SATHYABAMA

INSTITUTE OF SCIENCE & TECHNOLOGY

(Deemed to be University U/S 3 of UGC Act 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

SYLLABUS

SCHOOL OF COMPUTING

BACHELOR OF ENGINEERING IN COMPUTER SCIENCE AND ENGINEERING

(8 SEMESTERS)

REGULATIONS – 2019

SATHYABAMA INSTITUTE OF SCIENCE & TECHNOLOGY

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

Regulations – 2019 is applicable to the students admitted to the Degree of Bachelor of Engineering (B.E.), Bachelor of Technology (B.Tech) (Eight Semesters) programme effective from the academic year 2019-2020.

1. NOMENCLATURE

- **Programme** : Refers to the Bachelor of Engineering / Technology Stream that a student has chosen for study.
- **Course** : Refers to the course (Subject) that a student would have to undergo during the study in the Institution
- **Batch** : Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2019–2023 refers to students belonging to a 4 year Degree programme admitted in 2019 and completing in 2023.
- **School** : Each Programme and Department of the Institution is grouped under various Schools. Eg. School of Computing consists of Departments of Computer Science and Information Technology. This School offers various Undergraduate and Postgraduate Programmes in Engineering like B.E (Computer Science), Batch (Information Technology) and M.E (Computer Science).
- **Dean** : Refers to the Head of a School. Group of Departments under which various UG and PG Programmes are offered.
- **HoD** : Refers to the Head of a Department (HoD) offering various UG and PG programmes. He/She will be the Head of all faculty members and Students belonging to the Department

2. STRUCTURE OF PROGRAMME

2.1 Every Programme will have a curriculum with syllabi consisting of theory and practical such as:

(i) General Foundation courses comprising English, Mathematics, Basic Sciences and Engineering Sciences.

(ii) Core courses belonging to the Major Programme of study.

(iii) Electives offered by the School and the Department related to the Major programme of study.

(iv) Common Electives to be chosen from
Professional elective from respective school and
Open elective, which can be chosen by any student of any stream.

(v) Laboratory courses such as Workshop practice, Computer Practice, Engineering Graphics, etc.

(vi) Professional Training Courses during the semester.

(vii) Project Work

2.2 Each semester curriculum shall normally have a blend of lecture courses and practical courses.

2.3 Each course is normally assigned certain number of credits as follows:

- **Lecture Hours (Theory)** : 1 credit per lecture hour per week.
- **Laboratory Hours** : 1 credit for 2 Practical hours, 2 credits for 3 or 4 hours of practical per week.
- **Interdisciplinary project** : 3 credits for six hours per week in sixth semester
- **Project Work phase I** : 3 credits for 6 hours of project work (phase I) per week.
- **Project Work phase II** : 7 credits for 14 hours of project work (phase II) per week.
- **Professional Training** : 2 credits for 4 hours per week
- **Industry 4.0** : 2 credits for 4 hours per week
- * All the engineering course having 3 credits may have 4 lecture hours of which one hour will be dedicated for tutorial which will not be accounted as a credit.

2.4 The medium of instruction, examinations and project report will be in English Language throughout the Programme.

2.5 For the award of the degree, a student has to earn the total number of credits as specified in the curriculum of the relevant branch of study.

3. DURATION OF THE PROGRAMME

A student is normally expected to complete the B.E./B.Tech. Programme in 8 semesters but in any case not more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system). The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

4.1 He/She secures not less than 90% of overall attendance in that semester.

4.2 Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

5 **SCHOOL DEAN**

Each school is headed by a school dean which comprises of many departments and courses offered by them. The school dean is responsible for all activities taking place inside the school in coordination with all department heads and all faculty members belonging to the school. The school dean will be appointed by the Institution on rotational basis. The school dean shall act as a linkage between the HoD's, faculty members and the students. The school dean makes a review of all the academic activities of faculty , students and research on a regular time interval and takes steps to improve the morale of all faculty and students.

6 **HEAD OF THE DEPARTMENT**

Each department offering various UG and PG programmes is headed by a chief (HoD). The head of the department (HoD) is responsible for allotting courses to each faculty member uniformly in consultation with other HoD's and school deans. The HoD is responsible for streamlined teaching of courses to students, improvement and assessment of teaching quality within the department on a continuous basis, assessment of faculty members, transparent conduct of continuous assessment examinations, interacting with parents, ensuring that all academic and non-academic activities of faculty and students are monitored and steps taken for their improvement.

7 **YEAR COORDINATOR**

The Head of the Department shall appoint a year coordinator for each batch of students admitted in to a programme, throughout their period of study. The year coordinator shall act as a linkage between the Hood, faculty members and the students. The year coordinator gets information about the syllabus coverage by the faculty members, requirements of the students academically and otherwise, attendance and progress of the students from the respective class counselors. The year coordinator also informs the students about the academic schedule including the dates of assessments and syllabus coverage for each assessment, weightage for each assessment, their continuous assessment marks and attendance % details before the commencement of end semester examinations.

8 **CLASS COUNSELOR**

There shall be a class counselor for each class/section. The class counselor will be one among the teachers of the department. He/She will be appointed by the Head of the respective department. The responsibilities for the class counselor shall be:

- ✓ To act as the channel of communication between the HoD, school dean, year coordinator, course coordinator, faculty and students of the respective class.
- ✓ To collect and maintain various statistical details of students.
- ✓ To help the batch coordinator in planning and conduct of the classes.
- ✓ To monitor the academic performance of the students including attendance and to inform the year coordinator.
- ✓ To take care of the students' welfare activities like industrial visits, seminars, awards etc.

9 **COURSE COORDINATOR FOR EACH COURSE**

- Each theory course offered to more than one class or branch or group of branches, shall have a "course coordinator". The course coordinator will be nominated by the school dean in consultation

with respective head of the department. The course coordinator will be normally senior faculty members who are one among the teachers teaching the course.

The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure

- A common teaching methodology is followed for the course.
- The study materials are prepared by the faculty members and communicated to the students periodically,
- The involvement of students in course based projects and assignments,
- To prepare common question paper for continuous assessment tests,
- For uniform evaluation of continuous assessments answer sheets by arriving at a common scheme of evaluation.

- The course coordinator is responsible for evaluating the performance of the students in the continuous assessments and end semester examinations and analyse them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and school dean for suitable action.

10. EXAMINATIONS

There will be a continuous assessment examination and end semester examination for both theory and practical courses of all programmes.

(i) **Theory courses**

Continuous Assessment	:	50 Marks
End Semester Exams	:	50 Marks

(ii) **Practical courses**

Continuous Assessment	:	50 Marks
End Semester Exams	:	50 Marks

10.1 CONTINUOUS ASSESSMENT EXAMS

(a) Theory Courses

- There will be a minimum of two continuous assessment exams, for each theory course. Each assessment exam will be conducted for a maximum of 50 Marks. The total marks secured in the two assessment exams out of 100, will be converted to 45 Marks. The percentage (%) of attendance secured by the candidate in a course in a semester will carry a weightage of 5 Marks, which will be added to the continuous assessment marks for each course.
- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

(b) Practical Courses

- For practical courses, the student will be evaluated on a continuous basis for 25 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 20 marks for model exam at the end of the semester and 5 marks for attendance in the course.
- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab incharge and batch coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester exams.

If a student has not done all the experiments assigned for that lab, before the scheduled date or has attendance percentage less than 90%, the student will not be allowed to appear for the model and end semester practical exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course is offered.

10.2 END SEMESTER EXAMINATIONS

- The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May during the even semesters for both theory and practical courses of all programmes.

11. ELECTIVE COURSES

Every student has the option of choosing elective courses during the period of study. These electives will be offered in the pre final and final year of study. The student has to select electives offered by the respective department. The student also has the choice of selecting the other electives from electives offered by departments within the school in that semester and/or from the electives which can be opted as elective by all undergraduate branches of the Institution (open electives).

12. FINAL YEAR PROJECT WORK

- Project work has to be done by each student in the final year. The project work has been divided in to two phases (phase 1 and 2). Project work phase 1 has to be done in the pre-final semester and phase 2 during the final semester.
- Project work may be allotted to a single or two students as a group. In special cases, the number of students in a project group cannot exceed three, if it can be justified by the project supervisor and HoD, that the project work content is large enough.
- For project work, assessment is done on a continuous basis by 3 reviews for 50 marks and final viva voce carries 50 Marks.
- There shall be three project reviews (conducted during the pre-final semester and final semester) to be conducted by a review committee. The student shall make presentation on the progress made, before the committee. The head of the department shall constitute the review committee for each branch in consultation with school dean. The members of the review committee will evaluate the progress of the project and award marks.

	PROJECT REVIEWS			FINAL PROJECT VIVA VOCE
	1	2	3	
Max. Marks	5	15	30	50

- The total marks obtained in the three reviews, rounded to the nearest integer is the continuous assessment marks out of 50. There shall be a final viva-voce examination at the end of final semester conducted by one internal examiner, one external examiner and the supervisor concerned.

- A student is expected to attend all the project reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the reviews, even if they are working on a project in an industry based outside Chennai city. It is their duty to inform the organization about the project reviews and its importance, and get permission to attend the same. If a student does not attend any of the project reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the final viva voce.
- The final project viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. The external examiner shall be appointed by the controller of examinations. The internal and external examiner will evaluate the project for 20 Marks each. The project report shall carry a maximum of 10 marks.
- The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If a candidate fails to submit the project report on or before the specified deadline, he/she can be granted an extension of time up to a maximum limit of 5 days for the submission of project work, by the head of the department.
- If he/she fails to submit the project report, even beyond the extended time, then he/she is deemed to have failed in the project work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and school dean.

13. PASSING REQUIREMENTS

- A candidate should secure not less than 50% of total marks prescribed for the courses, subject to securing a minimum of 30% marks out of maximum mark in end semester exams. Then he/she shall be declared to have passed in the examination.
- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

14. AWARD OF DEGREE

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Grade	Grade Points (GP)
90-100	A++	10
80-89	A+	9
70-79	B++	8
60-69	B+	7
50-59	C	6
00-49 (Reappear)	RA	0
ABSENT	AAA	0
Withdrawal	W	0
Authorised Break of Study	ABS	0

CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$\text{GPA} = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_i C_i} \qquad \text{CGPA} = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_i C_i}$$

Where C_i – Credits for the course

GP_i – Grade Point for the course

$\sum_i$ – Sum of all courses successfully cleared during all the semesters

n - Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

Final Degree is awarded based on the following:

CGPA ≥ 9.0	-	First Class - Exemplary
CGPA ≥ 7.50 < 9.0	-	First Class with Distinction
CGPA ≥ 6.00 < 7.50	-	First Class
CGPA ≥ 5.00 < 6.00	-	Second Class

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

15. GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- Name of the candidate with date of birth and photograph.
- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester, marks and the grade secured
- The Grade Point Average (GPA) for the semester.

16. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E/B.Tech. degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 8 semesters within the maximum period specified in clause 3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 6 years (5 Years for Lateral Entry Candidates) reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the Institution.

iv) No disciplinary action pending against the student.

v) The award of Degree must have been approved by the Board of Management of the Institution.

17. CLASSIFICATION OF DEGREE AWARDED

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) securing a overall CGPA of not less than 9.0 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class - EXEMPLARY**. Authorized Break of Study vide Clause 20, will be considered as an Appearance for Examinations, for award of First Class – Exemplary. Withdrawal from a course shall not be considered as an appearance for deciding the eligibility of a candidate for First Class – Exemplary
2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) securing a overall CGPA of not less than 7.5 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 20, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall

not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction.

3. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 8 consecutive semesters (maximum of 6 semesters for Lateral entry students who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vide Clause 20 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided (in addition to four years for Normal B.E / B.Tech and 3 years for Lateral Entry) will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.
4. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 12 consecutive semesters (10 consecutive semesters for Lateral Entry students, who join the course in the third semester) after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.
5. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.
6. A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the Head of the Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

18. WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the School Head through HoD.
- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class – Exemplary, First Class with Distinction and First Class.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

19. AUTHORIZED BREAK OF STUDY

- This shall be granted by the Management, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.
- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the School Dean in advance (Not later than the Reopening day of that semester) through the Head of the Department stating the reasons. He /She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he left.
- The authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification only for First Class.
- The total period for completion of the programme shall not exceed more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system) irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.
- If any student is not allowed to appear for End Semester Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered as permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.
- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one Semester by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.
- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrolment. Such candidates are not entitled to seek readmission under any circumstances.

20. PROFESSIONAL TRAINING

- Every student is required to undergo Industrial Visits during every semester of the Programme. HoDs shall take efforts to send the students to industrial visits in every semester.
- The students will have to undergo Professional training for a Minimum period of 2 weeks during the semester Holidays at the end of second year.
- This could be internship in an industry approved by the School Dean or Professional Enrichment courses (like attending Summer Schools, Winter Schools, and Workshops) offered on Campus or in Registered off Campus recognised Training Centres approved by the School Dean for a minimum period of 3 weeks.
- A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organisation, in which the student has undergone training and the Head of the Department concerned, shall be submitted after the completion of training. The evaluation of report and viva voce examination can be computed as per norms for the End Semester examination.
- The evaluation of training will be made by a three member committee constituted by Head of the Department in consultation with year coordinator and respective Training Coordinator. A presentation

should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

21. NON CREDIT COURSES

Every student has to enrol for "environmental science and engineering" as a mandatory course either in first or second semester. Every student has the opportunity to enroll in any of the following Non Credit Courses, during the programme. The student will have to register for the courses with the respective coordinator before the end of First Semester.

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- Youth Red Cross (YRC)
- SPORTS CONTRIBUTION: The student is involved in any sport and represents the institution in Tournaments.
- PROFESSIONAL CLUBS: Any student can also involve in any of the Professional Clubs available in the Institution.

The above contribution should be completed by the end of sixth Semester (end of Pre-final year) as per the requirements. The Contribution and the Performance of the candidate, will be Printed in the Final Semester Grade sheet and Consolidate Grade Sheet under the Category "NON CREDIT COURSES" indicated as SATISFACTORY or NOT SATISFACTORY.

22. OPPORTUNITY TO GAIN EXPOSURE OUTSIDE THE INSTITUTION

- This is facilitated by the "Centre for Academic Partnership & International Relations" of Sathyabama Institute of Science and Technology consisting of a team of experienced faculty members involved in forging Partnerships with Leading Universities, Educational Institutions, Industrial and Research establishments in India and Abroad.
- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any Universities in India and abroad.
- This is possible only with the List of Research Organizations, Educational Institutions in India and abroad approved by Sathyabama Institute of Science and Technology.
- A student should have got a minimum of 6 CGPA without any arrears at the time of applying and at the time of undergoing such courses outside, to avail this facility.
- The student can have the option of spending not more than three to Six months in the Final year or Pre- final year of his/her Degree. During this period, the student can do his/her Project work or register for courses which will be approved by the Centre for Academic Partnerships (CAP), under the Guidance of a Project Supervisor who is employed in the Organization and Co-guided by a faculty member from our Institution.

- Applications for the above should be submitted by the students to the Centre for Academic Partnerships (CAP), in the required format, with complete details of University, Courses and Equivalence Details and approved by the School Dean.
- The Centre will go through the applications and select the students based on their Academic Performance and enthusiasm to undergo such courses. This will be communicated to the Universities Concerned by the Centre.
- The performance of the student in the courses, registered in that Institute or University will be communicated officially to Centre for Academic Partnership & International Relations.
- The students who undergo training outside the Institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

23. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall be liable for disciplinary action as prescribed by the Institution from time to time.

