken abilities of students needed for professional and social success in interpersonal situations, group interactions, and personal and professional presentations.
- Practice specific functions and vocabulary in a business context.
- Produce short business reports, proposals and correspondence.
- Write various business documents through reading techniques.

COURSE OUTCOMES:

COs	Course Outcomes	Blooms Level	Module No	POs
1	Possess comprehensive skills in listening and reading business texts in formal context	Understanding and Applying	2	7
2	Communicate effectively both in their academic as well as professional environment	Applying and creating	2 &1	10
3	Clear grasp on the register of business language	Understanding	1	8
4	Possess the ability to write business reports and proposals clearly and precisely to succeed in their future	Applying and creating	1	12
5	Make effective presentations and participate in formal context	Applying and creating	2	10

REFERENCE BOOKS:

1. Guy Brook Hart (2014) Cambridge English Business Bench Mark: Upper Intermediate, Second Edition: CUP.CUP (2002) Cambridge: BEC VANTAGE Practice Papers, CUP
2. Schnurr, S (2013) Exploring Professional Communication: Language in Action. London: Routledge.
3. Seely, J (2005) The Oxford Guide to Effective Writing and Speaking. Oxford: OUP

22BC207-SOFTWARE ENGINEERING

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Data Base Management Systems, Operating Systems, ObjectOriented Programming.

COURSE DESCRIPTION AND OBJECTIVES:

This course focuses on the concepts of software development life cycle, role of process models and methods to prepare software requirement specification document. In addition to that, it also imparts knowledge of design, development and testing of software. The objective of this course is to enable the student to develop defect free and efficient software as per the given requirements.

MODULE-1

UNIT-1 **14L+0T+4P=18 Hours**

INTRODUCTION TO SOFTWARE ENGINEERING:GENERIC VIEW OF PROCESS-PROCESS MODELS

Introduction to Software Engineering: Software, Project,Software myths.Software Engineering - A layered technologyA process framework, Software Development Life Cycle (SDLC), The Capability Maturity Model Integration (CMMI), Process Assessment. The Waterfall Model, Incremental Process Models, Evolutionary Process Models (Spiral and Prototype models).

UNIT-2 **10L+0T+12P=22 Hours**

AN AGILE VIEW OF PROCESS- REQUIREMENTS ENGINEERING- BUILDING THE ANALYSIS MODEL

Agile process models - The Unified process, Extreme Programming, Scrum. Inception, Elicitation, Elaboration, Negotiation, Specification (SRS Document, IEEE Standards for SRS), Validation, Requirements management, Feasibility Study.Data Modeling - Data objects, Attributes, Relationship, Cardinality and modality; Class based Modeling - Identify analysis classes, specify attributes and Define operations.

PRACTICES:

- Identifying the Requirements from Problem Statements. (Take any Real Time Problem)
- Estimation of Project Metrics.
- Modeling UML Use Case Diagrams and Capturing Use Case Scenarios.
- State chart and Activity Modeling.

MODULE-2

UNIT-1 **14L+0T+4P=18 Hours**

DESIGN ENGINEERINGCREATINGAN ARCHITECTURAL DESIGN- PRODUCT METRICS - QUALITY MANAGEMENT

Design concepts: The design model.Software architecture; Data design; Architectural styles and patterns; Architectural design.Golden rules; User interface analysis and design; Interface analysis; Interface design steps; Design evaluation.

Product Metrics: Metrics for analysis model; Metrics for design model; Architecture metrics and Object-oriented metrics; Metrics for source code; Metrics for testing; Metrics for maintenance.

Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software Quality Assurance, Configuration management, assessing and controlling software quality.

UNIT-2 **10L+0T+12P=22 Hours**

TESTING STRATEGIES - RISK MANAGEMENT

Testing Strategies:A strategic approach to software testing; Test strategies for conventional software; Validation testing; System testing.Black-Box and White-Box testing.

Risk Management: Reactive vs Proactive risk strategies; Software risks; Risk identification; Risk projection; Risk refinement; RMMM; RMMM plan.Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software Quality Assurance, Configuration management, assessing and controlling software quality.

PRACTICES:

- Modeling UML Class Diagrams and Sequence diagrams
- Estimation of Test Coverage Metrics and Structural Complexity.
- Design of Test Cases

List of Projects:

PROJECT -1

A POINT-OF-SALE (POS) SYSTEM: A POS system is a computerized application used to record sales and handle payments; it is typically used in a retail store, it includes hardware components such as a computer and bar code scanner, and software to run the system. It interfaces to various service applications, such as a third-party tax calculator and inventory control. These systems must be relatively fault tolerant; that is, even if remote services are temporarily unavailable they must still be of capturing sales and handling at least cash payments. A POS system must support multiple and varied client-side terminals and interfaces such as browser, PDAs, touch-screens.

PROJECT - 2

ONLINE BOOKSHOP EXAMPLE: Following the model of amazon.com or bn.com, design and implement an online bookstore.

PROJECT - 3

A SIMULATED COMPANY: Simulate a small manufacturing company. The resulting application will enable the user to take out a loan, purchase a machine, and over a series of monthly production runs, follow the performance of their company.

PROJECT - 4

A MULTI-THREADED AIRPORT SIMULATION: Simulate the operations in an airport. Your application should support multiple aircrafts using several runways and gates avoiding collisions/conflicts.

Landing: an aircraft uses the runway, lands, and then taxis over to the terminal. Take-Off: an aircraft taxies to the runway and then takes off.

PROJECT - 5

AN AUTOMATED COMMUNITY PORTAL: Business in the 21st Century is above all BUSY. Distractions are everywhere. The current crop of "enterprise intranet portals" is often high noise and low value, despite the large capital expenditures it takes to stand them up. Email takes up 30 - 70% of an employee's time. Chat and Instant Messaging are either in the enterprise or just around the corner. Meanwhile, management is tasked with unforeseen and unfunded leadership and change-agent roles as well as leadership development and succession management. What is needed is a simplified, repeatable process that enhances communications within an enterprise, while allowing management and peers to self-select future leaders and easily recognize high performance team members in a dynamic way. Additionally, the system should function as a general-purpose content management, business intelligence and peer-review application. Glass code's goal is to build that system. The software is released under a proprietary license, and will have the following features: Remote, unattended moderation of discussions However, it will have powerful discovery and business intelligence features, and be infinitely extendable, owing to a powerful API and adherence to Java platform standards. Encourages peer review and indicates for management potential leaders, strong team players and reinforces enterprise and team goals seamlessly and with zero administration.

PROJECT - 6

A CONTENT MANAGEMENT SYSTEM: The goal is to enable non-technical end users to easily publish, access, and share information over the web, while giving administrators and managers complete control over the presentation, style, security, and permissions.

FEATURES:

- Robust Permissions System
- Templates for easy custom site designs
- Total control over the content
- Search engine friendly URL's
- Role based publishing system
- Versioning control
- Visitor profiling

PROJECT - 7

AN AUCTION APPLICATION: Several commerce models exist and are the basis for a number of companies like eBay.com, pricellne.com etc. Design and implement an auction application that provides auctioning services. It should clearly model the various auctioneers, the bidding process, auctioning etc.

PROJECT - 8

A NOTES AND FILE MANAGEMENT SYSTEM: In the course of one's student years and professional career one produces a 1 lot of personal notes, documents. All these documents are usually kept 1 on papers or individual files on the computer. Either way the bulk of the information is often erased corrupted and eventually lost. The goal of this 1 project is to build a distributed software application that addresses this problem. The system will provide an interface to create, organize and manage personal notes through the Internet for multiple users. The system will also allow users to collaborate by assigning permissions for multiple users to view and edit notes.

PROJECT - 9

LIBRARY MANAGEMENT SYSTEM(LMS): The goal is to enable students and librarians to easily access and manage the library and run it smoothly. Each physical library item - book, tape cassette, CD, DVD, etc. could have its own item number. To support it, the items may be barcoded. The purpose of barcoding is to provide a unique and scannable identifier that links the barcoded physical item to the electronic record in the catalog. Barcode must be physically attached to the item, and barcode number is entered into the corresponding field in the electronic item record. Barcodes on library items could be replaced by RFID tags. The RFID tag can contain item's identifier, title, material type, etc. It is read by an RFID reader, without the need to open a book cover or CD/DVD case to scan it with barcode reader.

PROJECT - 10

HOSPITAL MANAGEMENT SYSTEM: Simulate to show and explain hospital structure, staff, and relationships with patients, and patient treatment terminology.

SKILLS:

- Define a process for developing/completing different kinds of projects on time with expected quality.
- The software requirements and find out various ways to gather them and specifying them.
- Analyze and model (Diagrammatical/Representations) a software product.
- Design an effective, user-friendly interface for a given software product.

ACTIVITIES:

- Identify the customer requirements and define the process of developing the product.
- Draft the system and software requirements and prepare SRS document
- Design the project using UML diagrams
- Prepare test cases for testing the software product to ensure that it is defect-free.
- Make a list of possible risks and prepare a mitigation plan

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic concepts of software engineering.	Apply	1	1,2,3,4,5,9,10,11,12
2	Compare different process models and identify appropriate process model based on project requirements.	Apply	1, 2	1,2,3,4,5,9,10,11,12
3	Build Software Requirement Specification (SRS) document for any software product	Analyze	1	1,2,3,4,5,9,10,11,12
4	Design of solution using UML diagrams like use case, sequence diagrams etc.	Create	1,2	1,2,3,4,5,9,10,11,12
5	Create different testing techniques to ensure bug free software and measure metrics such as software size and quality of the product.	Create	2	1,2,3,4,5,9,10,11,12

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering, A practitioner's Approach", 7th Edition, McGrawHillInternational edition, 2017
2. Booch G., Rumbaugh J. and Jacobsons I, "The Unified Modeling Language User Guide", 2ndEdition, Addison Wesley, 2005.

REFERENCE BOOKS:

1. Simon Sennet, Steve McRobb and Ray Farmer, "Object Oriented Systems Analysis and Design, 2nd Edition, 2004.
2. Deepak Jain "Software Engineering, Principles and Practices", Oxford University Press,2008.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India,2010.

22BC208-COMPUTER NETWORKS

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Data Structures and Computer programming

COURSE DESCRIPTION AND OBJECTIVES:

This course focuses on imparting knowledge about various protocols involved in LANs and WANs. In addition, it gives good foundation on different protocols such as data link protocols, internet protocols and transport protocols present in the respective layers of computer networks.