24. REVISION OF REGULATIONS AND CURRICULUM

From time to time, the Institution may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

PROGRAMME: B.E.
COMPUTER SCIENCE AND ENGINEERING
CURRICULUM

SEMESTER-1										
Sl. No.	**COURSE TYPE**	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**	**Marks**		**PAGE No.**
								CAE	**ESE**	
1	Theory	SHSA1101	Technical English	3	0	0	3	50	50	
2	Theory	SMTA1101	Engineering Mathematics – I	3	*	0	3	50	50	
3	Theory	SCYA1101	Engineering Chemistry	3	*	0	4	50	50	
4	Theory	SBTA1101	Environmental Science and Engineering	3	0	0	0	50	50	
5	Theory	SEEA1103	Electrical and Electronics Engineering	3	*	0	3	50	50	
6	Theory	SCSA1104	Problem Solving Techniques with C and C++	3	*	0	3	50	50	
7	Practical	SCYA2101	Engineering Chemistry Lab	0	0	2	1	25	25	
8	Practical	SCSA2101	Python and Problem Solving Techniques Lab	0	0	4	2	50	50	
Total Credits for 1st semester = 19										
Total Marks for 1st semester = 750										

SEMESTER-2										
Sl. No.	**Course type**	**Course code**	**Course title**	**L**	**T**	**P**	**C**	**Marks**		**Page No.**
								CAE	**ESE**	
1	Theory	SMTA1201	Engineering Mathematics –II	3	*	0	3	50	50	
2	Theory	SPHA1101	Physics for Engineers	3	*	0	4	50	50	
3	Theory	SMEA1102	Engineering Drawing	1	0	4	3	50	50	
4	Theory	SCSA1201	Fundamentals of Digital Systems	3	0	0	3	50	50	
5	Theory	SCSA1204	Python Programming	3	0	0	3	50	50	
6	Theory	SCSA1203	Data Structures	3	*	0	3	50	50	
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	
8	Practical	SEIA2202	Digital Systems Lab	0	0	4	2	50	50	
9	Practical	SCSA2201	Data Structures Lab	0	0	4	2	50	50	
Total Credits for 2nd semester = 24										

Total Marks for 2nd semester = 850

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

* TUTORIAL HOUR NOT INCORPORATED IN CREDIT CALCULATION

SEMESTER-3

Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1302	Discrete Mathematics	3	*	0	3	50	50	
2	Theory	SCSA1301	Database Management Systems	3	0	0	3	50	50	
3	Theory	SCSA1302	Theory of Computation	3	*	0	3	50	50	
4	Theory	SCSA1303	Software Engineering	3	0	0	3	50	50	
5	Theory	SITA1301	Programming in Java	3	0	0	3	50	50	
6	Theory	SCSA1304	Advanced Data Structures	3	*	0	3	50	50	
7	Practical	SCSA2301	Database Management Systems Lab	0	0	4	2	50	50	
8	Practical	SITA2301	Programming in Java Lab	0	0	2	1	50	50	
9	Practical	SCSA2302	Code Optimization and Debugging - I	0	0	2	1	25	25	
Total Credits for 3rd semester = 22										
Total Marks for 3rd semester = 850										

SEMESTER- 4

Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1402	Probability and Statistics	3	*	0	3	50	50	
2	Theory	SCSA1401	Object Oriented Analysis and System Engineering	3	0	0	3	50	50	
3	Theory	SAIC4001	Industry 4.0	2	0	2	2	50	50	
4	Theory	SECA1404	Microprocessor and Microcontroller Based Systems	3	0	0	3	50	50	
5	Theory	SCSA1402	Computer Architecture and Organization	3	0	0	3	50	50	
6	Theory	SCSA1403	Design and Analysis of Algorithms	3	*	0	3	50	50	
7	Practical	SECA2405	Microprocessor and Microcontroller Lab	0	0	4	2	50	50	
8	Practical	SCSA2401	Object Oriented Analysis and System Engineering Lab	0	0	2	1	50	50	
9	Practical	SCSA2402	Code Optimization and Debugging - II	0	0	2	1	25	25	
Total Credits for 4th semester = 21										
Total Marks for 4th semester = 850										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
CAE – CONTINUOUS ASSESSMENT EXAMINATION, ESE – END SEMESTER EXAMINATION,
VIVA – VIVAVOCE

* TUTORIAL HOUR NOT INCORPORATED IN CREDIT CALCULATION

SEMESTER- 5										
Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SCSA1501	Operating Systems	3	0	0	3	50	50	
2	Theory	SCSA1502	Computer Networks and Design	3	0	0	3	50	50	
3	Theory	SITA1502	Customer Interface design and Development	3	*	0	3	50	50	
4	Theory	SCSA1503	Computer Graphics and Multimedia Applications	3	0	0	3	50	50	
5	Theory	SITA1503	Fog and Cloud Computing	3	0	0	3	50	50	
6	Theory		Elective-1	3	0	0	3	50	50	
7	Practical	SCSA2501	Computer Networks Lab	0	0	4	2	50	50	
8	Practical	SCSA2502	Operating Systems Lab	0	0	4	2	50	50	
9	Practical	S11APT1	Professional Training	0	0	0	2		100	
Total Credits for 5th semester = 24										
Total Marks for 5th semester = 900										

SEMESTER- 6										
Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SCSA1601	Machine Learning	3	*	0	3	50	50	
2	Theory	SCSA1602	Network Security	3	*	0	3	50	50	
3	Theory	SCSA1603	Big data Analytics	3	0	0	3	50	50	
4	Theory	SCSA1604	Compiler Design	3	*	0	3	50	50	
5	Theory		Elective – 2	3	0	0	3	50	50	
6	Practical	SCSA2601	Machine Learning and Data Analytics Lab	0	0	4	2	50	50	
7	Practical	SCSA2602	Compiler Design Lab	0	0	4	2	50	50	
8	Practical	S11APT2	Industrial Project	0	0	0	3		100	
Total Credits for 6th semester = 22										

Total Marks for 6th semester = 800

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
CAE – CONTINUOUS ASSESSMENT EXAMINATION, ESE – END SEMESTER EXAMINATION,
VIVA – VIVAVOCE

* TUTORIAL HOUR NOT INCORPORATED IN CREDIT CALCULATION

SEMESTER-7

Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	
2	Theory	SCSA1701	Cyber Physical Systems	3	0	0	3	50	50	
3	Theory	SCSA1702	Artificial Intelligence	3	*	0	3	50	50	
4	Theory		Open Elective-1	3	0	0	3	50	50	
5	Theory		Elective – 3	3	0	0	3	50	50	
6	Practical	SCSA2701	Cyber Physical Systems Lab	0	0	4	2	50	50	
7	Practical	S11APROJ1	Project (phase 1)				3	50	50	
Total Credits for 7th semester = 20										
Total Marks for 7th semester = 700										

SEMESTER-8

Sl. No.	Course type	Course code	Course title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	
2	Theory		Elective – 4	3	0	0	3	50	50	
3	Practical	S11APROJ2	Project (Phase 2)				7	50	50	
Total Credits for 8th semester = 13										
Total Marks for 8th semester = 300										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
CAE – CONTINUOUS ASSESSMENT EXAMINATION, ESE – END SEMESTER EXAMINATION,
VIVA – VIVAVOCE
* TUTORIAL HOUR NOT INCORPORATED IN CREDIT CALCULATION

Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total no.	Total Credits	Total Marks	Total no.	Total Credits	Total Marks
1	6	16	600	2	3	150
2	6	19	600	3	5	250
3	6	18	600	3	4	250
4	6	17	600	3	4	250

5	6	18	600	3	6	300
6	5	15	500	3	7	300
7	5	15	500	2	5	200
8	2	6	200	1	7	100
Overall Total	42	122	4200	20	43	1800

Overall total credits for B.E.(CSE) programme	165
Overall total marks for B.E.(CSE) programme	6000

LIST OF PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course code	Course title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SCSA3001	Data Mining and Data warehousing	3	0	0	3	50	50	
2	SITA3003	Advanced Java Programming	3	0	0	3	50	50	
3	SCSA3002	Quality Engineering	3	0	0	3	50	50	
4	SCSA3003	Software Defined Networks	3	0	0	3	50	50	
5	SCSA3004	Advanced Computer Architecture	3	0	0	3	50	50	
6	SCSA3005	System Software Architecture	3	0	0	3	50	50	
7	SECA3009	Digital Image Processing	3	0	0	3	50	50	
8	SITA3008	Internet of Things	3	0	0	3	50	50	
9	SCSA3006	Green Computing	3	0	0	3	50	50	
10	SCSA3007	Introduction to Visual Computing	3	0	0	3	50	50	
11	SCSA3008	Distributed database and Information Systems	3	0	0	3	50	50	
12	SCSA3009	Soft Computing	3	0	0	3	50	50	
13	SCSA3010	Performance Evaluation of Computers	3	0	0	3	50	50	
14	SCSA3011	Hardware Interfaces and its Application	3	0	0	3	50	50	
15	SITA3009	Cyber Forensics and Cyber Law	3	0	0	3	50	50	
16	SCSA3012	Knowledge Management Systems	3	0	0	3	50	50	
17	SCSA3013	System Modeling and Simulation	3	0	0	3	50	50	
18	SCSA3014	Open Source Systems	3	0	0	3	50	50	
19	SCSA3015	Deep Learning	3	0	0	3	50	50	
20	SCSA3016	Data science	3	0	0	3	50	50	
21	SITA1501	Wireless Sensor Network and Architecture	3	0	0	3	50	50	
22	SITA1601	Mobile Application and Development	3	0	0	3	50	50	

23	SEIA3006	Robotics and Automation	3	0	0	3	50	50	
24	SCSA3017	Quantum Computing	3	0	0	3	50	50	
25	SITA3010	Natural Language Processing	3	0	0	3	50	50	
26	SCSA3018	Parallel System Programming	3	0	0	3	50	50	
27	SCSA3019	Augmented and Virtual Reality	3	0	0	3	50	50	
28	SITA3011	Block chain Technologies	3	0	0	3	50	50	

OPEN ELECTIVE COURSES

Sl. No.	Course code	Course title	L	T	P	C	MARKS		Page No.
							CAE	ESE	
1	SALA4001	Intellectual Property Law	3	0	0	3	50	50	
2	SAEA4001	Fundamentals of Aerospace Technology	3	0	0	3	50	50	
3	SBAA4001	Fundamentals of Management	3	0	0	3	50	50	
4	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	
5	SBTA4001	Biology for Engineers	3	0	0	3	50	50	
6	SBMA4001	Neurology	3	0	0	3	50	50	
7	SBMA4002	Modelling of Physiological Systems	3	0	0	3	50	50	
8	SBMA4003	Drug Delivery System	3	0	0	3	50	50	
9	SBMA4004	Fundamentals of Mechatronics	3	0	0	3	50	50	
10	SBMA4005	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	
11	SBMA4006	Virtual and Augmented Reality	3	0	0	3	50	50	
12	SBMA4007	Medical Optics and Laser Applications	3	0	0	3	50	50	
13	SBMA4008	Forensic Science	3	0	0	3	50	50	
14	SBMA4009	Human Factors in Engineering and Design	3	0	0	3	50	50	
15	SCHA4001	Corrosion Engineering	3	0	0	3	50	50	
16	SCHA4002	Energy Engineering	3	0	0	3	50	50	
17	SCHA4003	Environmental Impact Assessment	3	0	0	3	50	50	
18	SCHA4004	Environmental Pollution and Control	3	0	0	3	50	50	
19	SCIA4001	Disaster Management	3	0	0	3	50	50	
20	SCSA4001	R Programming	3	0	0	3	50	50	
21	SCSA4002	5 G Network	3	0	0	3	50	50	
22	SECA4001	Software Tools for Engineering Applications	3	0	0	3	50	50	
23	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	
24	SMEA4002	Wind and Solar Energy	3	0	0	3	50	50	

Programme Curriculum grouping based on course components -2019 Regulation

Course Component	Curriculum Content (% of total number of credits of the programme)	Total number of contact hours	Total number of credits
Basic Sciences	7.2	10	**12**
Engineering Sciences	18.78	43	**31**
Humanities and Social Sciences	3.6	6	**6**
Programme Core	53.33	110	**88**
Programme Electives	9.09	15	**15**
Project(s)	6.06	-	**10**
Internships/Seminars	3.03	-	**5**
Total	**100**	**202**	**165**

SHSA1101	TECHNICAL ENGLISH	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable the students to read and respond to specialized (scientific) materials and to subject areas included for their study.
- To provide an opportunity for students to comprehend and react in oral and written forms to the specialized texts that they read in their respective courses so as to summarise and paraphrase the texts presented in the class.
- To provide opportunities for students to respond to listening and writing tasks by using digital tools
- To enhance 21st century skills like communication, collaboration, critical thinking and creativity through blended learning contexts

UNIT 1 LANGUAGE AT THE WORD LEVEL 9 Hrs.

Listening: Note Taking, Summarising the information related to resume preparation and also in flow chart templates
Speaking: Self Introduction, Talking about likes and dislikes
Reading for global understanding: The content from subject related matter or *True Love by Isaac Asimov*
Writing: Formal and informal emails and letters and letter to the editor with current problems and solutions suggested.
Vocabulary: Affixes**,** technical terms, collocations, ordering words, sequence words, contextual guessing of words
Language Focus: changing one form of speech into another; present tense, signalling words for time and order
Language Lab work: Focus Digital literacy: students join Google classroom/ or class wiki: become familiar with these online tools, by introducing themselves by doing ice breaking activity

UNIT 2 LANGUAGE AT THE SENTENCE LEVEL 9 Hrs.

Listening and Predicting: Listen to the current trends about product sales; arrive at inference about technical and environmental issues
Speaking: Debate on current issues, JAM on current topics
Reading for global comprehension: Identifying topic sentences by reading Short story on Men are Different or content from the subject areas.
Writing: Writing compare/ contrast paragraphs, process descriptive paragraphs and paraphrasing passages to express meaning in own words.
Vocabulary: identifying and framing verbal phrases, prepositions and prepositional phrases form the reading materials suggested
Language focus : Recognising Past and future tense, Conjunctions and sentence linkers with specific focus on signalling words for Comparison/similar ideas, Contrast/opposite ideas, adjectives/ adverbs for comparisons there by to use in senesces.
Identify clauses, kinds of sentences based on their functions in the passage, Transformation of sentences from one type into the other (Simple, compound, complex), impersonal passive voice.
Language Lab: Digital literacy: Respond to quiz using Google spread sheet, Prepare a quiz on Language focussed areas, sharing links in Google classroom, and collect answers/ respond to survey sheets of their classmates to write compare contrast paragraphs of responses in wikis.

UNIT 3 LANGUAGE AT THE DISCOURSE LEVEL –REPORTING 9 Hrs.

Listening: Listening for gist / to summarize and to find the attitude and tone of the speaker
Speaking: Making Group Presentations based on information gathered by eliciting responses-Preparing a questionnaire, with open ended questions to make a survey about electronic gadgets/ social media/ environmental issues using elements of reasoning to make a presentation in the class.
Reading - Skimming and scanning to find specific information and preparing notes on Passage on 'Making Effective presentation'
Writing: Framing open ended questions using elements of reasoning. Survey Report: Preparation of and documenting to report the findings. Arranging the sentences in the right order.
Vocabulary: Word classification, word associations, paired expressions
Language focus: Subject verb agreement, punctuation, Common errors in spelling, punctuation

Language Lab: Digital literacy: Use interactive power point tools like Prezi, Slideshare to make presentation on the survey report to share link in the Google classroom

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UNIT 4 LANGUAGE AT THE DISCOURSE LEVEL - PRODUCT DESCRIPTION 9 Hrs.

Listening: Classifying information related products
Speaking: Group discussion on current topics to arrive at solutions to problems by using elements of reasoning
Reading: Reading to prepare notes, categorising under headings and subheadings by reading Short Extracts from User Manuals. Reading and contextual guessing by reading about products
Writing: Instructions and recommendations, Preparation of User Manual on the electronic products in current usage
Vocabulary: Classification of words, descriptive words about products, definitions, compound nouns
Language: Reported Speech, causatives and double negatives, Tag questions
Language Lab: Digital literacy: Use Padlet/ quia to develop and complete vocabulary tasks created by peers in group work.

UNIT 5 LANGUAGE AT THE DISCOURSE LEVEL – CRITICAL THINKING AND CREATING 9 Hrs.

Listening and summarizing: Listening to famous speeches to identify the structure of speeches- Ted Talks/ peer presentations to fill the template
Speaking: Giving impromptu talks, Speech Writing
Reading for Global Understanding: Read technical passages and trends in social media or technological developments to summarise, Read speeches by MS Narayana Murthy ' My Life's Lessons , Dr APJ Kalam's Speech "Unity of Minds" to identify the structure of Speech
Writing: Essay writing related to the Speeches suggested for reading, besides topic areas covered in all the units, self and peer editing using rubrics
Vocabulary: Homophones/Homonyms, idioms and phrases related to technology
Language focus: Same word acting as different parts of speech
Language Lab: Digital literacy: to create their own Blogs thereby to share their creations, interactive exercises and quizzes make them visible online.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Classify technical words to use them in sentences framing, compose problem solving paragraphs in semi formal letters, use rubrics to self evaluate, listening to take linear notes, reading to infer, predict and to differentiate facts from opinions, guess contextual meaning of words, modify the verbs in present tense, use learnt language in role plays with 80% accuracy

CO2: Categorize information based on global understanding of reading materials to prepare notes in graphic format like tables, use cohesive words related to comparing and contrasting by writing short paragraphs based on visual inputs in the form of bar diagrams, pie chart etc; describe process by composing paragraphs, recognize topic sentences and identifying verbal phrases while reading, use prepositions and prepositional phrases, modify the verbs from one form to the other in past and future tenses with 80% accuracy

CO 3: Generate specific information by using scanning and skimming reading materials, Construct questionnaire to conduct class survey by framing open ended questions to generate data on current issues to make oral presentations and report in written format by using template provided, arrange sentences in the right order by using sentence linkers as clues, revise the written materials by identifying elements of editing, edit errors related to subject verb agreement, punctuation and spelling besides
coherence with 70 % accuracy, use reported speech in spoken and written form in class room in reporting contexts, list paired words, word associations by recalling and identifying by noticing them while reading

CO 4: Paraphrase based on reading to discuss and design products thereby to create and design user manual, identify technical words related to compound nouns to expand and to paraphrase, enact role plays to present the product, discuss facts and opinions of the product in pair and team work, read current topics to summarise in note form , listen to current issues to deduct meaning from the context, choose the right option, define technical words related to the reading materials.

CO 5: Summarise reading materials, use the ideas while writing essays, take, and differentiate meaning of homonyms and homophones

CO 6: Demonstrate the ability to work cooperatively in a small group environment, in activities developed for language learning in the classroom/ online for formative assessment purposes, use and develop rubrics for self reflection, apply elements of reasoning skills for critical reading, identify facts and opinions and make judgements independently, develop intellectual courage and perseverance in pair and group work.

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TEXT / REFERENCE BOOKS

1. English for Science and Technology (2013) by Department of English, Sathyabama University.
2. P Bhaskaran Nair, C Radar Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93-85386-008
3. Leiki M (1998) Academic Writing. CUP
4. Seely John(2013) Oxford Guide to Effective Writing and Speaking , OUP
5. Sen S , Mahendra etal. (2015) Communication and Language Skills . Foundation books. Chennai
6. Sheelagh Deller (2012) Teaching Other Languages Through English , CUP
7. Links for reference
8. https://www.teachingenglish.org.uk/article/theories-reading-2
9. http://www.uefap.com/writing/parag/par_sig.htm
10. https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/
11. https://www.uen.org/rubric/previewRubric.html?id=1219
12. https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric
13.Unit I reading adapted version - https://www.lifehack.org/articles/productivity/10-steps-for-success-applying-the-power-your-subconscious-mind.html

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SMTA1101	ENGINEERING MATHEMATICS – I	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

The Objective of this Course is to identify, reflect upon, evaluate and achieve conceptual understanding and knowledge of traditional Calculus to form independent judgments. The purpose of this course is for Modeling the Engineering problems and obtaining its solutions Mathematically. This helps in understanding Science, Engineering and Computer Science analytically and logical thinking is attained.

UNIT 1 MATRICES 9 Hrs

Characteristic equation of a square matrix – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen Vectors – Cayley-Hamilton theorem (without proof) – verification, finding inverse and power of a matrix – Diagonalisation of a matrix using orthogonal transformation – Quadratic forms – Nature of quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 9 Hrs

Curvature – centre, radius and circle of curvature in Cartesian co-ordinates – Evolutes – Envelope of family of curves with one and two parameters – Evolute as envelope of normal.

UNIT 3 FUNCTIONS OF SEVERAL VARIABLES 9 Hrs

Partial derivatives (Definition) – Total derivative – Jacobian – Taylor's expansion – Maxima and minima of functions of two variables – Constrained maxima and minima using Lagrange's multiplier method.

UNIT 4 INTEGRAL CALCULUS I 9 Hrs

Definite integrals – Properties of definite integrals and problems – Beta and Gamma integrals – Relation between them – Properties of Beta and Gamma integrals with proofs – Evaluation of definite integrals in terms of Beta and Gamma function.

UNIT 5 INTEGRAL CALCULUS II 9 Hrs

Double integrals in Cartesian and Polar co-ordinates – Change of order of integration – Change of variables from Cartesian to Polar coordinates – Area of plane curves using double integrals – Triple integrals – Volume using triple integrals in Cartesian co-ordinates (Simple Applications**).**

Max.45Hours

COURSE OUTCOMES

After completing this course, students will understand the following concepts thoroughly and will be able to apply it in academic problems and industrial real life problems.

CO 1:Defineeigen values and eigen vectors, radius and circle of curvature. Recall properties of definite integrals
CO2:Understand the concept of partial derivatives to find Jacobian and Taylor's series expansion. Explain change of order of integration.
CO3:Uses of Cayley Hamilton theorem and its verification. Solve problems in Area and Volume using integration.
CO4:Point out the stationary points and categorize maxima and minima. Discuss the problems involving Beta and Gamma integrals.
CO5:Produce diagonal matrix by transformation of symmetric matrices.
CO6:Develop the canonical form of a quadratic form. Construct evolute and envelope of family of curves

TEXT/REFERENCE BOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.
2. .Grewal B.S., Higher Engineering Mathematics, 41th Edition, Khanna Publications, Delhi, 2011.
3. Veerarajan T., Engineering Mathematics for First Year, II Edition, Tata McGraw Hill Publishers, New Delhi, 2008.
4. Kandaswamy P & Co., Engineering Mathematics for First Year, IX revised edition, S.Chand& Co Pub., 2010.`
5. Venkataraman M.K., Engineering Mathematics – First Year (2nd edition), National Publishing Co., 2000
6. .Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint , 2010
7. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmipublications,Reprint 2008

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration:3 Hrs.**
Part A: 10 questions carrying 2 marks each – No choice	20 marks
Part B: 2 questions from each unit of internal choice, each carrying 16 marks	80 marks

SCYA1101	ENGINEERING CHEMISTRY	L	T	P	Credits	Total Marks
		3	*	0	4	100

COURSE OBJECTIVES

- To understand the basic concepts of quantum chemistry and molecular spectroscopy
- To learn the importance of functional materials for electronic devices
- To know the significance of chemistry in engineering and technology

UNIT 1 BONDS TO BANDS 12 Hrs.

Introduction to quantum chemistry – Motion of a quantum mechanical particle in one dimension (time-independent) – Schrödinger wave equation for hydrogen atom (No derivation) – Physical meaning of wave function - Angular and radial wave functions and probability densities – Quantum numbers – Principal, azimuthal, spin and magnetic quantum numbers – Wave functions and orbital shapes - *s,p,d,f*- LCAO-MO of H_2 – Band theory of solids: Conductors, semi-conductors and superconductors – Role of As and Ga doping on band structures.

UNIT 2 MOLECULAR SPECTROSCOPY 12 Hrs.

Electromagnetic spectrum – Interaction of radiation with matter – Energy levels in molecules – Microwave spectroscopy – Principle – Classification of molecules based on moment of Inertia – Rotational energy expression (J levels) – Calculation of J for CO molecule – Vibrational spectroscopy – Normal modes of vibrations – Vibrations of polyatomic molecules (CO_2 and H_2O) – Determination of Force constant – Electronic transitions in organic molecules – Mathematical derivation of Beer Lambert's law – Stimulated Emission – Lasers in action – Excimer laser, Diode laser and Gas laser.

UNIT 3 FUNCTIONAL MATERIALS 12 Hrs.

Introduction to conducting polymers – Charge transport carriers: Exciton formation in organic solar cells and organic light emitting diodes (principle and working) – Conduction mechanism in polymers: Soliton, polaron and bipolaron formation in polyacetylene and polyaniline – Liquid crystals: Characteristic features and phases of liquid crystals – Liquid crystal displays.

UNIT 4 CARBON MATERIALS FOR HEALTH, STEALTH AND ENERGY 12 Hrs.

Introduction to carbon materials – Fullerenes – Production, properties and applications – VanderWaal's solid – Structure ofgraphene, graphene oxide and reduced graphene oxide – Mechanical and electrical properties of graphene – Graphene based energy storage devices for space applications – Carbon nanotubes – Single-walled and multiwalled CNTs - Synthesis of CNTs by Thermal CVD and laser ablation method – Electrical and mechanical properties of CNTs - Applications of CNTs.

UNIT 5 ENGINEERING MATERIALS 12 Hrs.

Phase equilibria: Gibbs phase rule – Terms involved in Phase rule – Phase diagram of water system – Thermal method of analysis – Construction of simple eutectic system (Lead-Silver system).

Fuels – Classification of fuels – Determination of calorific values of solid fuels by bomb calorimeter – Manufacture of synthetic petrol by Fischer-Tropsch method – Knocking in IC engines – Chemical structure – Octane and cetane rating of fuels.

Nanomaterials: Size dependent properties of nanomaterials – Synthesis of gold and silver nanoparticles by Chemical reduction method – Applications of nanoparticles in medicine.

Max.60Hours

COURSE OUTCOMES

CO1- To understand quantum chemistry and its application to band theory.
CO2- To analyse the interaction of radiation with matter in spectroscopic techniques.
CO3- To interpret charge transport mechanism for electronic devices.
CO4- To illustrate the applications of carbon materials in health, stealth and energy.
CO5- To learn basic concepts of phase diagram, nanoparticle synthesis and importance of fuel.
CO6- To analyze and demonstrate the applications of materials in real world.

TEXT / REFERENCE BOOKS

1. Introductory Quantum Chemistry, A.K.Chandra, Tata McGraw-Hill, 4th edition, 1994.
2. Physical chemistry, Ira N. Levine, 6th Edition,
3. Physical Chemistry, David W. Ball, Thomson, 2011
4. Concise Physical Chemistry, Donald W. Rogers, John Wiley and Sons, 2011
5. Principles of Instrumental Analysis, Douglas A. Skoog, Donald M.West, 6th Edition, Cengage,2014.
6.Handbook of Batteries - David Linden, Thomas B. Reddy, McGraw-Hill, 2002 - Technology & b Engineering
7. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publication.
8. Polymer Science and Technology, Joel. R. Fried, 3rd Edition, Prentice Hall of India Private Ltd (2012)

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SBTA1101	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C	Max. Marks
		3	0	0	0	100

COURSE OBJECTIVE

- To impart knowledge on the issues related to environment and to emphasize the importance of a clean environment

UNIT 1 INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10 Hrs.

Definition, scope and importance, need for public awareness, forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, floods, drought, conflicts over water, dams-benefits andproblems, mineral resources: use effects on forests and tribal people. water resources: use and over-utilization ofsurface and ground water, exploitation, environmental effects of extracting and using mineral resources, case studiesfood resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture,fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: growing energy needs,renewable and non renewable energy sources, use of alternate energy sources: Case studies. Land resources: landas a resource, land degradation, man induced landslides, soil erosion and desertification, role of an individual inconservation of natural resources, equitable use of resources for sustainable lifestyles.

UNIT 2 ECOSYSTEMS AND BIODIVERSITY 10 Hrs.

Concept of an ecosystem, structure and function of an ecosystem - producers, consumers and decomposers -energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction,types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desertecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Introduction to biodiversity,definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity:consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, national and locallevels. India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching ofwildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity, in-situ and exsituconservation of biodiversity.

UNIT 3 ENVIRONMENTAL POLLUTION 9 Hrs.

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d)marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards. Solid waste management: causes,effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, pollutioncase studies, disaster management: floods, earthquake, cyclone and landslides.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT 8 Hrs.

From unsustainable to sustainable development, urban problems related to energy, water conservation, rainwater harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns,case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozonelayer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation, consumerism and wasteproducts - environment protection act: air (prevention and control of pollution) act - water (prevention and control ofpollution) act, wildlife protection act; forest conservation act. Issues involved in enforcement of environmentallegislation, Key initiatives of Rio declaration, Vienna convention, Kyoto protocol, Johannesburg summit and publicawareness.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT 8 Hrs.

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of informationtechnology in environment and human health, case studies. Visit to a local area to document environmental assetsriver/forest/grassland/hill/mountain. Visit to a local polluted site-urban/rural/ industrial/agricultural-study of commonplants, insects, birds-study of simple ecosystems, pond, river, hill slopes etc.

Max.45 Hours

TEXT / REFERENCE BOOKS

1. Meenakshi. P, Elements of Environmental Science and Engineering, 1st Edition, Prentice Hall of India, New Delhi, 2009.
2. Ravikrishnan. A, Environmental Science & Engineering, 3rd Edition, Sri Krishna Publications, Chennai, 2008.
3. Wrigh. R. T &Nebel B.J, Environmental science-towards a sustainable future by Richard 8th edition, Prentice Hall of India,NewDelhi,2006
4. ErachBharucha, Text Book of Environmental Studies, 2nd Edition, University Press, Chennai, 2006

SEEA1103	ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the analysis of DC and AC Circuits.
- To gain knowledge about the working of electrical machines.
- To impart Knowledge on the operation of the basic electronic devices.

UNIT 1 D.C. CIRCUITS 9 Hrs.

Electrical Quantities - Ohm's law - Kirchoff's laws -Resistance in series and parallel combinations - Current and Voltage division rules - Mesh analysis and Nodal analysis.

UNIT 2 A.C. CIRCUITS 9 Hrs.

Sinusoidal functions - R.M.S and Average values for Sinusoidal waveform - Phasor representation - Sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - RL , RC and RLC series circuits - power and power factor - Introduction to three phase circuits with balanced load.

UNIT 3 INTRODUCTION TO MACHINES 9 Hrs.

Construction and Principle of Operation of DC Generators - DC Motors - Single Phase Transformer - Single Phase Induction Motors - Stepper Motor.

UNIT 4 SEMICONDUCTOR DEVICES 9 Hrs.

VI Characteristics of PN-junction diodes and Zener diodes, BJT and its configurations – input/output Characteristics, Junction Field Effect Transistor – Drain and Transfer Characteristics, MOSFET – Depletion type and Enhancement type, Uni Junction Transistors - Silicon Controlled Rectifiers.

UNIT 5 DIGITAL ELECTRONICS 9 Hrs.

Number systems – Binary arithmetic - Boolean algebra, laws & theorems – Boolean Functions - Simplification of Boolean functions - Logic gates - Implementation of Boolean expressions using logic gate - Standard forms of Boolean expression.

MAX. 45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Analyze electrical circuits using Kirchoff's Laws.
CO2: Compare the behaviour of R, L and C and their combinations in AC circuits.
CO3: Describe the construction and working principle of DC and AC machines.
CO4: Demonstrate the characteristics of various semi-conductor devices.
CO5: Understand the concept of digital electronics.
CO6: Recognize the importance of electronic devices.

TEXT / REFERENCE BOOKS

1. B.N.Mittle & Aravind Mittle, Basic Electrical Engineering, 2nd edition, Tata McGraw Hill, 2011.
2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1st edition, S.Chand & Co., 2009.
3. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, 2nd edition, PHI Learning Private Ltd, 2010.
4. D.P Kothari and I.J Nagarath, Electrical Machines, 3rd edition, Tata McGraw-Hill Publishing Company Limited, 2006.
5. Dr.Sanjay Sharma, Electronic Devices and Circuits, 2nd edition, S.K.Kataria & Sons, 2012.
6. John Bird, Electrical Circuit Theory and Technology, 4th edition, Published by Taylor & Francis, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1104	PROBLEM SOLVING TECHNIQUES WITH C AND C++	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of PST and methodologies which are essential for building good C/C++ programs.
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions.
- To impart the knowledge about pointers which is the backbone of effective memory handling
- To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

UNIT 1 INTRODUCTION TO COMPUTER PROBLEM SOLVING 9 Hrs.

Algorithms - Building blocks of algorithms (statements, control flow, functions) -Nnotation (pseudo code, flow chart) - Algorithmic problem solving for socio economic conditions in global perspectives - Simple strategies for developing algorithms (iteration, recursion) - Efficiency of algorithms.

UNIT 2 BASICS OF C PROGRAMMING 9 Hrs.

Introduction to C: Features of C - Structure of C program-Data Types-'C' Tokens-Input/output statements-Control Statement, Functions: – Types of Functions –Recursion.
Algorithms: Reversing the digits of a number - Generation of Fibonacci sequence- Factorial Computation.

UNIT 3 ARRAYS, STRINGS AND STRUCTURES 9 Hrs.

Arrays : Single and Multidimensional Arrays–– Array as Function Arguments, Strings: String Handling Functions, Structure: Nested Structures – Array of Structures – Structure as Function Argument–Function that Returns Structure, Union.
Algorithms: Sum of array elements- Removal of duplicates from an array-Finding the K^{th} smallest element.

UNIT 4 POINTERS AND FILE PROCESSING 9 Hrs.

Pointers: Introduction, Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer, Dynamic Memory Allocation, Storage Classes, File Handling in 'C'.
Algorithms: Swap elements using Call by Reference – Sorting Arrays using pointers- Finding sum of array elements using Dynamic Memory Allocation.

UNIT 5 OBJECT ORIENTED PROGRAMMING CONCEPTS 9 Hrs.

Introduction-Procedure vs. object oriented programming-Concepts: Classes and Objects-Operator & Function Overloading-Inheritance-Polymorphism and Virtual Functions.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Develop solutions for the given problem.
CO2: Design and Implement applications using arrays and strings.
CO3: Develop and Implement applications using memory allocation and File concepts.
CO4: Use proper class protection to provide security.
CO5: Describe the reusability of code through Inheritance.
CO6: Demonstrate the use of virtual functions to implement polymorphism.

TEXT / REFERENCE BOOKS

1. Dromey.R.G, “How to Solve it by Computer”, Prentice-Hall of India, 8th Indian Reprint, 2008.
2. Aho.A.V., Hopcroft.J.E and Ullman.J.D, “The Design and Analysis of Computer Algorithms”, Pearson education, 2004.Deitel and Deitel, C how to Program, 7th Eition, Pearson Education, 2013.
3. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Pearson Education, 2015.
4. Yashavant Kanetkar, Understanding Pointers in C, 4th Revised & Updated Edition, Bbp Publications, 2008.
5. E Balagurusamy, Object Oriented Programming with C++, 3rd edition, Tata McGraw Hill, 2006.
6. Bhave, Object Oriented Programming with C++, Pearson Education, 2004.
7. John R Hubbard, “Programming with C++”, Schaums Outline Series, McGraw Hill, 2nd edition, 2009.
8. Bjarne Stroustrup, Programming: Principles and Practice using C++, 1st Edition, Addison Wesley Publications, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B :2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCYA 2101	ENGINEERING CHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To understand the basic principle involved in adsorption, kinetics and viscosity measurements.
- To acquire practical knowledge in pH metry, Potentiometry and Conductometry.
- To develop the skill in water analysis.

The List of probable experiments is mentioned below, which delineates the experiment to be performed in a semester. Any Eight experiments can be selected from the list.