MODULE-1

UNIT-1 **12L+0T+4P=16 Hours**

PHYSICAL LAYER& DATA LINK LAYER

Uses of computer networks, Network hardware, Network software, ReferenceModels, Guided transmission media, Data link layer design issues, Elementary datalink protocols, The channel allocation problem

UNIT-2 **12L+0T+16P=24 Hours**

MAC LAYER

Medium allocation methods, Error detection and correction, Sliding window protocols, Example data link protocols, Multiple accessprotocols.

PRACTICES:

- Bit stuffing and byte stuffing
- Error detection and correction
- Performance calculation in MCA protocols
- Performance evaluation in sliding window protocol
- Study on physical addressing

MODULE-2

UNIT-1 **10L+0T+6P=16 Hours**

NETWORK LAYER

Network layer design issues, Routing algorithms - optimality principle, shortest pathrouting, flooding, distance vector routing, link state routing and hierarchical routing; The network layer in the internet - IP addresses, Services provided to the upper layers.

UNIT-2 **14L+0T+10P=24 Hours**

TRANSPORT AND APPLICATION LAYER

Elements of transport protocols, Congestion control algorithms, QoS improving techniques, leaky bucket and token bucket algorithms, Internetworking, IPv4, IPv6, IMCP, ARP, DHCP and mobile IP, Congestion Control, UDP and TCP, Performance Issues, The world wide web, Domain name system, E-mail, Streaming Audio and Video, Content Delivery.

PRACTICES:

- Logical addressing division
- Performance evaluation routing and congestion control algorithms
- TCP/IP programming
- UCP/IP programming
- Configuration of email system

SKILLS:

- Implement Local Area Networks with different topologies.
- Simulate various routing protocols.
- Network troubleshooting
- Work on various network devices to establish a Network for Institute
- Classify different classes of IP addresses.

ACTIVITIES:

- Connect Configure workstations in Ethernet and WLAN.
- Simulate data linkprotocols.
- Detect and correct the errors in data transmission.
- Analyze IP, TCP, UDP, ARP, DNS, HTTP, FTP, Telnet protocols.
- Configure intranet routers and Develop network applications.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the suitable network devices and methodologies to establish required network for given scenario	Apply	1	1, 2,3,4,5,9,10 12
2	Simulate and demonstrate the OSI reference model layer services	Analyze	1	1, 2, 3, 4, 5, 9, 10, 12
3	Analyze the various computer network addressing techniques like physical addressing, logical addressing, port addresses and special addressing.	Analyze	2	1, 2, 3,4, 5, 9, 10,12
4	Design and develop simple network applications using TCP/IP suite in one high level programming language	Create	2	1, 2, 3, 4, 5, 9, 10,11, 12

TEXT BOOK:

1. Andrew S.Tanenbaum, "Computer Networks", 5th Edition. Pearson Education, 2014.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data communications and Networking", 4th Edition, TMH, 2017.
2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2017.

22BC209-WEB APPLICATION DEVELOPMENT

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Python,DBMS,Web Technologies, Web Services, Android

COURSE DESCRIPTION AND OBJECTIVES:

This course explores and demonstrate Understand the advantages of front end and back end tech. The objective of this course is to offer the knowledge and skill on the basic principles and concepts in complete web development.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO WEB PROGRAMMING

Git - An Introduction to Version Control, Git, Command-line Scripting, Basic HTML, CSS

Bootstrap - Overview, Environment setup, Precompiled Bootstrap, Source Code, Grid System, Bootstrap CSS Overview, Typography, Code, Tables, Forms, Helper Classes, Responsive Utilities, Glyph icons, Dropdowns, Navigation Elements, Breadcrumb, Pagination, Badges, Progress bars, Plugins Overview, Transition Plugin, Model Plugin, Dropdown Plugin, Scroll spy Plugin, Tab Plugin, Tooltip Plugin, Popover Plugin, Alert Plugin, Button Plugin, Collapse Plugin, Carousel Plugin, Affix Plugin.

UNIT-2 **12L+0T+8P=20 Hours**

CLOUD AND DEVOPS

Motivation-Cloud as a Platform, Operations, Deployment Pipeline: Over all Architecture Building and Testing, Deployment, Case study: Migrating to Micro services.

Origin of DevOps - The developers versus operations dilemma, Key characteristics of a DevOps culture, deploying a Web Application, Creating and configuring an account, Creating a web server, Managing infrastructure with Cloud Formation, Adding a configuration management system

PRACTICES:

- Configure the web application in Bootstrap
- Development of web application using DevOps
- Configure the web server for web application using DevOps

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

DJANGO and MONGODB

Django - Creating the Project, Running the Development Server, Creating the Application, designing a Model, setting up the Database, Setting up the Application, Dynamic Web Sites, Communication, Data Storage, Presentation.

Introduction to Mongodb - JSON and MongoDB, adopting a Non, relational Approach, opting for Performance vs. Features Running the Database Anywhere, Generating or Creating a Key, Using Keys and Values, Implementing Collections

UNIT-2 **12L+0T+8P=20 Hours**

ANGULAR JS, NODE JS AND EXPRESS FRAMEWORK

Introduction to Angular JS - Introduction, Features, Angular JSModel-View, Controller, Expression, Directives and Controllers, Angular JS Modules, Arrays, Working with ng-model,

Working with Forms, Form Validation, Error Handling with Forms, Nested Forms with ng-form, Other Form Controls

Node JS and Express Framework - Introduction, Using the Terminals, Editors, Building a Webserver with Node, The HTTPModule, Views and Layouts, Middleware, Routing, Form Handling with Express, The Request and Response Objects, Handle bars, Comments and Blocks, Polymorphism

PRACTICES: (MAKE ALL YOUR APPLICATION IN YOUR GIT ACCOUNT)

- Battleships Multiplayer Gaming Application
- Angular 2 chess game
- Build a web application using Bootstrap

SKILLS:

- Able to apply various fundamentals for problem solving using python.
- Able to implement DevOps.
- Able to create object-oriented solution by applying various concept like polymorphism, inheritance and package with python programming.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Experiment with**Git and use Bootstrap, Django fundamentals concepts to build and deploy robust web applications and apps	Apply	1, 2	1,2,3,4,5,9,10,12
2	**Make use of**different data types to design programs involving DevOps practices.	Apply	1	1,2,3,4,5,9,10,12
3	**Apply**functional, reliable and user-friendly Angular JS programs for a given problemapplication.	Apply	1	1,2,3,4,5,9,10,12
4	**Develop** solutions using Mongo DB	Apply	2	1,2,3,4,5,9,10,12
5	**Analyze** the usage of Node JS and Express	Analyze	2	1,2,3,4,5,9,10,12

TEXT BOOKS:

1. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016
2. Adam Freeman - ProAngular JS, 1st Edition, Apress, 2014
3. David Hows, Peter Membrey, EelcoPlugge"MongoDB Basics", Apress, 2014.
4. Ethan Brown, "Web Development with Node and Express", 1st Edition,Oreilly Publishers, 2014.
5. BradDayley, "Learning Angular JS", 1st Edition,Addison-Wesley Professional, 2014.

REFERENCE BOOKS:

1. AgusKurniawan, "AngularJS Programming by Example", 1st Edition, PE Press, 2014.
2. Kyle Banker, Peter Bakkum, Shaun Verch, Dough Garrett, Tim Hawkins, "MongoDB in Action",2nd Edition, Manning Publications, 2016.
3. Steve Hoberman, "Data Modeling for MongoDB", 1st Edition, Technics Publication, 2014.
4. ShyamSeshadri, Brad Green, "AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps", Apress, 2015.
5. Evan M. Hahn,"Express in Action", 1st Edition, Manning Publications, 2014.

22BC210-ORGANIZATION BEHAVIOR

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: English Communication

COURSE DESCRIPTION AND OBJECTIVES:
To comprehend the dynamics of Management practices in international context, to evaluate behavioral frameworks that suits for Corporate world from Global perspective and various business model that suits for all international context.

MODULE-1

UNIT-1 **10L+8T+0P=18 Hours**

INTRODUCTION TO OB

Nature of OB: Nature and scope of OB - contributing disciplines to OB - Environmental and Organizational context of Organizational Behavior.

UNIT–2 **6L+8T+0P=14 Hours**

PERCEPTION, PERSONALITY AND ATTITUDE

Perception - Process: Individual and Organizational factors that influence perceptual process. Role of perception in managerial activities and organizational processes.

Personality and Attitudes: Personality as continuum – Meaning of Personality – Johari window and Transactional Analysis Nature and Dimension of Attitudes.

EXPECTED LIST OF PRACTICES/TUTORIALS

- Survey on resistance to changing policies in The Banking Sector, The IT Sector
- Undertake a study to find out the various non-financial incentives used to motivate employees.
- A study in job enrichment and factors contributing to absenteeism and employee turnover in any industry of your choice.
- Analyze the characteristics and components of attitudes.
- Perform a study on the determinants of personality of a group of individuals.
- **Case study:** Organizational Behavior by Steven L McShane, Mary Ann VonGlinow and Radha R Sharma, TaTa McGraw Hill companies, Fouth Edition, Pg-6.

MODULE-2

UNIT–1 **10L+6T+0P=16 Hours**

GROUP DYNAMICS

Group Dynamics: The Nature of groups. Kinds of groups – Stages of Group Development – Factors Contributing to Groups Cohesiveness - Meaning & types of stress – Effect of Stress – Strategies of cope with stress Principles of Learning & Reinforcement - Observational Learning - Cognitive Learning - Organizational Behavior Modification - Steps in Organizational Behavior Modification process

UNIT-2 **6L+10T+0P=16 Hours**

CONFLICT MANAGEMENT

Nature of conflict – Dynamics of Conflict – Conflict resolution modes – approaches to conflict management – sources of conflict in organization.

EXPECTED LIST OF PRACTICES/TUTORIALS:

- Analyze the organizational culture and climate in the BPO industry.
- Conduct a study on the reasons for attrition in the BPO industry.
- Studying organizational structures of any 10 companies and classifying them into different types of organizations which are those organizations.
- Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities and behaviors with respects to the trait, behavioral and contingency theories studied.
- **Case Study:**"Nuts and Bolts", Principles of Management, Cengagelearning , William , Manjunath , Sandhya Page no 531-532.
- Identifying any five job profiles and listing the various types, abilities required for those jobs and also the personality traits/attributes required for the jobs identified.