List of Experiments

1. Separation and identification of organic compounds and determination of R_f values by thin layer chromatography.
2. Estimation of hardness of water by EDTA method.
3. Determination of freezing point depression of a compound.
4. Determination of pKa value of glycine by pHmetry.
5. Estimation of mixture of acids by conductometry.
6. Estimation of ferrous ion by potentiometry.
7. Determination of saponification value of oil.
8. Determination of the partition coefficient of a substance between two immiscible liquids.
9. Verification of freundlich adsorption isotherm using adsorption of acetic acid by charcoal.
10. Determination of high molecular weight polymer using Ostwald viscometer.
11. Estimation of copper in brass.
12. Determination of alkalinity of water.
13. Estimation of Iron by photocolorimetry.
14. Determination of dissolved oxygen content of water sample by Winkler's method.
15. Estimation of sodium in water by using Flame Photometry.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Develop practical skills in water analysis.
CO2: Develop practical skills to estimate the alloys.
CO3: Develop practical skills to determine the strength of acid by conductance measurements.
CO4: Develop practical skills to understand redox reaction by emf measurement.
CO5: Verify the Freundlich adsorption for adsorption of acetic acid on charcoal.
CO6: Develop the basic analytical skills in chemistry.

SCSA2101	PYTHON AND PROBLEM SOLVING TECHNIQUES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- Identify the problem.
- List the possible ways to obtain the solution
- Evaluate and Select the Best algorithm to solve the problem
- Deploy suitable methods to get the desired output.
- Call the methods in order

LIST OF EXPERIMENTS

1. Program to exchange the values of two variables
2. Program to circulate the values of n variables
3. Program to find distance between two points.
4. Program to find square root
5. Program to find GCD
6. Program to find Exponentiation
7. Program to find sum an array of numbers
8. Program to find factorial
9. Program to implement Sine function computation
10. Program to Generate the Fibonacci sequence
11. Program for Reversing the digits of an integer
12. Program to find the smallest divisor of an integer
13. Program to find the greatest common divisor of two integers
14. Program to Generate Prime Numbers
15. Program to Compute the Prime Factors of an integer
16. Program to Raise a Number to a Large Power
17. Program for Removal of Duplicates
18. Program for Partitioning
19. Program to find the kth smallest Element
20. Program to generate histogram

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Analyze and classify the given problem into various modules.
CO2: Design the program with basic syntax by reading input from the user and generating the desired output
CO3: Develop the codes containing looping and decision making statements
CO4: Implement user defined functions
CO5: Apply recursion and call the function with appropriate parameters

SMTA1201	ENGINEERING MATHEMATICS- II	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 DIFFERENTIAL EQUATIONS 9 Hrs.

Higher order linear differential equations with constant coefficients – Particular Integral for e^{ax}, sinax or cosax, x^n, $x^n e^{ax}$, xsinax, xcosax, e^{ax}sinbx or e^{ax}cosbx – Method of Variation of Parameters – Homogeneous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT 2 VECTOR CALCULUS 9 Hrs.

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector Integration – Simple problems on line, surface and volume Integrals – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (without proofs)– Simple applications involving cubes and rectangular parallelopipeds.

UNIT 3 LAPLACE TRANSFORMATION 9 Hrs.

Laplace transform – Transforms of standard functions – properties – Transforms of derivatives and integrals – Transforms of the type $e^{at}f(t)$, tf(t), f(t)/t – Transform of periodic functions – Transform of unit step function and impulse function – Inverse Laplace transforms – Convolution theorem – Initial and final value theorems.

UNIT 4 APPLICATIONS OF LAPLACE TRANSFORMATION 9 Hrs.

Linear ordinary differential equation with constant coefficients – Integral equations – Integral equations of convolution type – simultaneous linear differential equations with constant coefficients.

UNIT 5 FOURIER TRANSFORMATION 9 Hrs.

The infinite Fourier transform – Sine and Cosine transform – Properties – Inversion theorem – Convolution theorem – Parseval's identity – Finite Fourier sine and cosine transform.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able

- **CO1:** List the properties of Laplace transform. Recall the solution of ordinary Differential equations
- **CO2:** Understand the concept of Directional derivative, Irrotational and Solenoidal vector fields
- **CO3:** Explain Laplace transform and Fourier transform of functions and solve them
- **CO4:** Discuss different types of inverse Laplace and Fourier transform problems
- **CO5:** Evaluate problems on Green's, Stoke's and Divergence theorems
- **CO6:** Produce the solution of integral and differential equations using Laplace transforms

.

TEXT / REFERENCE BOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.
2. Grewal B.S., Higher Engineering Mathematics, 41th Edition, Khanna Publications, Delhi,2011.
3. Bali N.P and Manish Goyal, A Text book of Engineering Mathematics, Eigth Edition, Laxmi Publications Pvt Ltd., 2011.
4. Veerarajan T, Engineering Mathematics for First Year, II Edition, Tata McGraw Hill Publishers, 2008.
5. W.E. Boyce and R.C.DiPrima,, Elementary Differential Equations and Boundary Problems, 9th Edn., Wiley India,

2009.

6. Venkataraman M.K., Engineering Mathematics – First Year (2nd edition), National Publishing Co., 2000.
7. S. L., Ross, Differential Equations, 3rd Ed.,Wiley India.,2009
8.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SPHA1101	PHYSICS FOR ENGINEERS	L	T	P	Credits	Total Marks
		3	*	0	4	100

COURSE OBJECTIVES

- To introduce the basic concepts of quantum mechanics.
- To realize the electronic structure of various materials via the band theory.
- To appreciate the role of quantum physics in the design and development of novel sensor devices.
- To understand the heat transfer mechanism in solids and fluids.

UNIT 1 BASIS OF QUANTUM PHYSICS 12 Hrs.

Introduction –electromagnetic waves - Photoelectric effect, Compton scattering, photons, Franck-Hertz experiment, Bohr atom, electron diffraction, wave - particle duality of radiation, de Broglie waves, wave-particle duality of matter. Physical interpretation of wave function, conditions to be satisfied for an acceptable wave function, normalized wave function, wave packets, Heisenberg uncertainty principle - statement, applications to radius of Bohr's first orbit and to energy of particle in 1D box. Operators associated with different observables, Schrodinger Equation – stationary states - Eigen value, Eigen function. Physical applications of Schrödinger's equation to (i) square well potential in one dimension: transmission and reflection coefficient at a barrier. Application of barrier penetration-α decay, field-ionization and scanning tunnelling microscope

UNIT 2 PHYSICS OF SOLIDS 12 Hrs.

Structure of solids - Bloch Theorem and Origin of energy bands, band structure of conductors, semiconductors (n-type and p-type), insulators, half metals, semi metals. Metals - Free Electron Theory of metals, Fermi level, Fermi surface, density of states. Wiede-mann Franz Law- Derivation. Semiconductors-Direct and indirect band gap, derivation of intrinsic carrier concentration in terms of energy band gap, experimental determination of energy band gap. Superconductors- Properties, BCS theory - energy gap, AC & DC Josephson effect, Superconducting Quantum Interference Device, Cryotron, Magnetic levitation.

UNIT 3 MAGNETISM, LASER FUNDAMENTALS AND OPTO ELECTRONICS 12 Hrs.

Magnetism- Bohr magneton, magnetic moments due to electron spin, Ferromagnetism- Weiss theory-Energies involved in domain formation, Hysteresis. Magnetic bubbles - formation and propagation. Nano magnets and magneto resistance,spin valve using GMR and TMR – hard disk drive storage technology. Lasers-Spontaneous and stimulated emission, condition for Laser action, Einstein Coefficients, relation between spontaneous and stimulated emission probability. Injection Laser Diode (ILD). Quantum Cascade Laser, Comparison between ILD and QCL.

UNIT 4 THERMAL PHYSICS 12 Hrs.

Laws of thermodynamics-basic concepts, closed and open systems-first law. Heat transfer-thermal expansion of solids and liquids – expansion joints-bimetallic strips, thermal conduction, convection and radiation. Conduction in solids – thermal conductivity- Forbe's method, Lees' disc method, conduction through compound media, formation of ice on ponds, thermal insulation, applications- heat exchangers, refrigerators, ovens and solar water heaters. Thermal Convection - properties of radiant heat, sea and land breeze. Prevost's theory of heat exchanges.Thermal Radiation – emission and absorption radiation, emissive power, black body radiation – Kirchoff's, Stefan's laws, wien's law, Newton's law of cooling.

UNIT 5 SENSORS AND DEVICES 12 Hrs.

Introduction- measurands and measurement, basic concepts, types, mechanism, examples, significance and drawbacks, applications of each of pressure sensors, temperature sensors, vibration sensors, acoustic sensors, LDR and photo diode, pressure gauge-bourdon tube, magnetic sensors – Hall sensors, strain gauge-strain sensitivity.

MAX . 60 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO 1: To identify the basic concepts in quantum mechanics, magnetism, lasers, superconductors, semiconductors & in thermal physics

CO 2: To analyze the band structure of various materials

CO 3: To apply the wave mechanical concepts to determine the radius of Bohr atom, transmission and reflection coefficient.

CO 4: To generate equation of motion of matter waves and to solve for cases related with 1D square well potential, linear harmonic oscillator and barrier penetration.

CO 5: To compare the efficiency of various memory storage devices, heat exchanger devices, opto electronic devices and sensors.

CO 6: To determine the thermal conductivity of conducting and insulting materials, convective heat transfer coefficient, emissivity, rate of cooling, etc.

TEXT / REFERENCE BOOKS

1. Griffiths, David J. Introduction to Quantum Mechanics. Pearson Prentice Hall, 2004. ISBN: 9780131118928.
2. Shankar, Ramamurti**.** Principles of Quantum Mechanics. Plenum Press, 1994.
3. Mahesh C Jain, Quantum Mechanics: A Textbook for Undergraduates, 2017.
4. Kittel, Charles. Introduction to Solid State Physics. 8th ed. New York, NY: John Wiley &Sons, 2004.
5. Ashcroft, Neil W., and N. David Mermin. Solid State Physics. New York, NY: Holt, Rinehart and Winston, 1976.
6. William D. Callister, & David G. Rethwisch, Materials Science & Engineering -An Introduction, 9th edn., 2013.
7. R.Asokamani, Solid State Physics, second edition, Easwar press, 2015 ISBN: 9781904798835.
8. R.K.Gaur&S.L.Gupta - Engineering Physics, DhanpatRai publication 2007 Edition.
9. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
10. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
11. G. Keiser, Optical Fiber Communications, McGraw-Hill Inc., 3rd Ed. (2000).
12. Heat and Thermodynamics, D.S.Mathur, Sultan Chand, 1995.
13. Heat and Thermodynamics BrijLal, N. Subrahmanyam, S. Chand, Limited, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SMEA1102	ENGINEERING DRAWING	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To know the basics of Engineering Graphics.
- To make the student to possess the efficient drafting skill.
- To make the students to understand the importance of sectioning and concept of development.
- To learn about the orthographic and pictorial projections.

UNIT 1 LETTERING, DIMENSIONING AND GEOMETRICAL CONSTRUCTION 9 Hrs.

BIS - Lettering - Two systems of dimensioning - Dividing a straight line into any number of equal parts - Bisecting an angle and right angled triangle - Drawing a regular pentagon and hexagon given one side - Conic sections - ellipse, parabola, hyperbola by eccentricity method.

UNIT 2 PROJECTION OF POINTS AND LINES 9 Hrs.

Projection - Types of projection - Projection of points lying in four quadrants - Projection of lines (First angle projection only) - Projection of lines parallel and inclined to one or both the planes.

UNIT 3 PROJECTION OF SOLIDS 9 Hrs.

Projection of simple solids like prisms, pyramids, cylinder, cone with its axis perpendicular to HP, axis perpendicular to VP, axis inclined to HP.

UNIT 4 SECTION OF SOLIDS 9 Hrs.

Purpose of sectioning - Sectional views - Hatching - Section plane perpendicular to one plane and parallel to other plane - Section plane inclined to HP - Section plane inclined to VP - True shape of the section

UNIT 5 DEVELOPMENT OF SURFACES AND ORTHOGRAPHIC PROJECTION 9 Hrs.

Need for development of surfaces - Types of development of surfaces - Development of pentagonal and hexagonal prisms - Development of cylinders - Development of pentagonal and hexagonal pyramids - Development of cones.

Orthographic Projection- Free hand sketch –conversion of 3D into 2D

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Identify the national standards related to the Engineering drawing based on BIS and construct conic sections and polygons.

CO2:.Draw orthographic projections of points, lines.

CO3: Draw orthographic projections of solids

CO4: Draw orthographic section of solids and improve the Students visualization skill to develop New products.

CO5: Draw the development of surfaces and its applications in manufacturing industry.

CO6: Draw the orthographic view of solids and learn to convert pictorial into orthographic projection.

TEXT/REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 – 1988 (http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf).

2. Natarajan, K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 21st Edition, 2012.

3. Bhatt, N.D., Engineering Drawing Drawing, Charotar Publishing House, 53rd Edition, 2014.

4. Venugopal, K., Prabhu Raja, V., Engineering Graphics, New Age International Publishers, 15th Edition, 2018.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1201	FUNDAMENTALS OF DIGITAL SYSTEMS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand number systems and codes
- To illustrate simplified Boolean expressions using Gates.
- To construct combinational logic circuits
- To design sequential logic circuits
- To analyze circuits and latches

UNIT 1 NUMBER SYSTEMS,COMPLIMENTS AND CODES 9 Hrs.

Number Systems – Binary Numbers-Number base conversions-Octal and Hexa Decimal Numbers – Complements –Signed Binary Numbers-Binary Arithmetic –Binary Codes-Decimal Code-Error Detection code-Gray Code- Reflection and Self Complementary codes-BCD number representation – Alphanumeric codes ASCII/EBCDIC –Hamming Code- Generation, Error Correction.

UNIT 2 BOOLEAN ALGEBRA AND LOGIC GATES 9 Hrs.

Axiomatic definitions of Boolean Algebra – Basic Theorems and Properties of Boolean Algebra – Boolean Functions-Canonical and Standard forms-Digital Logic Gates– Simplification of Boolean Expressions:The map method- SOP and POS – NAND and NOR implementation-Don't Cares –The Tabulation Method-Determination and Selection of Prime Implicants.

UNIT 3 COMBINATIONAL LOGIC 9 Hrs.

Design Procedure-Adder – Subtracter – Code Conversion – Analysis Procedure –Multilevel NAND/NOR circuits-Exclusive OR functions – Binary adder and subtractor– Decimal adder – BCD adder – Magnitude Comparator – Decoders – Demultiplexer – Encoder – Multiplexers.

UNIT 4 SYNCHRONOUS SEQUENTIAL LOGIC 9 Hrs.

Flip Flops – Analysis of clocked sequential circuit –Reduction and Assignments–Flip flop excitation tables-Design Procedure-Design of counters-Registers-Shift registers-Synchronous Counters-Timing sequences-Algorithmic State Machines-ASM chart-timing considerations-control implementation.

UNIT 5 ASYNCHRONOUS SEQUENTIAL LOGIC AND MEMORY UNIT 9 Hrs.

Circuits with Lathes-Analysis procedure and Design Procedure-Reduction of state and Flow tables-Race –Free State Assignment.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Perform conversions between number systems.
CO2: Simplify Boolean expressions and model using gates.
CO3: Discover the principles behind combinational logic circuits used in real time
CO4: Survey the flip-flops needed for sequential logic circuits design
CO5: Analyze the sequential logic circuits
CO6: Discuss about memory unit and arithmetic logic unit.

TEXT / REFERENCE BOOKS

1. Morris Mano, "Digital Logic & Computer Design", Prentice Hall India, 2006.
2. Thomas L Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, 2009.
3. A.P.Malvino and D.P.Leach, "Digital Principles and Applications", 6th Edition, McGraw-Hill, 2006.
4. Thomas C. Bartee, "Computer Architecture Logic Design", 3rd Edition, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1204	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why python is a useful scripting language for developers.
- To learn how to use lists, tuples and dictionaries in python programs.
- To learn how to build and package python programs for reusability.
- To learn how to read and write files in python.
- To learn how to use exception handling in python applications for error handling.

UNIT 1 INTRODUCTION **9 Hrs.**

History of Python- Introduction to the IDLE interpreter (shell) - Data Types - Built-in function - Conditional statements - Iterative statements- Input/output functions - Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING , MODULES, PACKAGES **9 Hrs.**

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT 3 GUI PROGRAMMING **9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK **9 Hrs.**

Database(using NoSQL): Connector module –Cursor – Staements – Exceptions in database.
Network connectivity: Socket module – Client – Server – Email –URL Access.

UNIT 5 CASE STUDY **9 Hrs.**

Web Programming using Python Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in python
CO2: Do the decision making and write functions in Python.
CO3: Explain how to design GUI Applications in Python and evaluate different database operations.
CO4: Design and develop Client Server network applications using Python.
CO5: Ability to design real life situational problems and think creatively about solutions of them.
CO6: Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT / REFERENCES BOOKS

1. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, “Practical Programming: An Introduction to Computer Science Using Python 3”, Pragmatic Bookshelf, 2nd Edition, 2014.
3. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, Apress.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: 10 Questions of 2 marks each - No choice **20 Marks**

PART B: 2 Questions from each unit of internal choice; each carrying 12 marks **80 Marks**

SCSA1203	DATA STRUCTURES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart the basic concepts of data structures and algorithms
- To be familiar with writing recursive methods.
- To understand concepts about searching and sorting techniques.
- To implement basic concepts about stacks.
- To apply the concepts of queues and its types.