SKILLS:

- Examine group dynamics, power and influence in organizations, and explain how they are interrelated.
- Explain how the process of perception and diversity influences the management processes and contributes to individual differences.
- Describe sources of conflict and stress in organizations and illustrate ways of effectively managing them.

COURSE OUTCOMES:

CO	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Understand nature and scope of OB	**Understanding**	1	2,5
2	Become aware of perceptual process and possible errors and act accordingly	**Apply**	1	2,4
3	Identify differences in personalities and attitudes	**Analyze**	1	2
4	Act according to the group dynamics and handle stress	**Apply**	2	4
5	Resolve certain issues by applying conflict management	**Apply**	2	4,5

TEXT BOOK:

1. Luthans, Fred, "Organizational Behaviour", 12th edition, Mcgraw Higher Ed, 2013.

REFERENCE BOOK:

1. Debra L. Nelson, James Campbell Quick, "OrganisationBehaviour", 8th edition, Cengage, 2013.

22BC211-QUANTITATIVE APTITUDE & LOGICAL REASONING

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Nil

COURSE DESCRIPTION AND OBJECTIVE:

The Students will be introduced to various Arithmetic and Reasoning Problems. The students will have acquaintance with various problems like Time & Work, Time & distance, Percentages, Profit & Loss etc. besides solving puzzles and Critical Reasoning.

MODULE-1

UNIT-1 6L+6T+0P=12 Hours

Number system, LCM & HCF of numbers, Percentage, Ratio and proportion, Profit, loss and discount, Average & Mixtures, Simple Interest & Compound interest.

UNIT-2 6L+6T+0P=12 Hours

Time and work, Time & distance, Problems on trains, Problems on ages, Permutation & Combinations, Probability.

PRACTICES:

Each concept would be taught in detail in the class followed by 10 problems solved in the class. Students would have to solve 10 additional problems as homework assignment in each concept.

MODULE-2

UNIT-1 6L+6T+0P=12 Hours

Number series, Letter series, Analogy, Odd man out, Coding and decoding, Syllogisms- Statement & Conclusions, Puzzle test.

UNIT-2 6L+6T+0P=12 Hours

Blood relations, Direction sense test, Order & Ranking, Seating Arrangements, Calendar & Clocks.

PRACTICES:

Each concept would be taught in detail in the class followed by 10 problems solved in the class. Students would have to solve 10 additional problems as homework assignment in each concept.

SKILLS:

- Helps in developing and improving problem solving skills
- Allow students to develop critical thinking skills

COURSE OUTCOMES:

Upon the completion of the course students will be able to

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Meetthedemandsofcurrentjobmarketbesidesequippingthemhigherstudieslike CAT, GMAT etc...	Understanding	1	2, 5
2	SolveArithmeticandReasoningProblemswithinshortestpossibletimewithoutpaperwork.	Apply	1	2, 5
3	Exhibitbetteranalytical skillsandaptitudeskills	Analyze	2	2, 4
4	Developinterpretationalskills.	Evaluation	2	2, 4

TEXT BOOKS:

1. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. CHAND Publications, Revised Edition,2017
2. ARIHANT, A New Approach To Verbal & Non-Verbal Reasoning- Arihant Publication- Revised Edition-2021

REFERENCE BOOKS:

1. Trishna,"Knowledge Systems- Quantitative Aptitude for Competitive Examinations", Pearson Publication, 1st Edition, 2013.
2. R. S. Aggarwal,"A Modern Approach to Verbal & Non-Verbal Reasoning", S. CHAND Publications, Revised Edition, 2018.

22BC301-INTERNET OF THINGS

L	T	P	C
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basic Knowledge of Computer Hardware and Computer Programming

COURSE DESCRIPTION AND OBJECTIVES:

Students will be explored to the concepts and applications of Internet of Things, interconnection and integration of the physical world and the cyberspace. They are also able to design & develop IOT Devices and applications.

MODULE-1

UNIT-1 **12L+0T+4P=16Hours**

INTRODUCTION AND DOMAIN SPECIFIC IOT

Introduction: Introduction to Internet of Things, Physical design of IOT, Logical design of IOT, IOT Enabling Technologies, IOT Levels.

Domain specific IoT: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT-2 **12L+0T+12P=24 Hours**

ELEMENTS OF IOT AND INTRODUCTION TO PYTHON MODULES AND PACKAGES

Hardware Components-Computing (Arduino, Raspberry Pi), Sensors, Actuators, I/O interfaces, Communication Protocols (ZigBee, Bluetooth, 6LoPAN, and MQTT),Software Components-Programming API‟s (using Python/Arduino).

Introduction: Functions, Modules, Packages, File handling, Date/ time Operations, Classes, Python package.

PRACTICES (USING ARDUINO UNO /RASPBERRY PI BOARD):

- Demonstration and study of Raspberry Pi board, GPIO Pins and familiarity of various sensors
- Demonstration and study of other Hardware board of IoT such as Arduino Uno and NodeMCU Reading different types of data from the user and display that data using Scanner class.
- Design and Implementation of controlling LED.
- Design and Implementation of controlling LED.
- Design and Implementation of sensing light through LDR.

MODULE-2

UNIT-1 **12L+0T+4P=16 Hours**

M2M AND SYSTEM MANAGEMENT WITH NETCONF-YANG

Introduction to M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network function virtualization, Need for IOT systems management, Simple network management protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG.

UNIT-2 **12L+0T+12P=24 Hours**

IOT DESIGN METHODOLOGY

Design methodology, Case study using weather monitoring; IOT Physical Devices & Endpoints, exemplary Device, Raspberry Pi interfaces, programming of IOT devices

PRACTICES (USING ARDUINO UNO /RASPBERRY PI BOARD):

- Design and Implementation to find obstacles through sensor.
- Design and Implementation of detecting noise through microphone sensor.
- Design and Implementation of output devices through relay module.
- Design and Implementation of vibration sensor.
- Design and Implementation of sensing and display temperature.
- Design and Implementation of uploading sensor data into cloud using Python.
- Implement Python program to send email.

SKILLS:

- Analyze the application areas of IOT
- Writing Python scripts for IoT circuits.
- Design and develop IoT applications for given specific problem statement

ACTIVITIES:

- Installing Raspberry Pi Simulator.
- Design and develop IoT applications for given specific problem statement

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Design and develop IoT applications for given specific problem	Apply	2	1,2,3,4,5,9,10, 12
2	Analyze the application areas of IOT	Analyze	1	1,2,3,4,5,9,10, 12
3	Analyze the building blocks of Internet of Things and characteristics	Analyze	1	1,2,3,4,5,9,10, 12
4	Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.	Evaluate	2	1,2,3,4,5,9,10, 12

TEXT BOOKS:

1. Arsh deep Bahga, Vijay Madisetti,"Internet of Things: A Hands-on-Approach", 1st Edition, VPT, 2014.
2. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,"Internet of Things", 1st Edition, John Wiley & Sons., 2019.

REFERENCE BOOKS:

1. Adrian McEwen, "Designing the Internet of Things", 1st Edition, Wiley Publishers, 2013.
2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things",1st Edition, DND Ventures LLC, 2013.

22BC302-DATA MINING

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basics of statistics, linear algebra

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the concepts, principles, methods and implementations of data mining subject, with a focus on 3 major data mining functions: 1. Association rule mining 2. Classification 3. Cluster Analysis. In the first part of the course student will learn terminology of data mining and different kinds of data pre-processing techniques. In the second part of the course student will learn major data mining techniques, their implementation and applications.

MODULE-1

UNIT-1 **10L+0T+6P=16 Hours**

INTRODUCTION TO DATA MINING

Introduction to the need of data mining, Different kinds of data and patterns that can be mined, basic statistical descriptions of data, matrix representation of data, similarity and dissimilarity, need of the data pre-processing, handling missing values and noise in data, identifying redundant and correlated attributes, finding frequent item sets and generating association rules using Apriori and FP growth algorithms.

UNIT-2 **14L+0T+10P=24 Hours**

DATA HANDLING USING STATISTICAL METHODS

Computing basic statistical descriptions of different kinds of data(mean, median, mode, variance, and standard deviation), distance and similarity metrics(Euclidean, Manhattan, cosine).Missing values handling methods, computing correlation of nominal and numerical data using Chi-square & Pearson method, computing Frequent patterns using Apriori and FP growth methods.

PRACTICES:

- Computing mean, median, mode, variance, Standard deviation measures.
- Matrix representations of data
- Computing Euclidean, Manhattan, Cosine distance measures.
- Missing values handling methods.
- Chi-square method
- Pearson method
- Finding frequent patterns and association rules using Apriori algorithm
- Finding frequent patterns and association rules using Frequent Pattern growth algorithm

MODULE-2

UNIT-1 **10L+0T+6P=16 Hours**

CLASSIFICATION

Introduction to classification and different approaches to perform classification. Concept of Information Gain, gain ratio and Gini Index, Bayes theorem and its terms, linearly separable and inseparable cases, concept of Neural Networks and working model of Multilayer Perceptron classifier, model evaluation techniques, classification through Encembling Techniques

UNIT-2 **14L+0T+10P=24 Hours**

CLUSTERING

Introduction to clustering and different approaches for clustering. K means and K medoid methods of partitioning based clustering, Agglomerative and Divisive methods of hierarchical clustering. Cluster evaluation methods.

PRACTICES:

- Decision tree classifier
- Naïve Bayes classifier
- KNN classifier
- SVM classifier
- Forward propagation of NN
- Updating the weights for backward propagation of NN
- K means and K medoid Clustering technique
- Agglomerative and Divisive clustering technique

SKILLS:

- Pre-processing the data
- Finding frequent patterns and forming association rules
- Classification of Numerical data
- Finding the clusters for the given un-labelled data

ACTIVITIES:

- Finding the association rules by computing frequent item sets from large transactional data sets
- Designing classifier models with various parameters for different problems
- Finding the clusters for given un-labelled data

COURSE OUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Build** the data analysis and visualization reports for large data sets.	Apply	1	1, 2, 3, 5, 9, 10, 12
2	**Apply** various clustering techniques to label the unlabeled data	Apply	2	1, 2, 3, 5, 9, 10, 12
3	**Apply**classification techniques to build the classifiers for binary and multiclass problems.	Apply	2	1, 2, 3, 5,9, 10 12
4	**Generate** Association rules by finding frequent patters from large transactional datasets.	Create	1	1, 2, 3, 5, 9, 10, 11, 12

TEXT BOOK:

1. Jiawei Han, MichelineKamber and Jian Pei, “Data mining Concepts and Techniques”, 3rd edition, Morgan Kaufmann. 2012.

REFERENCE BOOKS:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”,2nd edition, Pearson, 2018
2. Jure Leskovec, Anand R ajaraman and Jeffrey D Ullman, “Mining of Massive Datasets”,5th edition, Stanford University, 2014.