UNIT 1 INTRODUCTION TO ALGORITHMS **9 Hrs.**

Introduction Data Structures - Need - classification - operations –Abstract data types (ADT) - Array - characteristics - types - storage representations. Array Order Reversal-Array Counting or Histogram-Finding the maximum Number in a Set, Recursion- Towers of Hanoi-Fibonacci series-Factorial.

UNIT 2 LINKED LISTS **9 Hrs.**

Introduction - Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list - Applications of singly linked list to represent polynomial - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List.

UNIT 3 STACKS **9 Hrs.**

Basic Stack Operations - Representation of a Stack using Arrays - Algorithm for Stack Operations - Stack Applications: Reversing list - Factorial Calculation - Infix to postfix Transformation - Evaluating Arithmetic Expressions.

UNIT 4 QUEUES **9 Hrs.**

Basic Queue Operations - Representation of a Queue using array - Applications of Queues - Round robin Algorithm - Enqueue - Dequeue - Circular Queues - Priority Queues.

UNIT 5 SEARCHING AND SORTING TECHNIQUES **9 Hrs.**

Basic concepts - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the concept of recursive algorithms.
CO2: Demonstrate the different types of data structures.
CO3: Able to understand the operations on linear data structures.
CO4: Summarize searching and sorting techniques.
CO5: Choose appropriate data structure as applied to specified problem definition.
CO6: Understand and implement the applications of linear data structures.

TEXT / REFERENCE BOOKS

1. Jean-Paul Tremblay, Paul G. Sorenson,'An Introduction to Data Structures with Application',TMH, 2017.
2. Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2004, 2nd Edition.
3. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Editin, 2004.
4. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SPHA2101	PHYSICS LAB	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To introduce experiments in optics, semiconductors, magnetism, thermal physics and quantum mechanics in order to acquire the firsthand information and to realize the basic physics concepts.

LIST OF EXPERIMENTS (ANY EIGHT EXPERIMENTS)

A. SEMICONDUCTORS

1. Measurement of carrier concentration of semiconductors.-Four probe method
2. Determination of Hall coefficient -Hall Effect experiment-.
3. Determination of Energy gap of a semiconductor diodes
4. Study of I–V characteristics and variation of photocurrent voltage and intensity- by Photo Diode Characteristics.
5. Measurement of Resistivity of a semiconductor by 2-probe and 4-probe module.
6. Measurement of high resistance measurement by 2-probe module.

B.OPTICS

7. Measurement of wavelength of laser source using diffraction grating.
8. Measurement of fibre loss- Optical fibre
9. Diffraction Grating using spectrometer - Determination of Wavelength of Light.
10. Measurement of speed of light in water and glass medium – minimum deviation from a prism.

C. MAGNETISM

11 Hysteresis loop- Measurement of Hysteresis loss.
12 Magnetic susceptibility –Quincke's method

D. THERMAL PHYSICS

13 Characterization of Thermocouple
14 Determination of Thermal conductivity of bad conductor-Lee's Disc method

E. QUANTUM MECHANICS

15 Experimental Study of Photoelectric Effect.
16 ecording hydrogen atom spectrum.

COURSE OUTCOMES

CO1: To measure the band gap, electrical resistivity and carrier concentration of the given semiconductor.

CO2. To find Hall coefficients of the given material
CO3. To analyse the I-V characteristics of the given photo diode
CO4. To determine the wavelength of the given laser light source
CO5 To measure the Numerical aperture and the optical power loss of the given optical fiber.
CO6. To measure the magnetic susceptibility of the given liquid sample and to identify dia, para/ferro magnetic liquid sample. To find the B-H loss from the hysteresis loop

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks:50 **Exam Duration:2 Hrs**

CAE	Evaluation of Regular Lab class	15 Marks	25 Marks
	Model practical exam	10 Marks	
ESE	End Semester Practical exam		25 Marks

SEIA2202	DIGITAL SYSTEMS LAB	L	T	P	Credits	Total Marks

		0	**0**	**4**	**2**	**100**

COURSE OBJECTIVES

- To understand the functioning of logic gates and design of combinational circuits using logic gates
- To understand the working of Flip flops and its applications in Shift Register and Counters.

LIST OF EXPERIMENTS

1. Verification of the Basic gates
2. Verification of Boolean function using logic gates.
3. To Construct and verify the full and half adder using logic gates.
4. To Verify 2x4 Decoder and 4x2 Encoder functionally.
5. Code Converter
(a.) BCD to GRAY
(b.) GRAY to BINARY
6. Comparator
7. Design and study of Multiplexer and Demultiplexer
8. To construct and study the working of RS flip-flop, D flip-flop, T flip-flop, JK flip-flop
9. To verify various shift register
(a) SISO
(b) SIPO
(c) PISO
(d) PIPO
10. Design a counter using suitable flip-flop
(a) MOD Counter
(b) Ripple Counter
(c) Up- Down Counter

COURSE OUTCOMES

On completion of the course, students are able to

CO1: Understand the functioning of logic gates
CO2: Understand the functioning of flip flops
CO3: Implement Boolean functions using logic gates
CO4: Analyze and design combinational circuits
CO5: Implement Shift Registers using flip flops
CO6: Design counters using flip flops.

SCSA2201	**DATA STRUCTURES LAB**	**L**	**T**	**P**	**Credits**	**Total Marks**

		0	0	4	2	100

COURSE OBJECTIVES

- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To implement graph traversal algorithms.
- To get familiarized to sorting algorithms.
- To implement linear search and binary Search.

LIST OF EXPERIMENTS

1. Program to insert and delete an element in an array.
2. Program to implement operations on a Singly linked list.
3. Program to implement operations on a doubly linked list.
4. Program to sort the elements using insertion sort.
5. Program to sort the elements using quick sort.
6. Program to sort the elements using merge sort.
7. Program to implement a Stack using an array and Linked list.
8. Program to implement Queue using an array and Linked list.
9. Program to implement Circular Queue.
10. Program to convert an infix expression to postfix expression.
11. Program to implement display elements of a queue according to their priority.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Remembering the concept of data structures through ADT including List, Stack and Queues

CO2: Understand basic concepts about stacks, queues, lists, trees and graphs

CO3: Able to apply and implement various tree traversal algorithms and ensure their correctness

CO4: Ability to analyze algorithms and develop algorithms through step by step approach in solving problems with the help of fundamental data structures.

CO5: Compare and contrast Array based and Link based applications of typical data structures such as Stacks and Queues.

CO6: Design applications and justify use of specific linear data structures for various applications

SMTA1302	DISCRETE MATHEMATICS	L	T	P	CREDITS	TOTAL MARKS

		3	*****	**0**	**3**	**100**

COURSE OBJECTIVE

- Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 LOGIC 9 Hrs.

Statements – Truth tables – Connectives – Equivalent Propositions – Tautological Implications – Normal forms – Predicate Calculus – Inference theory for Propositional Calculus and Predicate Calculus.

UNIT 2 SET THEORY 9 Hrs.

Basic concepts of Set theory – Laws of Set theory - Partition of set, Relations – Types of Relations: Equivalence relation, Partial ordering relation – Graphs of relation – Hasse diagram – Functions: Injective, Surjective, Bijective functions, Composition of functions, Identity and Inverse functions.

UNIT 3 GROUP THEORY 9 Hrs.

Groups – Properties of groups – Semi group and Monoid (definition and examples only) – Subgroups, Cosets - Lagranges Theorem.

UNIT 4 COMBINATORICS 9 Hrs.

Mathematical induction – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT 5 GRAPH THEORY 9 Hrs.

Introduction to graphs – Types of graphs (directed and undirected) – Basic terminology – Sub graphs – Representing graphs as incidence and adjacency matrix – Graph Isomorphism – Connectedness in Simple graphs, Paths and Cycles in graphs - Euler and Hamiltonian paths (statement only) – Tree – Binary tree (Definition and simple problems).

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Apply it in academic problems and industry/real life problems.

CO2: Define logic and set theory and to list the tautological implications and types of functions

CO3: Categorize and implement the properties of groups

CO4: Appraise the solution of mathematical induction and pigeonhole principle

CO5: Develop the recurrence relation and generating functions

CO6: Evaluate Euler and Hamiltonian paths

TEXT /REFERENCE BOOKS

1. Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Mc Graw Hill Publishing Co., 35th edition,2008.
2. Kenneth H. Rosen, Discrete mathematics and its applications, 6th Edition, McGraw- Hill, 2007.
3. Veerarajan T., Discrete mathematics with Graph Theory and Combinatorics, Tata Mcgraw Hill Publishing Co., NewDelhi, 2006.
4. Narasingh Deo, Graph Theory with application to Engineering and Computer Science, Prentice Hall India, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1301	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**Credits**	**Total Marks**
		3	**0**	**0**	**3**	**100**

COURSE OBJECTIVES

- To understand terms related to database design and management
- To gain knowledge in relational model and relational database management system
- To implement relational databases using SQL & My SQL
- To understand database security and performance issues
- To understand the basics of Data warehousing and Data mining

UNIT 1 INTRODUCTION TO DATABASES 9 Hrs.

Databases and database users – Database system concepts and architecture – Data modeling using entity Relationship(ER) model – Enhanced ER model- Relational Model - The Relational Data Model and Relational Database Constraints - The Relational Algebra and Relational Calculus.

UNIT 2 DATABASE DESIGN 9 Hrs.

Overview of the Hierarchical Data Model - Overview of the Network Data Model – Relational database design: Mapping ER Model to Relational Model - Commercial query languages: QBE – Functional dependency – Normalization

UNIT 3 QUERY PROCESSING 9 Hrs.

SQL Queries --Embedded SQL -My SQL: Basics, Queries in MySQL and Algorithms for Query Processing and Optimization - Introduction to Transaction Processing Concepts and Theory - Concurrency control techniques.

UNIT 4 RECOVERY AND SECURITY 9 Hrs.

Database Recovery Techniques - Database Security – Debate on the distributed databases and Client- Server Architecture with reference to Indian Railway Reservation System.

UNIT V 5 OBJECT DATABASE AND CURRENT TRENDS 9 Hrs.

Concepts for Object Database - Emerging Database Technologies and Application - Introduction to Data warehousing & Data mining –Applications of Data mining.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Design ER-models to represent simple database application scenarios

CO2: Ability to understand and design data modelling using Entity-Relationship model

CO3: Implement SQL to a broad range of query and data update problems

CO4: Articulate socio-economic applications of distributed databases and use database recovery mechanisms

CO5: Familiar with data warehousing and data mining applications

CO6: Apply Normalization techniques to normalize and improve the database design

TEXT/REFERENCE BOOKS

1. Elmasri & Navathe, "Fundamentals of Database Systems", 6th Edition, Addison Wesley, 2011.
2. Abraham Silberschatz, Henry.F.Korth and S.Sudharshan, "Database System Concepts", 4th Edition, 2002.
3. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012
4. Jan L. Harrington, "Object oriented database design", Harcourt India private limited 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1302	THEORY OF COMPUTATION	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce Automata Theory and Regular Languages.
- To understand Context Free languages and recognizers for different languages.
- To design Turing Machines for various languages.
- To understand the concepts involved in software development.
- To gain knowledge on undecidable problems.

UNIT 1 FINITE AUTOMATA AND REGULAR LANGUAGES 9 Hrs.

Finite automata and regular languages - Regular languages and regular expressions - Finite automata -Non-determinism and Kleene's theorem - Non-deterministic finite automata and NFA with null transition.

UNIT 2 CONTEXT-FREE LANGUAGES AND NORMAL FORMS 9 Hrs.

Context-free grammars - Definition - More examples - Union, concatenations, and *'s of CFLs - Derivation trees and ambiguity - Unambiguous CFG for algebraic expressions - Normal Forms - CNF – GNF.

UNIT 3 PUSH DOWN AUTOMATA 9 Hrs.

Pushdown automata - Introduction - Definition - Deterministic pushdown automata - PDA corresponding to a given context-free grammar – Context-free Grammar corresponding to PDA. Pumping Lemma for CFG.

UNIT 4 TURING MACHINES 9 Hrs.

Turing machines - Models of computation and the Turing thesis - Definition of TM and TM as language acceptor - Non-deterministic TM and Deterministic TM – Universal TM.

UNIT 5 RECURSIVE LANGUAGES AND UNDECIDABILITY 9 Hrs.

Recursively enumerable and recursive languages – Properties of Recursively enumerable and recursive languages - Enumerating a language.Introduction to Undecidability- Halting problem-Undecidability of Post correspondence problem (PCP)-Modified PCP -Rice Theorem.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Identify, analyze and compute a solution to a problem.
CO2: Interpret data using computational theory.
CO3: Determine whether a language is context free or not.
CO4: Design a Turing Machine for a given problem.
CO5: Apply the theoretical knowledge the design of compilers.
CO6: Identify the limitations of some computational models.

TEXT /REFERENCE BOOKS

1. Introduction to Languages and the Theory of Computation, John. C. Martin, Tata McGraw-Hill, 2003.
2. Introduction to Automata Theory, Languages and Computation, Hopcroft, Motwani, and Ullman, Pearson Publishers, Third Edition, 2006

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SCSA1303	**SOFTWARE ENGINEERING**	**3**	**0**	**0**	**3**	**100**

COURSE OBJECTIVES

- Software process models and compare their applicability
- Identify the key activities in managing a software project
- Concepts of requirements engineering and Analysis Modelling
- Apply systematic procedure for software design and deployment
- Compare and contrast the various testing and maintenance

UNIT 1 SOFTWARE PROCESS AND PROJECT MANAGEMENT 9 Hrs.

The evolving role of software – the changing nature of software- Life cycle models - Water fall - Incremental - Spiral - Evolutionary - Prototyping – Concurrent development – Specialised process models - Verification - Validation - Life cycle process - Development process - System engineering hierarchy - Introduction to CMM - Levels of CMM

UNIT 2 REQUIREMENT ANALYSIS AND SPECIFICATIONS 9 Hrs.

Functional And Non-Functional - User - System - Requirement Engineering Process - Feasibility Studies –communication practices- Requirements - Elicitation - Validation and management - Fundamental of requirement analysis – Analysis principles – Structured System Analysis - Software prototyping - Prototyping in the Software Process - Data - Functional and Behavioral Models - Structured Analysis and Data Dictionary

UNIT 3 SOFTWARE DESIGN 9 Hrs.

Design process - Modular design - Design heuristic - Design model and document - Architectural design - Software architecture - Data design - Architecture data - Transform and transaction mapping - User interface design - User interface design principles.

UNIT 4 TESTING AND IMPLEMENTATION 9 Hrs.

Levels - Software Testing Fundamentals - Types of s/w test - White box testing- Basis path testing - Black box testing - Control Structure testing- Regression testing strategies - Strategic approach and issues - UNIT testing - Integration testing - Validation testing - System testing and debugging. Case studies - Writing black box and white box testing-Coding Practices-Refactoring.

UNIT 5 PROJECT MANAGEMENT AND ESTIMATION 9 Hrs.

Software cost estimation - COCOMO model - Quality management - Quality concepts- SQA - Software reviews - Formal technical reviews - Formal approaches of SQA and software reliability - Software maintenance - SCM - Need for SCM - Version control - Introduction to SCM process - Software configuration items. Re-Engineering - Software reengineering - Reverse engineering - Restructuring - Forward engineering.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Identify and apply software lifecycle model for a given problem and will know the criteria for each level of CMM.
CO2: Comprehend types of requirements and summarize Requirement Engineering Process
CO3: Design data, functional and behavioral model for any given software requirement.
CO4: Identify and analyze levels of testing and perform white box testing and black box testing for a given problem.
CO5: Describe concepts of software quality assurance and software configuration management.
CO6: Compare and contrast forward engineering, reverse engineering and reengineering.

TEXT / REFERENCE BOOKS

1. Pressman, “Software Engineering and Application”, 7th Edition, McGraw International Edition, 2009.
2. Ian Sommerville, ”Software Engineering”, 8th Edition, Pearson Education, 2008

3. Stephan Schach, “Software Engineering”, Tata McGraw Hill, 2007
4. Pfleeger and Lawrance, “Software Engineering: Theory and Practice” Pearson Education, Second Edition, 2001
5. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning PrivateLimited ,2009.
6. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
7. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks

SITA1301	PROGRAMMING IN JAVA	3	0	0	3	100

COURSE OBJECTIVES

- To introduce Object Oriented concepts in Java
- To understand Packages, Interfaces and Multithreading Concepts.
- To understand lang, io packages.
- To understand the concepts involved internet application development.
- To understand the internet application design using swing controls.

UNIT 1 INTRODUCTION TO JAVA 9 Hrs.

Classes and Objects – Class Fundamentals – Declaring Objects – Methods – Constructors – Garbage Collection. Inheritance – Basics – Using Super – Method Overriding – Abstract Classes – Using final with inheritance. String Handling – String class – String buffer class.

UNIT 2 PACKAGES, INTERFACES AND THREADS 9 Hrs.

Introduction to Packages – User Defined Packages - Importing packages – Access protection – Interfaces – Exception Handling - Exception Types – Using try, catch, throw, throws and finally –Multithreading – JavaThreadModel – Main thread – Creating multiple thread – Thread priorities – Synchronization.

UNIT 3 LANG AND IO PACKAGES 9 Hrs.