22BC801-DATA SCIENCE USING PYTHON

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Programming in python

COURSE DESCRIPTION AND OBJECTIVES: Data Science using Python course will guide to learn how to use the power of Python for Data Pre-Processing and analysis, Data exploration and Visualization**.**

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

DATA SCIENCE & NUMPY

Introduction to Data Science: Introduction to Data Science, Data Science Terminology, Data Science Process, Data Science Project Roles, Industrial applications of Data Science. Essential Python Libraries, NumPy Basics: Arrays and Vectorized Computation: The NumPyndarray: A Multidimensional Array Object, Universal Functions: Fast Element-wise Array Functions, Data Processing Using Arrays, File Input and Output with Arrays, Linear Algebra, Random Number Generation.

UNIT-2 **12L+0T+8P=20 Hours**

PANDAS

Getting Started with pandas: Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing, Data Loading, Storage, and File Formats, Reading and Writing Data in Text Format, Binary Data formats, Interacting with HTML and Web APIs, Interacting with data bases.

PRACTICES:

- How arrays of data are handled in the Python language itself, and how NumPy improves on this.
- Attributes of arrays: Determining the size, shape, memory consumption, and data types of arrays, Indexing of arrays, Slicing of arrays, Reshaping of arrays, Joining and splitting of arrays
- NumPy's universal functions, compute summary statistics for the data, Broadcasting, Exploring Fancy Indexing, algorithms related to sorting values in NumPy arrays, use of NumPy's structured arrays and record arrays.
- Data Manipulation with Pandas: Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Merge and Join.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

PLAYING & PLOTTING DATA

Combining and Merging Data sets, Reshaping and Pivoting, Data Transformation, String Manipulation.

Plotting & Visualization: Matplotlib introduction, Plotting functions in pandas, Plotting Maps: Case Study for different Applications.

UNIT-2 **12L+0T+8P=20 Hours**

DATA AGGREGATION AND GROUP OPERATIONS& TIME SERIES

Data Aggregation and Group Operations: Group by Mechanics, Data Aggregation, Group-wise Operations and Transformations, Pivot Tables and Cross-Tabulation.

Time Series: Date & Time Data Types and Tools, Time series Basics, Date Ranges, Frequencies, and Shifting. Time zone Handling, Periods and Period Arithmetic, Resampling and Frequency Conversion, Time series plotting, Moving window functions, Performance, and memory usage notes.

PRACTICES:

- Data Aggregations on Multi-Indices: Panel Data, Concat and Append, Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, High-Performance Pandas: eval() and query()
- Visualization with Matplotlib: Simple Line Plots, Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional Plotting in Matplotlib

SKILLS:

- Apply data science methods and techniques, and acquire analysis skills
- Data manipulation and data cleaning using python and pandas regular expressions

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Application **of** the analytical skills	Apply	1	1, 2, 9, 10, 12
2	Make usepackages like NumPy, Pandas, matplotlib etc.,	Apply	1	1, 2, 5, 9, 10, 12
3	Analyzevarious packages to analyze& interpret various domain data and visualize them	Analyze	2	1, 2, 3, 5, 9, 10, 12
4	Analyzethe insights of data for further decisions	Analyze	2	1, 2, 9, 10, 12

TEXT BOOK:

1. Wes McKinney, “Python for Data Analysis” 3rd Edition, O Reilly, 2022

REFERENCE BOOKS:

1. Jake VanderPlas, “Python Data Science Handbook”, 1st Edition, O'Reilly, 2016
2. Joel Grus, “Data Science from Scratch”, 2nd Edition, O Reilly, 2019
3. Foster Provost & Tom Fawcett, “Data Science for Business”, O Reilly, 2013

22BC802 - STATISTICAL METHODS FOR DATA VISUALIZATION

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Python programming

COURSE DESCRIPTION AND OBJECTIVES:

Statistics is critical for machine learning and this course imparts sufficient statistical knowledge required for machine learning. Statistics allow us to gather insights from data and determine whether our assumptions are valid or not. Using statistics, we can make educated assumptions and forecasts based on real-world data. This course makes students familiar with python libraries to apply statistical analysis and covers advanced python data structures and visualization methods. In addition, it teaches how to use python to implement advanced statistical analysis.

MODULE-1

UNIT-1 **14L+0T+12P=26 Hours**

DATA VISUALIZATION

PYTHON FOR STATISTICS: Why Statistics? Python Packages for Statistics, Numpy and Pandas data structures for statistics; Data Input: Load data from CSV, Excel, ASCII and Text Files; Saving data into files; Data types: Categorical and Numerical.

Data Visualization: Elements of data visualization, Exploration plots: Scatter plots, Line plots, bar plots, box plots, Error-plots, histograms, Kernel-density-estimation plots, Cumulative frequencies, Error-bars, box-plots, bubble-plot, grouped bar charts, pie charts, Advanced plots: correlation, regression, waffle charts, word clouds, Bi-variate, and multivariate plots

UNIT-2 **10L+0T+4P=14 Hours**

DESCRIPTIVE STATISTICAL ANALYSIS

Populations And Samples: Population Vs Sample, Need for Sampling,

Sampling Techniques: Random Sampling, Clusters Sampling, Systematic Sampling, Stratified Sampling Techniques.

Descriptive Statistical Analysis: Measures of Central Tendency: Mean, Median, Mode, Geometric Mean; Measures of Dispersion: Range, Percentiles, Standard Deviation and Variance.

PRACTICE ASSIGNMENTS:

- **Write code to perform the following operations on Numpy arrays:**
  i. Create a 2D Numpy array with 24 elements of size 4x6 and retrieve the last three rows, retrieve the first two column values, retrieve the sum of the second row, retrieve the sum of first column, and display the max value index in the array
  ii. Create a 2D Numpy array with 42 elements of size 7x6, add a new row, Delete an existing column, replace a specific value, and identify how many values are less than given x
  iii. Create a 1D-array with 64 elements, Reshape the array into 4, 2x8 arrays, also reshape the array into other possible shapes, Convert the data type into float, Split the array into three sub-arrays of same size
  iv. Create a 2D Numpy array with 35 elements of size 7x5, identify unique values in the array, identify the existence of duplicates, perform conditional replace operations, insert NaNs, replace NaNs,
- **Load a CSV file into Numpyarray and apply the following:**
  i. Write the code routine to print the masked (gray) colored sub-array
  ii. Print the maximum of the fifth row.
  iii. Reshape the array (change columns to rows, rows to columns)
  iv. Extract all the odd number using conditional logic
  v. Find the column wise mean, std and variance
- **Pandas library for analyzing tabular data:**
  - Load data from CSV files and understand your data
  - Query and index operations on the above data frame
  - Insert, delete and update your data
  - Apply various filters on the data
  - Group, merge and aggregate data in the data frames
  - Identify and Fix missing values in the data
- **Apply the following operations on the given csv file**
  i. Load data from CSV files
  ii. Retrieve first 10, last 10 rows, 3rd Column and a subgroup
  iii. Query and index operations on the above data frame
  iv. Insert, delete and update your data
  v. Apply aggregate operations
  vi. Apply various filters on the data
  vii. Group, merge, and aggregate data in the data frames

- **Visualize data with the help of the following graphical representations:**

  (a) Line plots (b) Bar plots (c) Error Plots (d) Scatter plots (e) KDE Plots (f) Heat Maps (g) Box Plots (h) Pie graph (i) Histogram (j) multiple graphs in single figure (k) saving figures

MODULE-2

UNIT-1 **8L+8T+8P=24 Hours**

PROBABILITY DISTRIBUTIONS

Discrete Distributions: Bernoulli Distribution, Binomial Distribution, Poisson Distribution.

Continuous Distributions: Normal Distribution and Examples of Normal Distribution; Central Limit Theorem

Continuous Distributions Derived from The Normal Distribution: t-Distribution, Chi-Square Distribution, F-Distribution.

UNIT-II **8L+8T+8P=24 Hours**

HYPOTHESIS TESTS FOR STATISTICAL ANALYSIS

Typical analysis Procedure: Data Screening and Outliers, Normality Check; Hypothesis Concept, Errors, p-Value, Interpretation of the p-Value, Types of Error, Sensitivity and Specificity

Hypothesis Tests For Statistical Analysis: z-test, Student's t-Test, One-Way Chi-Square Test, Chi-Square Contingency Test, Analysis of Variance (ANOVA): One-Way ANOVA, Two-Way ANOVA.

Linear Regression Models: Linear Correlation-Correlation Coefficient, Rank Correlation; General Linear Regression Model, Coefficient of Determination, Linear Regression Analysis with Python

PRACTICE ASSIGNMENTS:

- **Sampling and Resampling:**
  - Generate a population of random numbers
  - Generate multiple samples using Random sampling with and without random sampling
  - Load a balanced dataset and visualize the class distribution
  - Load an imbalanced dataset and visualize the class distribution
- **Interpreting Data Using Descriptive Statistics:** Compute Mean, Median, Mode, Standard Deviation, Variance, Co-variance, Interquartile Range and Skewness for two different datasets and write your interpretations about these statistical measures. Which measure is best suitable? Justify
- **Generating Samples from Probability Distributions:**
  - Generate a set of random numbers (which corresponds to a uniform distribution) using the function rand and plot its histogram. What is the shape of this histogram and why?
  - Investigate how the shape of the histogram is affected by the number of random numbers you have generated.
  - Similarly generate numbers using Bernoulli, Binomial distributions and plot a histo gram and check the shape.
  - Generate numbers using exponential and poisson distributions and plot a histo gram and check the shape.

- **Hypothesis tests:** Implement the following three popular statistical techniques for hypothesis testing:
    - Chi-square test, T-test and ANOVA test (Calculate the Test Statistic and P-value by running a Hypothesis test that well suits your data and Make Conclusions).
- **Linear Regression Analysis:** Download house prediction dataset and explore the data, Prepare the dataset for training, Train a linear regression model, and Make predictions and evaluate the model.

SKILLS:

- Statistical Tool Usage
- Data analysis
- Visualization

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply data acquisition tools to collect and visualize	Apply	1	1
2	Analyze data by evaluating various statistical measure	Analyze	1,2	2
3	Develop statistical models for data analysis	Develop	1,2	3
4	Installation and Usage of Python Tools for data visualization and statistical analysis	Apply	1,2	1,5

TEXT BOOKS:

1. Thomas Haslwanter, "An Introduction to Statistics with Python With Applications in the Life Sciences, - Springer- ISSN 1431-8784 - ISBN 978-3-319-28315-9 Springer International Publishing Switzerland 2016.

2. Zed A. Shaw, "Learn Python 3 the Hard Way", 1st edition, Pearson Education Inc 2018

REFERENCE BOOKS:

1 Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python" 2nd edition, Oreilly Publishers, 2020.

2 Bharti Motwani, "Data Analytics using Python" , 1st edition, Wiley Publisheres, 2021

22BC803-BIG DATA ANALYTICS

L	T	P	C
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basics of database, Data mining

COURSE DESCRIPTION AND OBJECTIVES:

This course gives an overview of Big Data, i.e., storage, retrieval, and processing of big data. In addition, it also focuses on the "technologies", i.e., the tools/algorithms that are available for storage, and processing of Big Data. It also helps a student to perform a variety of "analytics" on different data sets and to arrive at positive conclusions.

MODULE-1

UNIT-1 **10L+6T+0P=16 Hours**

INTRODUCTION TO BIG DATA ANALYTICS

Introduction: Data, Characteristics of data and types of digital data, Sources ofdata, working with unstructured data, Evolution, and definition of big data, Characteristics and need ofbig data, and Challenges of big data

Big Data Analytics: Overview of business intelligence, Data Science, and analytics, Meaning and characteristics of big data analytics, Need for big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in the big data environment.

UNIT-2 **6L+10T+0P=16 Hours**

HADOOP, HDFS

Introducing Hadoop, Need of Hadoop, Limitations of RDBMS, RDBMSversus Hadoop, Distributed computing challenges, History of Hadoop, Hadoop overview, the use cases ofHadoop, Hadoop distributors, HDFS, Processing data with Hadoop,managing resources and applications with Hadoop YARN, Hadoop ecosystem.

PRACTICES:

- Examples of digital data
- Types of digital data
- Real time examples of unstructured data
- Real time examples of structured and semi structured data
- Real time challenges of Big data environment
- Role of Data analyst in decision making process
- Hardware support to process huge amount of data
- Distributed environment vs. parallel environment
- CAP theorem
- BASE theorem
- Evolution of Hadoop
- Installation of Hadoop
- Basic commands in Hadoop
- YARN installation
- Managing resources with YARN

MODULE-2

UNIT-1 **10L+6T+0P=16 Hours**

MAPREDUCE, PIG, HIVE, SPARK

Introduction to mapper, reducer, combiner,partitioner, searching, sorting, compression, real-time applications using MapReduce, combiner,partitioner, Introduction to Hive, Hive architecture, Hive data types, Hive file format, Pig versus Hive. The anatomy of pig, Pig on Hadoop, Pig philosophy, Use case for pig, ETL processing, Pig Latin overview, Data types in pig, Relational operators, Piggy bank, Introduction, features of spark, components of spark,

UNIT-2 **6L+10T+0P=16 Hours**

PROGRAMMING USING MAPREDUCE, PIG, HIVE, SPARK

Programming using MapReduce, Matrix multiplication using MapReduce, and page rank algorithm using MapReduce.Hive query language (HQL),Partitions and bucketing, RCFile Implementation, working with XML files, User-defined Function(UDF) in Hive, programming with Resilient DistributedDatasets (RDD), Running pig, Execution modes of pig, HDFScommands, Word count example using pig.

PRACTICES:

- Modules of MapReduce
- Installation and configuration of MapReduce
- Installation of Hive,PIG,Spark
- Running and execution modes of Hive
- Real time application of Hive
- Running and execution modes of PIG
- Real time application of PIG
- Running and execution modes of Spark
- Real time application of Spark

SKILLS:

- Students will to build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- Students will be able to write Map-Reduce based Applications • Students will be able to design and build applications using Hive and Pig based Big data Applications
- Students will learn tips and tricks for Big Data use cases and solutions.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Classify fundamentals of various big data analytics techniques	Analyze	1	1, 2,3,4,5,9,10 12
2	Analyzethe Big Data frameworks like Hadoop to efficiently store and process BigData to generate Analytics.	Analyze	1	1, 2,3,4,5,9,10 12
3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics	Analyze	2	1, 2,3,4,5,9,10 12
4	Apply data analytics on real time datasets using Hive and Pig	Apply	2	1, 2,3,4,5,9,10 12
5	Evaluate functions of Hive, Pig and Spark using real time datasets	Evaluate	2	1, 2,3,4,5,9,10 12

TEXT BOOKS:

1. Seema Acharya and SubhashiniChellappan, "Big Data and Analytics", 1st Edition, Wiley, Publishers, 2015.
2. Holden Karau, Andy Konwinski, Patrick Wendell and MateiZaharia, "Learning Spark", 1stEdition, Oreilly, 2015.

REFERENCE BOOKS:

1. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge, University Press, 2012.
2. Boris lublinsky, Kevin t. Smith and AlexeyYakubovich, "Professional Hadoop Solutions", 1stEdition, Wiley, 2015.
3. Chris Eaton and Dirkderoosetal, "Understanding Big data", 1st Edition, McGraw Hill, 2012.
4. Tom White, "HADOOP: The definitive Guide", 1st Edition, O Reilly 2012.
5. VigneshPrajapati, "Big Data Analytics with R and Hadoop",1st Edition, Packet Publishing, 2013.

22BC804-NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basics of classification techniques, statistical measures.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to provideknowledgeon fundamental concepts of Natural Language Processing. The methods for representing and classifyingthe written text is the primary focus. Students will learn tokenization, word representation (TF-IDF and word vectors) and classification techniques. Further understanding sentiment analysis and recommendation systems.

MODULE-1

UNIT-1 **8L+6T+0P=14 Hours**

N GRAM LANGUAGE MODELS

Words, Corpora, Text Normalization, Minimum Edit distance. N Grams, Evaluating Language Models, Generalization and Zeros, Smoothing. Naïve Bayes and Sentiment Classification,

UNIT-2 **8L+10T+0P=18 Hours**

SENTIMENT ANALYSIS

Training the Naïve Bayes classifier, Optimizing for sentiment analysis, Naïve Bayes for other text classification tasks, as a language model, Evaluation Test sets and Cross validation, Statistical significance of testing, advanced feature selection.

PRACTICES:

- Computing 1gram,2gram and N gram tokens
- Stop word removing
- Stemming and Lemmatization
- Performing sentiment analysis using Naïve Bayes
- Building a language model
- Latent Semantic Analysis for feature selection/dimensionality reduction
- Latent Dirichlet Allocation method for topic modelling

MODULE-2

UNIT-1 **8L+6T+0P=14 Hours**

VECTOR SEMANTICS AND SEQUENCE PROCESSING

Vector Semantics: Lexical semantics, vector semantics, word vectors, Cosine for measuring similarity, **TF-IDF**: weighting terms in the vector, Applications, Word2Vec, Visualizing Embeddings, semantic properties of embeddings, Evaluating Vector models. **Sequence Processing with Recurrent Networks**: Simple Recurrent Networks, Applications of RNN's, **Deep Networks**: Stacked and Bidirectional RNNs, managing Context in RNNs: LSTMs and GRU.

UNIT-2 **8L+10T+0P=18 Hours**

POS TAGGING

Part of speech tagging: English Word classes, The Penn Treebank POS tag set, POS tagging, HMM POS tagging, Maximum Entropy Markov Models.

PRACTICES:

- Computing word similarity using cosine distance
- Computing TF-IDF values for words in a corpus
- Computing word embeddings using word2vec
- Visualizing the word vectors using TSNE plots
- Tokenizing and sequence generation
- RNN based sentiment analysis
- LSTM based sentiment analysis
- GRU based sentiment analysis

SKILLS:

- Text pre-processing and Analyzing
- Develop sentiment analyzers
- Develop recommendation systems
- Computing similarity score
- Develop Context preserving language models

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Build TF-IDF matrix for a given text corpora	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply word embeddings and demonstrate the word analogies.	Apply	1, 2	1, 2, 5, 9, 10,12
3	Apply Recurrent Neural Networks for sentiment analysis problem	Apply	2	1, 2, 5, 9, 10, 12
4	Analyseperformance differences of different types of word embeddings.	Analyze	2	1, 2, 3, 5, 9, 10
5	Evaluate the performance of LSTM and GRU models	Evaluate	2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOK:

1. Daniel Jurafsky, James H. Martin, "An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rdEdition, Pearson Publication, 2014.

REFERENCE BOOK:

1. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1stEdition, O_Reilly Media, 2009.

22BC805-INTRODUCTION TO ARTIFICIAL INTELLIGENCE

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Programming for Problem Solving, Data Structures, Design & Analysis of Algorithms, Discrete Mathematics, Probability and Statistics.

COURSE DESCRIPTION AND OBJECTIVES:
The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. In addition to this, student will understand the building blocks of AI such as search, knowledge representation, inference, logic and learning. This course enables the students to develop a small AI system for real time problems.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

INTELLIGENT SYSTEMS

Introduction, what is AI, Examples of AI systems, Brief history of AI, Intelligent Agent, Agents and environments, The concept of rationality, The nature of environments, Structure of agents.

UNIT-2: **10L+10T+0P=20 Hours**

PROBLEM SOLVING KNOWLEDGE REPRESENTATION

State Space Problem; Searching: Uniform search, Informed Search: Solving problems by searching: Best First Search, A* algorithm, AO* algorithm, Heuristic functions, Hill climbing, searching game trees: Min Max Search, Alpha Beta pruning.Propositional logic: Logical agents, reasoning patterns in propositional logic, Inference in propositional logic, Resolution, forward chaining, Backward chaining.