Java.lang package - Wrapper Classes– Simple type wrappers – Using clone() and the Cloneable Interface -IO Package - Introduction – Input Stream and Output Stream classes - Data Output Stream and Data Input Stream classes – FileInputStream – FileOutputStream. - Reader and Writer Classes – FileReader and FileWriter

UNIT 4 APPLET PROGRAMMING AND EVENT HANDLING 9 Hrs.

Applet Class – Applet basics – HTML APPLET tag – Passing parameters to applets -Delegation Event Model – Handling Mouse and Keyboard Events – Adapter Classes.

UNIT 5 SWINGS AND DATABASE CONNECTIVITY 9 Hrs.

Introduction - JApplet Class- JLabel Control - JTextField Control –JButton Control –JCheckbox Control-JRadioButton Control – J ComboBox Control – JtappedPane Control-J ScrollPane Control - JTable.Introduction –Establishing Connection – Creation of Data Tables – Entering Data into the Tables- Table Updating.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- **CO1:** Develop application programs using java object oriented concepts
- **CO2:** Implement the interface, package and multithread concepts
- **CO3:** Implement various built in packages and its applications
- **CO4:** Develop web based applications using applet programming
- **CO5:** Implement Swing concepts in real time applications.
- **CO6:** Design the internet applications frontend and connect with backend using database connectivity.

TEXT /REFERENCE BOOKS

1. Herbert Schildt ,"The Complete Reference JAVA2", Fifth Edition,Tata McgrawHill, 2017.
2. Bruce Eckel , "Thinking in Java", Pearson Education, Fourth Edition 2006.
3. Core Java Volume-I Fundamentals, 9th Edition, Cay Horstman and Grazy Cornell, Prentice Hall, 2013.
4. https://docs.oracle.com/javase/tutorial/
5. https://www.tutorialspoint.com/java/

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks

SCSA1305	ADVANCED DATA STRUCTURES	3	*	0	3	100

COURSE OBJECTIVES

- To acquire knowledge of organizing the data in non linear fashion.
- To get the idea of balancing the height of trees to optimize the structure and search time.
- To learn the process of establishing the network with various nodes with minimum cost & finding the shortest path.
- To understand the method of designing the table data structure and its applications.

UNIT 1 BASIC TREE CONCEPTS 9 Hrs.

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Implementation using Array and Linked list - Binary tree ADT representations, recursive and non recursive traversals - Binary Search Tree - Insertion and Deletion.

UNIT 2 ADVANCED TREE CONCEPTS 9 Hrs.

Threaded Binary Trees, AVL Tree, B-tree Insertion and deletion, Splay trees - Heap trees - Heapify Procedure, Tries.

UNIT 3 GRAPH CONCEPTS 9 Hrs.

Terminology, Representation using Array and Linked List - Types of graphs - Graph traversals - BFS and DFS - Applications.

UNIT 4 ADVANCED GRAPH CONCEPTS 9 Hrs.

Minimum Spanning Tree - Kruskal's, Prim's and Sollin's Algorithm - Shortest path using Dijkstra's, Bellman Ford and Floyd Warshall Algorithm.

UNIT 5 TABLES AND SETS 9 Hrs.

Rectangular tables - Jagged tables - Inverted tables - Symbol tables - Static tree tables - Dynamic tree tables - Hash tables.

Sets: Representation - Operations on sets - Applications.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Design and implement the various non-linear data structures and perform the intended operations.
CO2: Understand the strength of balancing the height of the trees.
CO3: Analyze the time complexity of various non linear data structures.
CO4: Apply the algorithms to find the shortest path & to connect the nodes with minimum cost.
CO5: Design the table and applying the table for many applications.
CO6: Compare and identify the usage of different data structures

TEXT / REFERENCE BOOKS

1. Ellis Horowitz and Sartaj Sahni "Fundamentals of Data Structures" Galgotia Book Source, Pvt. Ltd., 2004.
2. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2005.
3. Jean Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw-Hill, Second edition, 2001.
4. Aaron M Tanenbaum, Moshe J Augenstein and Yedidyah Langsam, "Data Structures using C and C++", Pearson Education, 2004.
5. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.
6. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Edition, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA2301	DATABASE MANAGEMENT SYSTEMS	L	T	P	Credits	Total Marks

	LAB	**0**	**0**	**4**	**2**	**100**

COURSE OBJECTIVES

- To instill sound understanding on the fundamentals of DBMS.
- To lay a formal foundation on the relational model.
- To introduce the basic concepts of SQL as a universal database language.
- To understand the necessity for normalization.
- To formulate problem statements for real life problems.

LIST OF EXPERIMENTS

1. Data Definition Language(DDL).
2. Data Manipulation Language(DML)
3. Data Control Language(DCL)
4. Constraints and Bulit-in functions.
5. Joins and Group-by functions.
6. PL/SQL programs using functions
7. PL/SQL programs using procedures
8. PL/SQL programs using triggers
9. Developing GUI applications using PHP.
    - Student Information System.
    - Inventory Management.
    - Payroll Processing.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand, appreciate and effectively explain the underlying concepts of database technologies

CO2: Populate and query a database using SQL DML/DDL commands.

CO3: Declare and enforce integrity constraints on a database.

CO4: Retrieve data from multiple tables.

CO5: Programming PL/SQL including stored procedures, stored functions, triggers.

CO6: Design and build a GUI application using PHP

SITA2301	PROGRAMMING IN JAVA LAB	L	T	P	Credits	Total Marks
		0	0	2	1	100

COURSE OBJECTIVES

- To implement Object Oriented concepts in Java
- To implement Packages, Interfaces and Multithreading Concepts.
- To develop applications using lang and io packages.
- To design web based application.
- To design GUI application design using swing controls.

CYCLE -1

1. Using Classes and Objects.
2. Types of Constructors
    - 2.1. Default Constructor.
    - 2.2. Parameterized Constructor.
    - 2.3. Copying values from one object into another object.
    - 2.4. Constructor Overloading.
3. Inheritance
    - 3.1. Single Inheritance.
    - 3.2. Multilevel Inheritance.
    - 3.3. Hierarchical Inheritance.
4. Using Super Keyword
    - 4.1. To access Property.
    - 4.2. To access method.
    - 4.3. To access Constructors.
5. Using final keyword.
6. Abstract Class Programs.
    - 6.1 Write a java program that illustrates the example for abstract class.
7. Multiple inheritances through interface.
8. A class implements interface but one interface extends another interface.
9. Inheritance interface.
10. Default & Static method in interface.
11. Packages
    - 11.1. Import package.*;
    - 11.2. Import package.classname;
    - 11.3. Fully Qualified name.
12. Exception Handling programs.
    - 12.1 Write a java program that describes the exception handling mechanism.
    - 12.2 Write a java program that describes the user defined exception.
    - 12.3 Write a java program that describes multiple catch blocks.
13. Write a program to implement the concept of threading by extending Thread Class.
14. Write a program to implement the concept of threading by extending Thread Class.
15. Write a program to implement the concept of threading by implementing Runnable Interface.
16. Build and run a program in which threads are synchronized through synchronized method.

Cycle-2

1. Write a Java Program to implement Wrapper classes and their methods.
2. By using
    a. Input Stream and Output Stream classes

   b. Reader and Writer Classes
   c. Data Output Stream and Data Input Stream classes.
3. Write a java program that describes the life cycle of an applet.
4. A java program for event handling
5. A Java Application Programming Interface by using swing controls
6. A java program for database connectivity and design the front using SWING controls

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Ability to implement application programs using java object oriented concepts
CO2: Able to implement interface, package and multithread concepts
CO3: Understand various built in packages and its applications
CO4: Knowledge on designing web based applications using applet programming
CO5: Create applications using Swing controls in real time applications.
CO6: Able to connect frontend and backend using database connectivity.

SCSA2302	CODE OPTIMIZATION AND DEBUGGING - I	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To improve the intermediate code by making it consume fewer resources
- To get the faster running machine code
- To improve the consistency of the code
- To enhance the readability of the code and easier code maintenance
- To improve the work flow of the code

LIST OF EXPERIMENTS

1. Implement Built In Function and Libraries using python
2. Implement Optimizing loop using python
3. Profiling CPU usage using python
4. Profiling memory usage using python
5. Implement query optimization in DBMS
6. Implement heuristics in query optimization in DBMS
7. Implement factorial of given number using memorization in data structure
8. Implement Divide and conquer method in data structure
9. Implement hybrid stable sorting algorithm in data structure
10. Implement linked list with improving the time complexity in data structure

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand importance of code optimization
CO2: Apply time complexity and space complexity of the algorithm for improving optimization.
CO3: Analyse and appreciate variety of performance measures for various optimization problems
CO4: Learn efficient computational procedures to solve optimization problems
CO5: Be able to use programming languages to implement optimization algorithms
CO6: Be able reduce the execution time of code by applying proper coding technique.

SMTA1402	PROBABILITY AND STATISTICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments. Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 PROBABILITY CONCEPTS AND RANDOM VARIABLE 9 Hrs.

Probability Space – Events – Axiomatic approach to Probability – Conditional Probability – Independent Events – Baye's Theorem – Random Variables – Functions of Random Variables and their Probability Distribution.

UNIT 2 PROBABILITY DISTRIBUTION 9 Hrs.

Discrete Distributions: Binomial, Poisson and Geometric – Continuous Distributions: Uniform, Exponential and Normal – Applications only (no derivation).

UNIT 3 TWO DIMENSIONAL RANDOM VARIABLES 9 Hrs.

Joint Probability distributions – Marginal and Conditional Distributions – Transformation of Random Variables.

UNIT 4 CORRELATION AND REGRESSION 9 Hrs.

Correlation – Linear regression – Multiple and Partial Correlation – Curve Fitting – Method of Least Squares – Fitting of the Curve of the form y = a+bx , y = a+bx+cx2, z = ax+by+c.

UNIT 5 ANALYSIS OF VARIANCE AND STATISTICAL QUALITY CONTROL 9 Hrs.

Review of F-test – Design of experiments: Completely Randomized Design, Randomized Block Design and Latin Square Design – Statistical Quality Control: Mean, Range, p, np, c – charts.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Define probabilities, probability distributions. List the discrete and continuous distributions
CO2: Explain functions of random variables and their probability distributions. Explain and derive the parameters of the distributions.
CO3: Choose appropriate probability theorem and solve the problems. Prepare the cumulative distribution for random variables. Application of the parameters of distributions. Sketch the control charts and point out the results based on the charts.
CO4: Distinguish correlation and regression. Categorize the regression coefficients.
CO5: Evaluate the constants involved in curves by the method of least squares. Evaluate the correlation coefficients. Compare the variances of design of experiments
CO6: Construct and develop the transformations of random variables. Also determine their mean and variances by expectations.

TEXT/REFERENCE BOOKS

1. Hong R.V, Tanis E.A and Zimmerman D L, Probability and Statistical Inference, Pearson Education Limited, Ninth Edition, 2015.
2. Miller I. and Freund J.E, Probability and Statistics for Engineers, Pearson Publishers, Ninth Edition, 2017.
3. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Tenth Edition, 2002.
4. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw-Hill, New Delhi, Fourth Edition, 2014.

5. Sivaramakrishna Das P., Vijaya Kumari C., Probability and Random Processes, Pearson Education, SixtEdition2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1401	OBJECT ORIENTED ANALYSIS AND SYSTEM ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To Understand the fundamentals of Object Oriented System Development
- To understand the object oriented methodologies.
- To use UML in requirements elicitation and designing.
- To understand concepts of relationships and aggregations.
- To test the software against its requirements specification

UNIT 1 AN OVERVIEW OF OBJECT ORIENTED SYSTEM DEVELOPMENT 9 Hrs.

Introduction - Object Oriented System Development Methodology - Why Object Orientation - Overview of Unified Approach - Object Basics: Object Oriented Philosophy - Objects - Classes - Attributes - Object Behavior and Methods, Messages and Interfaces, Encapsulation and Information Hiding - Class Hierarchy - Polymorphism - Object Relationships and Associations - Aggregations and Object Containment - Object Identity - Static and Dynamic Binding - Persistence. Object-oriented CASE tools, Object Oriented Systems Development Life Cycle: Software Development Process - Building High Quality Software - Use case Driven Approach – Reusability.

UNIT 2 OBJECT ORIENTED METHODOLOGIES 9 Hrs.

Rumbaugh et al.'s Object Modeling Technique - Booch Methodology - Jacobson et al. Methodologies – Patterns - Framework - Unified approach - Unified Modeling Language:Static and Dynamic Model - UML Diagrams - UML Class Diagram – UML Use Case –Case study- Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases- UML Dynamic Modeling –Case study- UML Extensibility - UML Metamodel.

UNIT 3 OBJECT ORIENTED ANALYSIS 9 Hrs.

Business Object Analysis - Use Case Driven Object Oriented Analysis - Business Process Modeling - Use Case model - Developing Effective Documentation - Object Analysis Classification: Classification Theory - Noun Phrase Approach - Common Class Patterns Approach - Use-Case Driven Approach - Classes Responsibilities and Collaborators - Naming Classes - Identifying Object Relationships, Attributes and Methods: Association – SuperSubclass Relationships - A-part of Relationships.

UNIT 4 OBJECT ORIENTED DESIGN 9 Hrs.

Object Oriented Design Process - Object Oriented Design Axioms - Corollaries - Designing Classes: Object Constraint Language - Process of Designing Class - Class Visibility - Refining Attributes - Access Layer: Object Store and Persistence - Database Management System - Logical and Physical Database Organization and Access Control - Distributed Databases and Client Server Computing - Object Oriented Database Management System – Object Relational Systems - Designing Access Layer Classes - View Layer: Designing View Layer Classes - Macro Level Process - Micro Level Process - Purpose of View Layer Interface - Prototyping the user interface.

UNIT 5 SOFTWARE QUALITY 9 Hrs.

Software Quality Assurance- Impact of Object Orientation on Testing - Develop Test Cases and Test Plans - System Usability and Measuring User Satisfaction: Usability Testing - User Satisfaction Testing.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the basics object model for System development.

CO2: Understand the object Oriented Methodologies
CO3: Express software design with UML diagrams
CO4: Understand the concept of Relationships
CO5: Design software applications using OO concepts.
CO6: Understand the various testing methodologies for OO software

TEXT /REFERENCE BOOKS

1. Ali Bahrami, “Object oriented systems development using the unified modelling language”, McGraw- Hill.
2. Grady Booch, James Rumbaugh, and Ivar Jacobson,“The Unified Modeling Language User Guide”, 3rd Edition Addison Wesley.
3. John Deacon, “Object Oriented Analysis and Design”, 1st Edition, Addison Wesley,.
4. Bernd Oestereich, “Developing Software with UML, Object - Oriented Analysis and Design in Practice”, Addison-Wesley.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	0	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND MATERIALS 7 Hrs.

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING 7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Case studies – Intellectual Property rights infringement in Biology.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT 7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal, public health issues-improving water management in surface and overhead irrigation- Integration of energy, water and environmental systems for a sustainable development

UNIT 4 SMART MANUFACTURING 8 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD 8 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS 8 Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for
CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : CaseStudies.

.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. William D. Callister,"Materials Science and Engineering, An Introduction, John Willey and Sons Inc. Singapore, 2001.

2. V. Raghavan, "Physical Metallurgy: Principle and Practice,. Prentice Hall India Pvt Ltd, 2006.

3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, “Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0”, Automation in Construction, Vol. 103,pp. 251-267, 2019.

3. Klaus Schwab, “Fourth Industrial Revolution”, Random House USA Inc, New York, USA, 2017.

4. Oliver Grunow, ”SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies” , Studylab Publications, 2016

5. Alasdair Gilchrist, “INDUSTRY 4.0: Industrial Internet of Things”, Apress, 2016

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 11 Questions of 2 marks each-No choice **22 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 13 marks **78 Marks**

SECA1404	MICROPROCESSOR AND MICROCONTROLLER BASED SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the operation of microprocessors and microcontrollers,
- To understand the machine language programming,
- To understand the interfacing techniques and their applications.

UNIT 1 BASIC CONCEPTS 9 Hrs.

8085 Microprocessor - Architecture and its operation, Concept of instruction execution and timing diagrams, fundamentals of memory interface - Addressing modes

UNIT 2 8085 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING 9 Hrs.

Instruction classifications, Writing and executing simple programs - Arithmetic and logic operations – Data transfer - Branching - Looping – Indexing - Counter and time delays - Writing subroutine - Conditional call and return instruction, simple programs.

UNIT 3 INTERFACING 9 Hrs.

Basic Interface concepts, memory mapped I/O and I/O mapped I/O, Interrupt and vectored interrupt, Programmable peripheral interface 8255 - Programmable Interval timer 8253 - Programmable interrupt controller 8259 - Programmable DMA controller 8257.

UNIT 4 8086 ARCHITECTURE 9 Hrs.

Architecture – Minimum mode and Maximum mode operation – Address Generation - Addressing modes - Overview of 8086 instruction set - Instruction format - Assembler Directives – Designing a Single Board Computer.

UNIT 5 MICROCONTROLLER 9 Hrs.