PRACTICES:

- Implementation of Vacuum Cleaner Agent.
- Implementation of BFS, DFS.
- Implementation of 8-Puzzle problem using A* algorithm.
- Implementation of n queen's problem.
- Implementation of MIN-MAX algorithm.
- Representation of simple fact for a statement

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

PLANNING

First order logic: Reasoning patterns in First order logic, Inference in First order logic, Resolution, forward chaining, Backward chaining, Unification. problem; The planning problem: Planning with state space search, Partial order planning, planning graphs, Planning with propositional logic, Analysis with planning approaches.

UNIT-2 **8L+8T+0P=16 Hours**

LEARNING

Forms of learning: Supervised Learning Unsupervised learning, Reinforcement learning, Ensemble Learning, Machine Learning, Learning Decision Trees, Expert system, Natural Language Processing.

PRACTICES:

- Implementation of a graph and apply BFS on it.
- Implementation on backward and forward reasoning.
- Implementation of containing facts related to following predicates
- Location (city, state) Stays (person, city) Display:
- list of persons, state and city
- (ii) Given person, find the state in which he is staying.
- Implementation of the answers about family members and relationships. Include predicates & clauses which define sister, brother, father, mother, Grandchild, grandfather and uncle. The program should be able to answer question such as following.
    - Father (X, bob)
    - Grandson (X, Y)
    - Uncle (bill, Sue)
    - Mother (marry, X)
- Implementation of an inductive learning algorithm for decision trees.

SKILLS:

- Analyze Intelligent systems.
- Apply problem solving techniques.
- Interface various knowledge representation.
- Create a dynamic planning.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply AI search Models and Generic Search strategies for problem solving.	Apply	1	1,2,3,4,5,9,10, 12
2	Apply and evaluate the searching strategies to achieve the goal for a given situation.	Apply	1	1,2,3,4,5,9,10, 12
3	Inspect and analyse Logic for representing Knowledge and Reasoning of AI systems	Analyze	1, 2	1,2,3,4,5,9,10, 12
4	Design different learning algorithms for improving the performance of AI systems	Create	1,2	1,2,3,4,5,9,10, 12
5	Conduct investigation and Implementation of project using AI learning Techniques.	Create	2	1,2,3,4,5,9,10, 12

TEXT BOOKS:

1. Stewart Russell and Peter Norvig, “Artificial Intelligence-A Modern Approach”, 4th Edition, Pearson Education/ Prentice Hall, 2020.
2. Ivan Bratko, “Prolog Programming for Artificial Intelligence”, 4th Edition, Addison Welsey, 2011.

REFERENCE BOOKS:

1. George F Luger, "Artificial Intelligence", 6th Edition, Pearson Education,2021.
2. Elaine Rich, Kevin Knight and Shiva Shankar B Nair, "Artificial Intelligence", 3rd Edition, Tata McGraw, 2017
3. Dan W Patterson, "Introduction to Artificial Intelligence and Expert systems", 2nd Edition Pearson, 2015.

22BC806-MACHINE LEARNING

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basic Statistics

COURSE DESCRIPTION AND OBJECTIVES:

The objective of this course is to familiarize the students with some basic learning algorithms and techniques and their applications, as well as general questions related to analyzing and handling large data sets. Several software libraries and data sets publicly available will be used to illustrate the application of these algorithms. The emphasis will be thus on machine learning algorithms and applications, with some broad explanation of the underlying principles.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO MACHINE LEARNING

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised, Reinforcement- The Machine Learning process. Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

UNIT-2 **12L +0T+8P = 20 Hours**

SUPERVISED LEARNING

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis, Logistic Regression- K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression- Ensemble methods.

PRACTICES:

- Installation of Python Libraries/tools for Machine Learning
- Data pre-processing using Python Machine Learning libraries
- Design a model to predict the housing price from Boston Dataset using Multivariate Linear Regression.
- Build a classifier using Logistic Regression, k- Nearest Neighbor / Decision Tree to classify whether the given user will purchase a product or not from a social networking dataset.

MODULE-2

UNIT-1 **12L+0T+4P=16 Hours**

UNSUPERVISED LEARNING

Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality - Dimensionality Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis.

Perceptron- Multilayer perceptron- Back Propagation – Initialization, Training and Validation Support Vector Machines(SVM) as a linear and non-linear classifier - Limitations of SVM.

UNIT-2 **12L+0T+12P=24 Hours**

ARTIFICIAL NEURAL NETWORKS

Bayesian Networks - Learning Naive Bayes classifiers - Markov Models – Hidden Markov Models Sampling – Basic sampling methods – Monte Carlo -Reinforcement Learning

PRACTICES:

- Segment a customer dataset based on the buying behaviour of customers using K-means/Hierarchical clustering.
- Dimensionality reduction of any CSV/image dataset using Principal Component Analysis.
- Recognition of MNIST handwritten digits using Artificial Neural Network.
- Build an email spam classifier using SVM.
- Classify the given text segment as 'Positive' or 'Negative' statement using the Naïve Bayes Classifier.
- Predict future stock price of a company using Monte Carlo Simulation.

SKILLS:

- Implement various classification algorithms.
- Implement variety of clustering techniques.
- Dealing with the data in high-dimensional space.

ACTIVITIES:

- Statistical analysis on dataset
- Classification
- Clustering

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Solve complex problems using artificial neural networks and kernel machines.	Apply	2	1, 2,3,5, 9,10,12
2	Develop an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction.	Apply	1	1, 2,3,5, 9,10,12
3	Analyze various machine learning algorithms and terminologies and perform data pre-processing using standard ML library.	Analyze	1	1, 2, 3, 5,9,10, 12
4	Design a predictive model using appropriate supervised learning algorithms to solve any given problem.	Create	2	1, 2,3,5,9,10 12

TEXT BOOKS:

1. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning",1st Edition Pearson Education, 2018.
2. Christopher Bishop, "Pattern Recognition and Machine Learning" 1st Edition, Springer, 2011.

REFERENCE BOOKS:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, 1st Edition, MIT Press, 2012.
2. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, 1st Edition, CRC Press, 2009.
3. Andreas C. Muller, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, 1st Edition, O'Reilly,2016.
4. Sebastian Raschka, “Python Machine Learning”, 1st Edition,Packt Publishing, 2015.

22BC807-ARTIFICIAL NEURAL NETWORKS

L	T	P	C
3	**0**	**2**	**4**

PREREQUISITE KNOWLEDGE: Basics of algorithms and programming

COURSE DESCRIPTION AND OBJECTIVES:

The course introduces the principles of neuro-computing with artificial neural networks, which widely used for addressing real-world problems such as classification, regression, pattern recognition, data mining, time-series modelling, etc.. This course majorly covers two kinds of learning such as supervised and unsupervised.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

ARCHITECTURE OF NEURAL NETWORK

Introduction to Artifical Neural Networks: Introduction; Artificial neural networks; Historical development of neural networks; Biological Neural Networks; Basic building blocks; Terminologies. Fundamental Models of Artificial Neural Networks: Introduction, McCullochPitts Neuron model; Perceptron Networks: Introduction; Single layer perceptron; Brief introduction to multilayer perceptron networks

UNIT-2 **8L+8T+0P=16 Hours**

MODELS OF ARTIFICIAL NEURAL NETWORKS

Comparison between them and the Computer; Comparison between artificial and biological neural network; Fundamental Models of Artificial Neural Networks: Learning rules - Hebbian learning rule, perceptron learning rule, Delta learning rule, Widrow-Hoff rule or least mean square (LMS) rule, Competitive learning rule; Out star learning; Boltzmann based learning; Hebb net.

PRACTICES:

- Plot a few activation functions that are beingused in neural networks.
- Generate ANDNOT function using McCulloch-Pitts neural net.
- Generate XOR function using McCulloch-Pitts neuron.
- With a suitable example demonstrate the perceptron learning law with itsdecision regions.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

TYPES OF NEURAL NETWORKS

Adaline and Madaline Networks: Introduction, Adaline, Madaline. Associative Memory Networks: Introduction; Feedback Networks: Introduction; Feed Forward Networks: Introduction; Self Organizing Feature Map: Introduction;Adaptive Resonance Theory: Introduction, ART Fundamentals, ART1, ART2.

UNIT-2 **8L+8T+0P=16 Hours**

ADVANCED NEURAL NETWORKS

Adaline and Madaline Networks: Algorithms for pattern association, Hetero associative memory neural networks, Auto associative memory network, Bi-directional associative memory.Feedback

Networks: Discrete Hopfiled Net, Continuous Hopfiled Net, Relation between BAM and Hopfiled Nets. FEED Forward Networks: Back Propagation Network (BPN), Radial Basis Function Network (RBFN).SelfOrganizing Feature Map: Introduction; Methods used for determining the winner; Kohonen self-organizing feature maps; Learning vector quantization(LVQ); MaxNet, Maxican Hat, Hamming Net.

PRACTICES:

- Program to show Back Propagation Network for XORfunction with Binary Input and Output.
- Program to show Back Propagation Network for XORfunction with Bipolar Input and Output.
- Program to illustrate ART neural network.

SKILLS:

- Create different neural networks of various architectures both feed forward and feed backward.
- Perform the training of neural networks using various learning rules.
- Testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Design**different neural networks such as MLP, SOM, Hopfiled net and ART etc.	Apply	1,2	1,3,5,9,10
2	Applythe linear and nonlinear models for learning the data.	Apply	1, 2	1, 2, 5, 9, 10
3	Identify the differences between networks for supervised and unsupervised learning.	Analyze	1	1, 2, 4, 5, 9, 10, 12
4	Analyze the performance of various neural networks on different kinds of data.	Analyze	1, 2	1, 2, 3, 5, 9, 10
5	Evaluate the neural networks for classify/ cluster the data to achieve higher performance.	Create	1,2	1,2,3,4,6,9,10,12

TEXT BOOK:

1. Sivanandam, S.Sumathi and S.N.Deepa; "Introduction toNeural Networks", 2nd Edition., TATA McGraw HILL: 2005.

REFERENCE BOOKS:

1. Simon. Hhaykin, "Neural networks A comprehensive foundation", 2nd Edition, Pearson Education, 2004.
2. B. Yegnanarayana, "Artificial neural networks", 1st Edition., Prentice Hall of India Pvt. Ltd, 2005.
3. Li Min Fu, "Neural networks in Computer intelligence",1st Edition., TMH, 2003.

22BC808-DEEP LEARNING

L	T	P	C
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Engineering mathematics, probability and statistics, algebra

COURSE DESCRIPTION AND OBJECTIVES:

The objective of this course is to introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems. The course also requires students to implement programming assignments related to these topicssuch as recurrent neural networks, long short-term memory cells and convolution neural networks.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

FUNDAMENTAL CONCEPTS OF DEEP LEARNING

Introduction to Deep Learning: Deep Learning, Paradigms of learning problems, Types of Deep Neural Networks – Artificial Neural Network, Multi-layer neural network,Convolution neural network, Recurrent neural network, Deep belief network, Perspectives, and Issues in deep learning framework.

Applications of Deep Learning – Fraud detection, Customer relationship management systems, Computer vision, Natural language processing, Autonomous vehicles, E-commerce

UNIT-2 **12L+0T+8P=20 Hours**

TYPES OF DEEP NEURAL NETWORKS

Convolution Neural Networks–Basic structure of Convolutional Network, Case studies: Alex net, VGGNet, GoogLeNet, Applications of CNN– Object Detection, Content based image Retrieval.

Recurrent Neural Networks– Basic structure of RNN, Case studies: Long Short-Term Memory, Gated Recurrent Units, Back propagation through time, Bidirectional LSTMs, and Bidirectional RNNs, Applications of RNN– Language Modelling and Generating Text, Text Summarization.

PRACTICES:

- Develop a deep learning model with an Artificial Neural Network to create a predictive model based on the Churn dataset for new customers. The predictive model must predict for any new customer that he or she will stay in the bank or leave the bank. So that bank can offer something special for the customers whom the predictive model predicts will leave the bank.
- Develop a deep learning model of your First Image Processing Project with Convolutional Neural Network.
- Develop a deep learning model for fruit classification using GoogleNetConvolutional Neural Network.
- Develop a deep learning model to solve sequence prediction problem using RNN with Dropout condition.
- Develop a deep learning model to perform anomaly detection model using LSTM.

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

GENERATIVE &ATTENTION MODELS

Generative models– Restrictive Boltzmann Machines (RBMs), Deep Boltzmann Machines, Autoencoders, and Generative Adversarial Networks.

Attention and memory models– Attention Mechanism, Types of Attention models – Local Attention, Global Attention, and Self-Attention.

UNIT-2 **12L+0T+8P=20 Hours**

BETTER TRAINING OF DEEP NEURAL NETWORKS

Training Neural Network–Keras, Tensorflow, Regularizations, Training deep models, Dropouts,Multi-task learning, Early Stopping, Parameter Initialization and Parameter Sharing,Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

PRACTICES:

- Develop a project for implementing Image Segmentation using CNN with Tensorflow.
- Develop a project for implementing Time Series Forecasting with LSTM Neural Network Python.
- Develop a project for building a Review Classification Model using Gated Recurrent Unit.
- Develop a project for building CNN Image Classification Models for Real Time Prediction.
- Design a Deep Learning Project on Store Item Demand Forecasting.

SKILLS:

- To know the fundamentals of deep learning.
- Main techniques in deep learning and the main research in this field.
- Design and implement deep neural network systems.
- Identify new application requirements in the field of computer vision.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Design** deep architectures and algorithms for pattern recognition	**Design**	1	1,2,3,5,12
2	**Analyse** classification problems probabilistically and estimate classifier performance	**Analyse**	2	1,2,3,5,12
3	**Apply** the essentials of Deep Learning and Deep Network architectures on real time applications.	**Apply**	1, 2	1,2,3,5,10,12
4	**Evaluate** the real-time applications of Deep Models	**Evaluate**	1, 2	1,2,3,5,10,12

TEXT BOOKS:

1. CharuC.Aggarwal, “Neural Networks and Deep learning”, Springer International Publishing, 2018
2. Satish Kumar, “Neural Networks, A Classroom Approach”, Tata McGraw -Hill, 2007.

REFERENCE BOOKS:

1. P.A. Devijer& J. Kittler, “Pattern Recognition - A Statistical Approach”, Prentice-Hall, 2008.
2. Christopher. M. Bishop, “Pattern recognition and machine learning”, Springer, 2006.
3. M. NarasimhaMurthy and Der V Susheela Devi, “Introduction to Pattern Recognition and Machine Learning”, IISC Press, 2008.
4. Simon Haykin, “Neural Networks, A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman, 2001.

22BC809-OPEN SOURCE FOR WEB TECHNOLOGIES

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: HTML, CSS and JavaScript

COURSE DESCRIPTION AND OBJECTIVES: This course introduces the concepts pertaining to open-source technologies such as LINUX, MySQL, PHP, Apache web server, and various other tools used to develop web applications. In addition, this course is to offer insight into various open-source technologies to develop web applications.

MODULE-1

UNIT-1 **10L+0T+8P=18Hours**

OPEN SOURCE

Open Source: Introduction, Open source operating System, Nature of open sources, Advantages, Application of open sources. Introduction to dynamic web content, Setting up a development server, Introduction to PHP, PHP functions and Objects, PHP arrays, Practical PHP.

UNIT-2 **14L+0T+8P=22 Hours**

OPEN SOURCE DATABASE

Open Source Database: Introduction to MySQL, Accessing MySQL using PHP, querying a MySQL database with PHP, Practical MySQL, preventing hacking attempts, Using MySQL procedure.

Form Handling: Form Handling building forms, Retrieving submitted data, An example program, Cookies, Sessions, and authentication using cookies in PHP, HTTP authentication, Using sessions.

PRACTICES:

- Develop dynamic web content pages
- Setting up a development server.
- Practice Basic PHP programs
- Working with PHP functions and Objects.
- Create arrays using PHP.
- Create dynamic web pages using PHP.
- Practice basic MySQL queries.
- Access MySQL database using PHP.
- Create Database Connectivity with PHP & MySQL.
- Working with MySQL procedures.
- Create forms using PHP and retrieve the data from the database.
- Work with Cookies and Sessions in PHP.

MODULE-2

UNIT-1 **10L+0T+8P=18 Hours**

HTML5

HTML5: Introduction to HTML5, The HTML5 Canvas, HTML5 audio, and video, Bringing it all together by designing a social networking site.

UNIT-2 **14L+0T+8P=22 Hours**

ANGULAR JS

Angular JS: The basics of AngularJS, Introduction MVC, Filters, and modules, Directives, Working with Forms, Services and server communication, Organizing views, Angular JS animation.

PRACTICES:

- Practice basic HTML5 tags.
- Usage of HTML5 audio, video, and canvas tags.
- Build a Social Networking Website.
- Practice basic AngularJS.
- Working with forms, services, and server communication through AngularJS.
- Using views in AngularJS applications.
- Create animations using AngularJS.

SKILLS:

- Use the Open source technologies.
- Develop dynamic web pages.
- Design a social networking website.
- Apply the AngularJS concepts to dynamic websites.
- Create animations using AngularJS.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiar with open source technologies.	Apply	1	1,2,3,4,5,9,10,12
2	Create dynamic web pagesusing PHP & MySQL	Apply	1	1,2, 3,4,5,9,10,12
3	Familiar with HTML5 tags and AngularJS.	Apply	1	1,2, 3,5,9,10,12
4	Design a social networking website using open-source technologies.	Analyze	2	1, 3,4, 5,9,10,12
5	Design and develop dynamic websites with animations using AngularJS.	Evaluate	2	1, 2, 3,4, 5,9,10,12

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL & JavaScript WITH JQUERY, CSS & HTML5", 5th Edition, O'Reilly, 2018.

2. Andrew Grant, "Beginning Angular JS", 1st Edition, Apress, 2014.

REFERENCE BOOKS:

1. Steve Prettyman, "Learn PHP 7 Object Oriented Modular Programming using HTML5, CSS3, JavaScript, XML, JSON, and MySQL", 1st Edition, Apress, 2015.

2. Adrian W. West and Steve Prettyman, "Practical PHP 7, MySQL 8, and MariaDB Website Databases: A Simplified Approach to Developing Database-Driven Websites", 2nd Edition, A Press, 2018.

22BC810-MOBILE APPLICATION DEVELOPMENT

L	T	P	**C**
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Basics of Object Oriented Programming through JAVA, XML.

COURSE DESCRIPTION AND OBJECTIVES:

This course helps a student to design effective mobile applications using the Android development environment. The main objective of this course is to create user-friendly applications that involve design of layout, window components, and multiple screens with one- touch options.

MODULE-1

UNIT-1 **8L+0T+6P=14 Hours**

GETTING STARTED WITH ANDROID PROGRAMMING AND ACTIVITIES

Introduction to Android: Android introduction, Versions of android, Features of android, Architecture, Devices in the market, Developer community.

Understanding Activities: Life cycle of an activity, applying styles and themes, Types of dialog boxes, Types of Intents, Resolving Intent filter collision, Returning Results from an Intent, passing the data using Intent Object,

UNIT-2 **8L+0T+10P=18 Hours**

INTENTS AND FRAGMENTS

Intents: understanding about Intent Objet and Intent filters, calling built in apps using Intents.

Fragments: Fragment types, Life Cycle, Interaction between Fragments

PRACTICES:

- Installation of Android studio, its required tools and AVD.
- Displaying the hello world message in AVD.
- Creating a basic activity and applying themes, styles to it,
- Displaying various types of Dialog objects.
- Linking activities with Intents.
- Passing data using intent object.
- Usage of Fragments and adding them dynamically to the application.
- Communication between fragments.

MODULE-2

UNIT-1 **8L+0T+6P=14 Hours ANDROID UI DESIGN & DISPLAY ORIENTATION**

Android UI Design: Understand components of a screen, View, View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll View.

Display Orientation: Anchoring Views, Resizing and Repositioning Views, managing changes to screen orientation, utilizing the action bar, Creating UI programmatically.

UNIT-2 **8L+0T+10P=18 Hours**

UNDERSTANDING BASIC VIEWS

Basic Views: Designing UI with basic views, Progress bar view, Auto complete Text View.

PRACTICES:

- Design an application with various Layouts.
- Designing Action bar to the application.
- Handling the basic view events of the application.
- Design an application to implement AutoComplete Text View.