Introduction - Architecture of 8051 - Memory organization - Addressing modes - Instruction set – Assembly Language Programming - Jump, Loop and Call Instructions - Arithmetic and Logic Instructions - Bit Operations -Programs – Introduction to Arduino

Max. 45 Hours

COURSE OUTCOMES

At the end of the course student will be able to

CO1: Understand the architecture and functional blocks of Processor 8085
CO2: Understand the addressing modes and instructions of Microprocessor 8085
CO3: Learn the architecture and functions of important interface chips.
CO4. Understand the architecture and functional blocks of Processor 8086
CO5. Learn the architecture and functions of 8051 and basics of Arduino controller
CO6. Design and implement Microprocessor and Microcontroller based system

TEXT / REFERENCE BOOKS

1. Ramesh Goankar, "Microprocessor architecture programming and applications with 8085 / 8088", 5th Edition, Penram International Publishing.

2. A.K.Ray and Bhurchandi, "Advanced Microprocessor", 1st Edition, TMH Publication
3. Kenneth J.Ayala, "The 8051 microcontroller Architecture, Programming and applications" 2nd Edition ,Penram international
4. Doughlas V.Hall, "Microprocessors and Digital system", 2nd Editon, Mc Graw Hill,1983
5. Md.Rafiquzzaman, "Microprocessors and Microcomputer based system design", 2nd Editon,Universal Book Stall, 1992.
6. Hardware Reference Manual for 80X86 family", Intel Corporation, 1990.
7. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson
8. “Arduino Made Simple” by Ashwin Pajankar

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1402	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on various types of Registers and Microinstructions.
- To discuss about the Data path design and Processor design in detail.
- To understand the types of memory organizations.
- To discuss about the registers, interface and communication in I/O devices.
- To analyze about the characteristics, structure, communication and synchronization of multiprocessors.

UNIT 1 CENTRAL PROCESSING UNIT 9 Hrs.

Introduction - General Register Organization - Stack organization - Basic computer Organization - Instruction codes - Computer Registers - Computer Instructions - Instruction Cycle - Arithmetic – Logic - Shift Micro operations - Arithmetic Logic Shift unit - Example Architectures: MIPS – Power – PC – RISC – CISC

UNIT 2 COMPUTER ARITHMETIC 9 Hrs.

Addition - Subtraction - Multiplication and Division algorithms - Floating Point Arithmetic operations Micro programmed Control - Control memory - address sequencing – Micro program Example - Design of Control unit - Example Processor design

UNIT 3 MEMORY ORGANIZATION 9 Hrs.

Memory Hierarchy - Main memory - auxiliary Memory - Associative Memory - Cache Memory - Virtual memory

UNIT 4 INPUT - OUTPUT ORGANIZATION 9 Hrs.

Peripheral Devices - I/O Interface - Modes of transfer - Priority Interrupt - DMA - IOP - Serial Communication

UNIT 5 CHARACTERISTICS OF MULTIPROCESSORS 9 Hrs.

Interconnection Structures - Interprocessor Arbitration - Interprocessor Communication and Synchronization - Cache coherence

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Classify the various types of registers, microinstructions and addressing modes.
CO2: Design the data path for processor
CO3: Demonstrate the usage of Memory Organization.
CO4: Describe about the I/O devices.
CO5: Explain the characteristics, structure, communication and synchronization of multiprocessor.
CO6: State the inter processor communication and synchronization.

TEXT /REFERENCE BOOKS

1. M.Morris Mano, “Computer system Architecture”, 3rd Edition, Prentice-Hall Publishers, 2007.
2. Mark Burrell, “Fundamentals of Computer Architecture”, Mcmillan Higher Education, 2003.
3. John D. Carpinelli, “Computer Systems Organization & Architecture”, Pearson Education, 2001.
4. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, McGraw-Hill, 2002.
5. William Stallings, “Computer Organization and Architecture - Designing for Performance”, Ninth Edition, Prentice Hall, 2012.
6. John P Hayes, Computer Architecture Organization, McGraw Hill Edition 4, 2003.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1403	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To analyze the performance of algorithms under various scenarios.
- To learn mathematical background for algorithm analysis & solving the recurrence equations.
- To learn various algorithm design techniques.
- To understand and apply the algorithms

UNIT 1 INTRODUCTION 9 Hrs.

Fundamentals of Algorithmic Problem Solving - Time Complexity - Space complexity with examples - Growth of Functions - Asymptotic Notations: Need, Types - Big Oh, Little Oh, Omega, Theta - Properties - Complexity Analysis Examples - Performance measurement - Instance Size, Test Data, Experimental setup.

UNIT 2 MATHEMATICAL FOUNDATIONS 9 Hrs.

Solving Recurrence Equations - Substitution Method - Recursion Tree Method - Master Method - Best Case - Worst Case - Average Case Analysis - Sorting in Linear Time - Lower bounds for Sorting: - Counting Sort - Radix Sort - Bucket Sort

UNIT 3 BRUTE FORCE AND DIVIDE-AND-CONQUER 9 Hrs.

Brute Force:- Travelling Salesman Problem - Knapsack Problem - Assignment Problem - Closest Pair and Convex Hull Problems - Divide and Conquer Approach:- Binary Search - Quick Sort - Merge Sort - Strassen's Matrix Multiplication.

UNIT 4 GREEDY APPROACH AND DYNAMIC PROGRAMMING 9 Hrs.

Greedy Approach:- Optimal Merge Patterns- Huffman Code - Job Sequencing problem- -- Tree Vertex Splitting Dynamic Programming:– Dice Throw-- Optimal Binary Search Algorithms**.**

UNIT 5 BACKTRACKING AND BRANCH AND BOUND 9 Hrs.

Backtracking:- 8 Queens - Hamiltonian Circuit Problem - Branch and Bound - Assignment Problem - Knapsack Problem:- Travelling Salesman Problem - NP Complete Problems - Clique Problem - Vertex Cover Problem .

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- **CO1:** Determine the suitable algorithmic design technique for a given problem.
- **CO2:** Identify the limitations of algorithms in problem solving
- **CO3:** Analyze the efficiency of the algorithm based on time and space complexity.
- **CO4:** Implement asymptotic notations to analyze worst-case and average case running times of algorithms.
- **CO5:** Interpret the fundamental needs of algorithms in problem solving.
- **CO6:** Describe the various algorithmic techniques and its real time applications.

TEXT/REFERENCE BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms David E. Goldberg, "Genetic Algorithm In Search Optimization And Machine Learning" Pearson Education India, 2013.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press, 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SECA2405	MICROPROCESSOR AND MICROCONTROLLER LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To give a basic introduction to microcontroller 8085 & 8051
- To provide students knowledge about trivial programs using 8085 & 8051
- To expertise in interfacing of various devices and equipment with 8051

LIST OF EXPERIMENTS

MICROPROCESSOR- 8085

1. Programs using Arithmetic Operations.
2. Programs for Code Conversions.
3. Largest, Smallest and Sorting of an Array (8085).

MICROCONTROLLER- 8051

1. Data Transfer Programs
2. Programs using Logical Instructions.
3. Programs using Boolean Instructions.
4. Reading and Writing on a Parallel Port.
5. Stepper Motor Controller.
6. Timer in Different Modes.
7. Serial Communication Implementation.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand 8085 & 8051 chip architecture in real time
CO2: Explain the Algorithm for programs in 8085 & 8051
CO3: Demonstrate the output of programs in 8085 & 8051
CO4: Analyse the performance 8051 in various aspects.
CO5: Determine the performance of memory chips with 8051
CO6: Evaluate the performance of 8051 using various interfaces

SCSA2401	OBJECT ORIENTED ANALYSIS AND SYSTEM ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	2	1	100

COURSE OBJECTIVES

- To understand the object oriented concepts
- To understand the concept of UML Diagrams.
- To train in Rational ROSE and Agro UML Tool
- To capture the requirements specification for an intended software system
- To draw the UML diagrams for the given specification
- To map the design properly to code

LIST OF EXPERIMENTS

1. Study experiment – Object Oriented Concepts
2. Study of UML diagrams – aim and scope of diagrams.
3. Study of CASE tools – Agrium and Rational ROSE
4. Draw standard UML diagrams using an UML modelling tool for a given case study and map design to code
   - Identify a software system that needs to be developed.
   - Document the Software Requirements Specification (SRS) for the identified system.
   - Identify the actors and use cases and develop the Use Case model.
   - Identify the classes and develop a Class Diagram by specifying the attributes and methods. The Relationships between the classes are identified to indicate how the classes are related to each other.
   - Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
   - Draw relevant State Chart and Activity Diagrams for the same system.
   - Generate the Code Sequence for
     a. Student Information System
     b. Online Ticket Reservation system
     C. Employee Payroll system
     d. Online Banking Application
     e. ATM processing
     f. Stock Maintenance
     g. Library Management
     h. Exam registration
     i. Book bank

COURSE OUTCOMES

On completion of the course the student will be able to:

CO1: Identify the Requirement specification of a given problem.
CO2: Apply the concept of UML diagrams to perform analysis and design using the Tools.
CO3: Perform OO analysis and design for a given problem specification.
CO4: Generate the code
CO5: Test the compliance of the software with the SRS.

SCSA2402	CODE OPTIMIZATION AND DEBUGGING - II	L	T	P	Credits	Total Marks
		0	0	2	1	50

COURSE OBJECTIVES

- To analyze the programming logic and apply the appropriate design approach
- To optimize the speed of the program by using proper utilization of available memory
- To make use of performance tools for tracking the application.
- To have a capacity to analyze and design software systems, components to meet desired needs
- To have a working ability and grasping attitude to design and conduct object-oriented analysis

LIST OF EXPERIMENTS

1. Implement minimum heap allocation in java
2. Implement string builder in java
3. Implement concurrency control using java
4. Checking the current log level using java
5. Implement Garbage collection using java
6. Implement grid line in object oriented analysis and design
7. Implement grid with two sets of diagonal lines in object oriented analysis and design
8. Implement concurrency in object oriented analysis and design
9. Implement design optimization for removing non usable associations in object oriented analysis and design
10. Implement sparing and storing derived attributes associations in object oriented analysis and design

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the impact of performance hits during application runtime.
CO2: Implement optimal functions for improving the performance
CO3: Analyze the proper utilization of memory for code
CO4: Design experiments using UML, as well as to analyze and evaluate their models
CO5: Discussing and understanding analysis and design heuristics that are involved in the course
CO6: Students will learn and understand how to map one style of diagrammatic notations into another

		L	T	P	Credits	Total Marks
SCSA1501	OPERATING SYSTEMS	3	0	0	3	100

COURSE OBJECTIVES

- To have an overview of different types of operating systems.
- To learn and implement the concept of process management.
- To observe the concept of storage management.
- To understand the concept of I/O and file systems.
- To learn the basics of Linux Programming

UNIT 1 INTRODUCTION 9 Hrs.

Introduction - Operating system structures - System components - OS services - System calls - System structure - Resources Processes - Threads - Objects - Device management - Different approaches - Buffering device drivers.

UNIT 2 PROCESS MANAGEMENT 9 Hrs.

Processes - Process concepts - Process scheduling - Operations on processes - Cooperating processes - CPU scheduling - Basic concepts - Scheduling criteria - Scheduling algorithms - Preemptive strategies - Non-preemptive strategies.

UNIT 3 SYNCHRONIZATION AND DEADLOCKS 9 Hrs.

The critical section problem - Semaphores - Classic problems of synchronization - Critical regions - Monitors-Dead locks - Deadlock characterization - Prevention - Avoidance - Detection - Recovery.

UNIT 4 MEMORY MANAGEMENT 9 Hrs.

Storage Management Strategies - Contiguous Vs. Non-Contiguous Storage Allocation - Fixed & Variable Partition Multiprogramming - Paging - Segmentation - Paging/Segmentation Systems - Page Replacement Strategies - Demand & Anticipatory Paging - File Concepts - Access Methods - Directory Structure - File Sharing - Protection - File - System Structure - Implementation.

UNIT 5 I/O SYSTEM, LINUX & SHELL PROGRAMMING 9 Hrs.

Mass Storage Structure - Disk Structure- Disk Scheduling - Disk Management - Swap Space Management - RAID Structure - Shell Operation Commands - File Management Operation - Internet Service - Telnet - FTP - Filters & Regular Expressions- Case Study (Linux) - Shell Programming - Variable, Arithmetic Operations, Control Structures, Handling Date, Time & System Information.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1:** Understand the fundamental components of a computer operating system and how computing resources are managed by the operating system.
- **CO2:** Apply the concepts of CPU scheduling, synchronization and deadlocks in real computing problems.
- **CO3:** Demonstrate the different memory and I/O management techniques used in Operating Systems.
- **CO4:** Have practical exposure to the concepts of semaphores and monitors for process synchronization.
- **CO5:** Create design and construct the following OS components: Schedulers, Memory management systems in the modern operating system.
- **CO6:** Understand file system structure and implement a file system such as FAT.

TEXT/ REFERENCE BOOKS

1. Abraham Silberschatz, Peter Galvin and Gagne, “Operating System Concepts”, 10th Edition, Addison Wesley, 2018.
2. Harvey M.Deitel, ”Operating System”, 3rd Edition, Addison Wesley, 2004.
3. Gary Nutt, ”Operating System, A modern perspective”, 3rd Edition, Addison Wesley, 2004.
4. Richard Peterson, “Linux : The Complete Reference”, 6th Edition, Tata McGraw Hills, 2008.
5. Andrew S. Tanenbaum, “Modern Operating Systems”.4th edition 2015

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1502	COMPUTER NETWORKS DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To recognize the principles of the big picture of computer networks.
- To understand the networking environment.
- To know the importance of VPNs.
- To convey the availability of tools and techniques for networking.
- To discuss about evolving technologies in networks.

UNIT 1 FUNDAMENTALS OF NETWORK DESIGN 9 Hrs.

Design Principles - Determining Requirements - Analyzing the Existing Network - Preparing the Preliminary Design - Completing the Final Design Development - Deploying the Network - Monitoring and Redesigning – Maintaining - Design Documentation - Modular Network Design - Hierarchical Network Design.

UNIT II UNDERLYING LAN CONCEPTS 9 Hrs.

LAN connectivity for small businesses – Integration – Token-Ring – Ethernet – ATM LAN emulation – InterLAN Switching – LAN to Mainframe – Building networks.

UNIT III VPNS, INTRANETS AND EXTRANETS 9 Hrs.

Virtual Network management and planning – VPNs for small businesses – Secure remote access in VPNs – IPSec VPNs – Integrating data centers with Intranets – Implementing and supporting Extranets.

UNIT IV NETWORKING TOOLS AND TECHNIQUES 9 Hrs.

Simulation method for designing multimedia networks – Determining remote bridge and router delays – Network baselining as a planning tool.

UNIT V EVOLVING TECHNOLOGIES 9 Hrs.

Trends in data communications – Merits of xDSL technology – Preparing for cable modems - Voice and video on the LAN – Internet voice applications – Building IP PBX telephony network – Fax over IP – Videoconferencing over IP networks.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1: Understand the principles of networks.
CO2: Interpret LAN concepts and design.
CO3: Gain knowledge in evolving technologies.
CO4: Clearly outline the logic behind VPNs.
CO5: Know the importance of tools and techniques in building a network.
CO6: Understand the underlying working concepts of a real-time network.

TEXT/ REFERENCE BOOKS

1. Gil Held, “Network Design: Principles and Applications (Best Practices)”, Auerbach Publications, 1st edition, 2000.
2. Diane Tiare and Catherine Paquet, “Campus Network Design Fundamentals”, Pearson Education, 1st edition, 2006.
3. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann Publishers Inc., 5th edition, 2012.
4. William Stallings, “Data and Computer Communications”, Pearson Education, 8th edition, 2016.
5. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Pearson Education, 6th edition, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA1501	CUSTOMER INTERFACE DESIGN AND DEVELOPMENT	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

To effectively design with a range of technologies.

- To develop static websites & dynamic web applications.
- To learn new emerging web technologies.
- To gain knowledge and skills required for web development careers.
- To develop skills in the use and application of specific methods in user experience design.

UNIT 1 HTML,XML,CSS & RWD 9 Hrs.

Introduction To HTML- DHTML , XML – Structuring XML document using DTD – Schemas – XML parsers – DOM – SAX presentation technologies – XSL – XFORMS – XHTML – Transformations – XSLT – XLINK – XPATH – XQuery.
Responsive Web Design-Intro-Fluid Grid-Viewport-Media Queries-Images.
Introduction To CSS-Syntax,Selectors-Types of style sheets.

UNIT 2 CLIENT SIDE SCRIPTING 9 Hrs.

Java Script – Advantages – Data types – Variables – Operators – Control statements – Functions – Objects and arrays – Windows and frames – Forms.
AJAX – XMLHttpRequest (XHR) – Create Object – Request – Response – Ready state.

UNIT 3 SERVER SIDE SCRIPTING 9 Hrs.

Introduction To PHP – Data Types – Control Structures – Arrays - Function – Html Form with PHP –Form Handling & Validation - File Handling – Cookies – Sessions – Filters – Exception Handling - Database Connectivity With MySQL.

UNIT 4 ANGULAR JS & JQUERY 9 Hrs.

Angular JS Expression – Modules – Directives – Data Binding – Controllers – Scopes – Filters – Services – Tables – Events – Form – Validation.
jQuery Syntax – Selects – Events – jQuery Effects – jQuery – jQuery HTML – jQuery Traversing

UNIT 5 UX & UI 9 Hrs.