SKILLS:

- Analyze the mobile application for user requirements.
- Usage of various components of Android operating system.
- Utilization of activities, intents, layouts and views for content

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Apply** the android mobile application design models and styles to mobile apps.	Apply	1	1,2,3,4,5,9,10, 12
2	**Apply** activities, dialog boxes, fragments, intents, views and layouts to android apps	Apply	1, 2	1,2,3,4,5,9,10, 12
3	**Analyze** various mobile applications during the design of mobile apps.	Analyze	1, 2	1,2,3,4,5,9,10, 12
4	**Create** user-friendly mobile user interfaces and views.	Create	2	1,2,3,4,5,9,10, 12
5	**Design** and develop mobile apps for given real time scenario using modern tool android studio.	Create	1, 2	1,2,3,4,5,9,10, 12

TEXT BOOK:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", 1st Edition, John Wiley & Sons.

REFERENCE BOOKS:

1. RaimonRefolsMontane, Laurence Dawson, "Learning and Android Application Development", 1st Edition, PACKT Publishing, 2016.
2. Reto Meier, "Professional Android 4 Application Development", 3rd Edition, Wrox, 2012.
3. Adam Gerber and Clifton Craig, "Learn Android Studio", 1st Edition, Apress, 2015.

22BC811-CLOUD COMPUTING

L	T	P	C
3	0	2	**4**

PREREQUISITE KNOWLEDGE: Computer Networks and Operating Systems

COURSE DESCRIPTION AND OBJECTIVES:

This course is to provide the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations. Another objective is to expose the students to frontier areas of Cloud Computing and information technology, while providing sufficient foundations to enable further study and research.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

CLOUD COMPUTING PARADIGMS

Principles of Parallel and Distributed Computing: Parallel and Distributed Computing, Elements of Parallel and Distributed Computing, Technologies for distributed computing, Web2.0, Service Oriented Computing, Utility Oriented Computing.

Introduction: Cloud computing at a Glance, Historical Development, Building Cloud Computing Environments, Computing Platform and Technologies, Cloud reference model, Types of the Cloud. Cloud Platform in industry, AWS, GAE, MS Azure.

UNIT-2 **12L+0T+8P=20 Hours**

VIRTUAL MACHINES AND VIRTUALIZATION OF CLUSTERS AND DATA CENTERS

Virtualization: Introduction, Characteristic of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization.

Clusters and Data Centers: Implementation Levels of Virtualization,Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management.

PRACTICES:

- Hardware architecture of Parallel processing.
- SISD, SIMD, MISD and MIMD basics.
- Components of Distributed systems.
- Distributed system Architecture.
- Client-Server and Peer-to-Peer architecture.
- Virtualized Environment.

Type II Hypervisor setup and configuration

- Create Virtual Machines (VM)
- Create Snapshot of all Virtual Machines
- Create clone of VM
- Configure Networking

Type I Hypervisor setup and configuration

- Virtual machines on Xen Migration of VMs
- Create a Virtual Network Switch
- Create Differencing Hard Disks for use by Virtual Machines
- Implementation of Desktop virtualization
- Implementation of Server virtualization – multiple servers on single system
- VM migration and Backup and recovery virtual machines in type I

MODULE-2

UNIT-1 **12L+0T+8P=20 Hours**

CLOUD ARCHITECTURE, SERVICES AND STORAGE

Layered Cloud Architecture Design: NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, laaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, S3.

UNIT-2 **12L+0T+8P=20 Hours**

SERVICE ORIENTED ARCHITECTURE

Introduction: Services and Service-Oriented Architecture, Message-Oriented Middleware, Portals and Science Gateways, Discovery, Registries, Metadata, and Databases, Workflow in Service - Oriented Architectures.

PRACTICES:

- EC2 AWS – S3 bucket based static webpages.
- AWS – Local balancing and auto scaling
- PaaS – GAE
- Deployment of Open stack or Virtual box from the scratch
- SaaS – Deployment of any SaaS application for an online collaborative too
- Creating an application in Dropbox to store data securely.
- Develop a source code using Dropbox API for updating and retrieving files.
- Cloud application development using IBM Bluemix Cloud.

SKILLS:

- Know the concept of cloud computing models.
- Development of cloud from the existing technologies.
- Knowledge on the various issues in cloud computing
- Identify the types of virtualization.
- Analyze the SOA benefits.
- Learn web service standards and technologies

ACTIVITIES:

- Virtual Machine configuring
- Accessing public cloud services.
- Analysis the GAE services.
- Execute the PaaS in Azure.
- Apply service models

COURSEOUTCOMES:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Build the hardware Virtual machine.	Apply	1	1, 2, 3,4,5,9,10,11 ,12
2	Make use ofvirtualization techniques in network	Apply	1	1, 2,3,4, 5,9,10,11,12
3	Applyvirtualization techniques to build virtual machine cluster	Apply	1	1, 2, 3, 4, 5, 9,10,11,12
4	Categorizevarious types cloud models and services	Analyze	2	1, 2, 3, 4, 5, 9,10,11,12
5	Classifyweb service, service oriented architecture and message oriented architecture.	Analyze	2	1, 2, 3, 4, 5, 9,10,11,12
6	Implementcomputation and storage cloud	Create	2	1, 2, 3, 4, 5, 9,10,11,12

TEXT BOOKS:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

REFERENCE BOOKS:

1. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management and Security”, CRC Press, 2017.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach”, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)”, O'Reilly, 2009

22BC812-FULL STACK TECHNOLOGIES

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Python,DBMS,Web Technologies, Web Services, Android

COURSE DESCRIPTION AND OBJECTIVES:

This course explores and demonstrate Understand the advantages of front end and back end tech. The objective of this course is to offer the knowledge and skill on the basic principles and concepts in complete web development.

MODULE-1

UNIT-1 **12L+0T+8P=20 Hours**

INTRODUCTION TO WEB PROGRAMMING

Git - An Introduction to Version Control, Git, Command-line Scripting, Basic HTML, CSS

Bootstrap - Overview, Environment setup, Precompiled Bootstrap, Source Code, Grid System, Bootstrap CSS Overview, Typography, Code, Tables, Forms, Helper Classes, Responsive Utilities, Glyph icons, Dropdowns, Navigation Elements, Breadcrumb, Pagination, Badges, Progress bars, Plugins Overview, Transition Plugin, Model Plugin, Dropdown Plugin, Scroll spy Plugin, Tab Plugin, Tooltip Plugin, Popover Plugin, Alert Plugin, Button Plugin, Collapse Plugin, Carousel Plugin, Affix Plugin.

UNIT-2 **12L+0T+8P=20 Hours**

CLOUD AND DEVOPS

Motivation-Cloud as a Platform, Operations, Deployment Pipeline: Over all Architecture Building and Testing, Deployment, Case study: Migrating to Micro services.

Origin of DevOps - The developers versus operations dilemma, Key characteristics of a DevOps culture, deploying a Web Application, Creating and configuring an account, Creating a web server, Managing infrastructure with Cloud Formation, Adding a configuration management system

PRACTICES:

- Configure the web application in Bootstrap
- Development of web application using DevOps
- Configure the web server for web application using DevOps

MODULE-2

UNIT-1: **12L+0T+8P=20 Hours**

DJANGO and MONGODB

Django - Creating the Project, Running the Development Server, Creating the Application, designing a Model, setting up the Database, Setting up the Application, Dynamic Web Sites, Communication, Data Storage, Presentation.

Introduction to Mongodb - JSON and MongoDB, adopting a Non, relational Approach, opting for Performance vs. Features Running the Database Anywhere, Generating or Creating a Key, Using Keys and Values, Implementing Collections

UNIT-2: **12L+0T+8P=20 Hours**

ANGULAR JS, NODE JS AND EXPRESS FRAMEWORK

Introduction to Angular JS - Introduction, Features, Angular JSModel-View, Controller, Expression, Directives and Controllers, Angular JS Modules, Arrays, Working with ng-model,

Working with Forms, Form Validation, Error Handling with Forms, Nested Forms with ng-form, Other Form Controls

Node JS and Express Framework - Introduction, Using the Terminals, Editors, Building a Webserver with Node, The HTTPModule, Views and Layouts, Middleware, Routing, Form Handling with Express, The Request and Response Objects, Handle bars, Comments and Blocks, Polymorphism

PRACTICES: (MAKE ALL YOUR APPLICATION IN YOUR GIT ACCOUNT)

- Battleships Multiplayer Gaming Application
- Angular 2 chess game
- Build a web application using Bootstrap

SKILLS:

- Able to apply various fundamentals for problem solving using python.
- Able to implement DevOps.
- Able to create object-oriented solution by applying various concept like polymorphism, inheritance and package with python programming.

COURSEOUTCOMES:

Upon successful completion of this course, students willhave the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Experiment with**Git and use Bootstrap, Django fundamentals concepts to build and deploy robust web applications and apps	Apply	1, 2	1,2,3,4,5,9,10,12
2	**Make use of**different data types to design programs involving DevOps practices.	Apply	1	1,2,3,4,5,9,10,12
3	**Apply**functional, reliable and user-friendly Angular JS programs for a given problemapplication.	Apply	1	1,2,3,4,5,9,10,12
4	**Develop** solutions using Mongo DB	Apply	2	1,2,3,4,5,9,10,12
5	**Analyze** the usage of Node JS and Express	Analyze	2	1,2,3,4,5,9,10,12

TEXT BOOKS:

1. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016
2. Adam Freeman - ProAngular JS, 1st Edition, Apress, 2014
3. David Hows, Peter Membrey, EelcoPlugge"MongoDB Basics", Apress, 2014.
4. Ethan Brown, "Web Development with Node and Express", 1st Edition,Oreilly Publishers, 2014.
5. BradDayley, "Learning Angular JS", 1st Edition,Addison-Wesley Professional, 2014.

REFERENCE BOOKS:

1. AgusKurniawan, "AngularJS Programming by Example", 1st Edition, PE Press, 2014.
2. Kyle Banker, Peter Bakkum, Shaun Verch, Dough Garrett, Tim Hawkins, "MongoDB in Action",2nd Edition, Manning Publications, 2016.
3. Steve Hoberman, "Data Modeling for MongoDB", 1st Edition, Technics Publication, 2014.
4. ShyamSeshadri, Brad Green, "AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps", Apress, 2015.
5. Evan M. Hahn,"Express in Action", 1st Edition, Manning Publications, 2014.