UX Introduction -Elements of UX Design- UX Design Process- Research Methods and Tools-Understanding User Needs and Goals. UX Design Process: Visual Design Principles-Information Design and Visualization-Interaction Design-Prototyping Tools-Usability Test.
UI Introduction-User Interface Components -Tools and Processes.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Able to work with XML technologies.
CO2: Design web page to perform form validation using client-side scripting language.
CO3: Implement new technologies such as Angular JS & jQuery.
CO4: Develop web applications using server-side scripting language.
CO5: Understand the differences between usability and user experience.
CO6: Effectively select and utilize design thinking processes and UX/UI tools.

TEXT/ REFERENCE BOOKS

1. Jeffrey C. Jackson, WebTechnologies: A Computer Science Perspective, Pearson Education, 2009
2. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
3. Ken Williamson, Learning AngularJS: A Guide to AngularJS Development, O'Reilly, 2015
4. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development, John Wiley & Sons Inc., 2014.
5. Callum Macrae, Learning from JQuery, O'Reilly, 2013.
6. Steve Krug,Dont Make Me Think,Second Edition,New Riders Publishing,USA,2006.
7.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SCSA1503	COMPUTER GRAPHICS & MULTIMEDIA	3	0	0	3	100

COURSE OBJECTIVES

- To introduce Two and Three dimensional graphical structure.
- To design 2D and 3D methods and Models
- To explore the visible surface detection with illumination and color models.
- To understand the concepts involved in multimedia and basis tools.
- To gain knowledge on Multimedia compression and animations.

UNIT 1 BASICS OF COMPUTER GRAPHICS **9 Hrs.**

Output primitives- Survey of Computer Graphics-Overview of Graphics System- Line drawing Algorithm (DDA Line Drawing Algorithm, Bresenhams Line Drawing Algorithm)-Circle drawing Algorithm- Curve Drawing Algorithm- Attributes of output Primitives- Antialiasing.

UNIT 2 2D TRANSFORMATION AND VIEWING **9 Hrs.**

2D Transformation and other transformation – 2D and 3D Viewing- Line Clipping(Cohen Sutherland)– Polygon Clipping (Sutherland Hodgeman) – Logical Classification Input Function.

UNIT 3 3D CONCEPTS AND CURVES **9 Hrs.**

3D Object: Representation Method- B-Rep- Sweep Representation- 3D Transformation – curve generation – Splines – Beziers – Blending of curves other interpolation techniques- Display Durves and Surface – Shape Description Requirements – Parametric function – 3D Concept Introduction – Fractals and Self Similarity – Successive refinement of Curves – Koch Curves and Paeno Curves.

UNIT 4 METHODS AND MODELS **9 Hrs.**

Visual Surface detection methods – Illumination models – Halftone Patterns – Dithering Techniques – Polygon Rendering Methods – Ray Tracing Methods – Color methods – Color Applications.

UNIT 5 MULTIMEDIA BASIS AND TOOLS **9 Hrs.**

Multimedia Basics and Tools – Introduction to Multimedia – Compression and Decompression – Data and File Format Standards – Digital voice and audio video image animation- Introduction to photoshop- workshop tools- Navigating window – Importing and Exporting Images – Operations on Images – resize, Crop, rotate.

Introduction to Flash – Elements of Flash Documents – Flash Environment- Drawing Tools – Flash Animation Importing and Exporting – Adding Sounds – Publishing Flash Movies.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Identify the various line & circle drawing algorithm.
CO2: Study the various transformations in 2D and 3D objects.
CO3: Understand the concepts of curves and surface.
CO4: Apply transformation and clipping algorithm in 2D and 3D objects.
CO5: Design Illumination and color models.
CO6: Implement 2D and 3D Transformation concepts in Real world Applications

TEXT/ REFERENCE BOOKS

1. Donald Hearn and M. Pauline Baker,Computer Graphics C Version, Second Edition, Prentice Hall, 2006.
2. Fabio Ganovelli, Massimiliano Corsini, Sumanta Pattanaik, Marco Di Benedetto “Introduction to Computer Graphics: A Practical Learning Approach” Taylor & Frainces Group. 2015.
3. Tay Vaughan ,”Multimedia”, 5th Edition, Tata McGraw Hill, 2001.
4. Ze-Nian Li, Mark S. Drew ,”Fundamentals of Multimedia”, Prentice Hall of India, 2004.
5. D. P. Mukherjee , “Fundamentals Of Computer Graphics And Multimedia ” Prentice Hall of India Private Limited, 2006.
6. D. McClelland, L.U.Fuller ,”Photoshop CS2 Bible”, Wiley Publishing, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA1502	FOG AND CLOUD COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of cloud computing and cloud enables.
- To understand cloud services and Multi-tenancy computing
- To study about various models of cloud environments and virtualization.
- To manage the cloud computing infrastructure with security.
- To gain knowledge of cloud and to understand about Fog, edge computing.

UNIT 1 UNDERSTANDING CLOUD COMPUTING 9 Hrs.

Basic Concepts and Terminology - Cloud Computing Architectural Framework - Types of Clouds - pros and cons of cloud computing – Cloud Characteristics - difference between web 2.0 and cloud - key challenges in cloud computing - Major Cloud players - Virtualization in Cloud Computing - Parallelization in Cloud Computing - cloud resource management – Cloud Enabling Technology

UNIT 2 CLOUD SERVICE MODELS 9 Hrs.

Software as a Service (SaaS) - Infrastructure as a Service (IaaS)- Platform as a Service (PaaS)- Web services - Service Oriented Architecture (SoA) - Elastic Computing - On Demand Computing- Service Management in Cloud Computing - Multi-tenancy computing , architecture.

UNIT 3 CLOUD DEPLOYMENT MODELS & VIRTUALIZATION 9 Hrs.

Deployment models: Public cloud – Private Cloud –Hybrid cloud – Community cloud - Need for virtualization – Types of Virtualization – Virtualization OS – VMware, KVM – System VM – Process VM - Virtual Machine Monitor – Properties - Xen, Hyper V, Virtual Box, Eucalyptus .

UNIT 4 MANAGEMENT IN CLOUD COMPUTING & SECURITY 9 Hrs.

Cloud data centres - Energy efficiency in data centre - Data Management in Cloud Computing - Mobile cloud computing service models – Open Source and Commercial Clouds, Cloud Simulator – sensor cloud- Fundamental Cloud security – Cloud security Threads – Additional considerations – Security solutions a case study.

UNIT 5 FOG COMPUTING 9 Hrs.

From Cloud to Fog - Fog Computing architecture - fog networks - Principles of Edge/P2P networking - Security and privacy in Fog.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.
CO2: Implement and install the cloud tools to make enable the cloud computing infrastructures.
CO3: Apply and design suitable Virtualization concept, Cloud Resource Management and collaboration services.
CO4: Create combinatorial auctions for cloud resources and services for computing clouds Develop and make cloud services as commercial.
CO5: Assess cloud and cloud to Fog with IoT.
CO6: Ability to, understand fog computing architecture

TEXT / REFERENCE BOOKS

1. Cloud computing concepts, technology and Architecture – Thomas Erl, Zaigham Mahmood, Ricardo Puttini , Pearson , 2017.
2. Instant Guide to Cloud Computing, Anand Nayar(Ed), Ashokkumar, sudeep Tanwar, BPB, 2019.
3. Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenpeter TATA McGraw - Hill, New Delhi - 2010
4. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
6. Fog Computing Concepts, Frameworks and Technologies , Mahmood, Zaigham (Ed.), Springer , 2018.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA2501	COMPUTER NETWORKS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand how to implement socket programming.
- To be familiar with simulation tools.
- To understand how to create applications using TCP and UDP.
- To gain Knowledge on various networking protocols.

LIST OF EXPERIMENTS

1. To find IP address of a machine
2. Time and Date server
3. Echo UDP server
4. TCP sockets
    a. Echo client & server
    b. Chat
    c. File transfer
5. Daemon program
6. Implementing stop and wait protocol & sliding window protocol
7. Code simulating ARP/RARP protocols
8. Code simulating PING and TRACEROUTE commands
9. RPC (Remote Procedure Call)
10. Study of Network Simulator (NS) and simulation of Congestion Control algorithms using NS
11. Case study
    a. Flooding
    b. Link state routing
    c. Distance vector routing

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Analyze the performance of the protocols in different layers.
CO2: Implement various protocols.
CO3: Design with simulation tools.
CO4: Analyze various routing algorithms.
CO5: Construct Wi-Fi model.
CO6: Understand socket programming.

SCSA2502	OPERATING SYSTEM LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To write programs in Linux environment using system calls.
- To implement the scheduling algorithms.
- To implement page replacement algorithms
- To implement file allocation methods.
- To develop solutions for synchronization problems using semaphores.

LIST OF EXPERIMENTS

1. Study of basic LINUX & vi Editor command
2. String and Numerical Handling Functions
3. Loop and Selection Constructs
4. File Handing Functions
5. Manipulate Date/Time/Calendar
6. Retrieve System information
7. Implementation of process scheduling mechanism – FCFS, SJF, Priority Queue
8. Producer Consumer Problem using Semaphores
9. Reader – Writer Problem
10. Diner's Philosopher Problem
11. First Fit, Worst Fit, Best Fit allocation strategy
12. Bankers Algorithm
13. Simulate Paging Technique of Memory Management
14. Simulate Page Replacement Algorithms
15. Implement memory management Scheme

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Learn the basic services and functionalities of the operating system using System Calls in Linux.
CO2: Model CPU Scheduling such as FCFS, SJF, Priority and Round Robin
CO3: Describe and solve Synchronization Problem
CO4: Simulate Memory Management Technique
CO5: Explain how to perform Paging Techniques
CO6: Demonstrate Page Replacement Algorithms

		L	T	P	Credits	Total Marks
SCSA1601	MACHINE LEARNING	3	*	0	3	100

COURSE OBJECTIVES

- To focus on the construction and study of algorithms that can learn from data.
- To emphasize on the logical, knowledge-based approach.
- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

UNIT 1 INTRODUCTION TO MACHINE LEARNING 9 Hrs.

Machine learning - examples of machine learning applications - Learning associations - Classification -Regression - Unsupervised learning - Supervised Learning - Learning class from examples - PAC learning -Noise,model selection and generalization - Dimension of supervised machine learning algorithm.

UNIT 2 DECISION THEORY 9 Hrs.

BayesianDecision Theory- Introduction- Classification - Discriminant function-Bayesiannetworks-Association rule - Parametric Methods - Introduction - Estimation –Multivariate methods-Data Parameter estimation–DimensionalityReduction-PCA-Linear discriminant analysis.

UNIT 3 CLUSTERING & REGRESSION 9 Hrs.

Clustering - Mixture densities - k-means clustering - Supervised Learning after clustering - Hierarchical clustering - Nonparametric Methods - Density estimation - Generalization of multivariate data - Smoothing models -Decision Trees - Univariate trees - Multivariate trees - Learning rules from data - Linear Discrimination-Gradient Descent.

UNIT 4 MULTILAYER PERCEPTRONS 9 Hrs.

Structure of brain - Neural networks as a parallel processing - Perceptron - Multilayer perceptron - Back propagation - Training procedures - Tuning the network size - Learning time.

UNIT 5 LOCAL MODELS 9 Hrs.

Competitive learning - Adaptive resonance theory - Self organizing map -Radial Basis functions - Bagging- Boosting- Reinforcement Learning.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- **CO1:** understand complexity of Machine Learning algorithms and their limitations;
- **CO2:** understand modern notions in data analysis oriented computing;
- **CO3:** be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
- **CO4:** be capable of performing distributed computations;
- **CO5:** can demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
- **CO6:** gain ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems

TEXT / REFERENCE BOOKS

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press,2004.
2. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997.
3. Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning:From Theory to Algorithms”, Cambridge University Press, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1602	NETWORK SECURITY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To explore the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To learn various mechanisms for network security to protect against the threats in the networks.

UNIT 1 INTRODUCTION 9 Hrs.

Services, Mechanisms and attacks - The OSI Security Architecture- A Model for Network Security – Classical Encryption Technique – Symmetric Cipher Model – Substitution Technique – Rotor Machines – Steganography.

UNIT 2 BLOCK CIPHERS AND THE DATA ENCRYPTION STANDARD (DES) 9 Hrs.

Simplified DES- Block Cipher principles – The Data Encryption Standard – The strength of DES – Confidentiality using symmetric encryption – Placement of encryption - Traffic confidentiality – Key distribution - Random number generation

UNIT 3 PUBLIC KEY ENCRYPTION AND KEY MANAGEMENT 9 Hrs.

Introduction to number theory – Public key cryptography and RSA – Key Management Diffie-hellman Key exchange.

UNIT 4 AUTHENTICATION AND HASH FUNCTIONS 9 Hrs.

Authentication requirements – Authentication functions – message authentication codes – Hash functions – Security of hash functions and MAC'S – MD 5 (Message Digest Algorithm) – HMAC.

Digital Signatures and authentication protocols:

Digital Signatures – Authentication protocols – Digital Signature Standard – Kerbews – X.509 Authentication Service.

UNIT 5 NETWORKSECURITY AND SYSTEM SECURITY 9 Hrs.

Electronic Mail Security – IP Security – Web Security – Intruders – Malicious S/Ws – Firewalls.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student would be able to

- **CO1:** Implement various symmetric encryption techniques for given applications
- **CO2:** Illustrate various public key encryption techniques
- **CO3:** Understand various key encryption mechanisms and key management strategies that can be applied for real time transactions.
- **CO4:** Evaluate authentication and hash algorithms.
- **CO5:** Summarize the basic network security mechanisms
- **CO6:** Basic concepts of system level security.

TEXT / REFERENCE BOOKS

1. William Stallings, "Cryptography and Network Security", Sixth edition, Pearson Education, 2013.
2. Behrouz A. Forouzan "cryptography and network security", ACM Digital Library, 2007
3. Man Young Rhee,"Internet security: cryptographic principles", "Algorithms and Protocols" Whey publications, 2003
4. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.
5. Joey Holland, "Cryptography: Principles and Practice" Larsen and Keller, 2017.
6. Sahadeo Padhye, Rajeev A. Sahu, Vishal Saraswat, "Introduction of Cryptography", CRC press, 2018.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1603	BIG DATA ANALYTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To become familiar with the fundamental concepts of Big Data
- To be competent in identifying the challenges in handling large volumes of data.
- To propose scalable solutions
- To understand the impact of Big Data in business intelligence, scientific discovery, and in day-to-day life.
- To learn the tools and techniques for handling large datasets.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction to Big Data – Issues and Challenges in the traditional systems - Evolution of Big Data – Four V's of Big Data – Big Data Use Cases and characteristics – Intelligent Data Analysis – Data Analytic Tools – Big Data StorageStatistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error – Random Sampling

UNIT 2 BIG DATA TOOLS I 9 Hrs.

Big Data Applications using Pig and Hive – Fundamentals of HBase and ZooKeeper – IBM Infosphere Big Insights – Introduction to FLUME – KAFKA

UNIT 3 BIG DATA TOOLS II 9Hrs.

Introduction to NoSQL - MongoDB – Spark – Cassandra - Cassandra Data Model – Data Design – Cassandra Architecture – Read and Write Data – Clients – Integrate with Hadoop

Introduction - Importance of Effective Data Visualization - Introduction to Tableau - Choosing the Right Chart Type - Using the Color Effectively Reducing Clutter - Dashboard Creation and Formatting

UNIT 4 HADOOP 9Hrs.

Introduction to Hadoop – Hadoop Distributed File System – Analysing data with Hadoop – Scaling – Streaming – Clustering: Single Node and Multi Node – Working with Hadoop Commands – Working with Apache Oozie

UNIT 5 MAP REDUCE 9 Hrs.

Algorithms using map reduce - Matrix-Vector – Multiplication – Word Count - Understanding inputs and outputs of MapReduce, Data Serialization – Introduction to YARN – MapReduce Vs YARN – YARN Architecture – Scheduling in YARN – Fair Scheduler – Capacity Scheduler

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student would be able to

CO1: Configure the tools required for setting up Big Data Ecosystem
CO2: Understand conceptually how Big Data is stored and organized
CO3: Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues
CO4: Interpret data findings effectively in visual formats
CO5: Explore the fundamentals of various big data applications
CO6: Implement the Algorithms for data analytics

TEXT / REFERENCE BOOKS

1. Joshua N. Milligan, "Learning Tableau", Packt Publishing, 2015.
2. Chuck Lam, "Hadoop in Action", Manning Publications Co., 2018.

3. Tom White, “Hadoop the Definitive Guide”, Oreilly, 4th Edition, 2015.
4. Eben Hewitt, “Cassandra: The Definitive Guide”, O’Reilly, 2010.
5. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, Edition I, ISBN-10: 1107015359 | ISBN-13: 978-1107015357, 2011.
6. Jimmy Lin and Chris Dyer, “Data-Intensive Text Processing with MapReduce”, Morgan & Claypool Publishers, 2010.
7. Jonathan R. Owens, Brian Femiano, and Jon Lentz, “Hadoop Real World Solutions Cookbook”, Packt Publishing, ISBN-10: 1849519129 | ISBN-13: 978-1849519120, 2013

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1604	COMPILER DESIGN	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand, design and implement a lexical analyzer.
- To understand, design and implement a parser.
- To understand, design code generation schemes.
- To understand optimization of codes and runtime environment.
- To design and develop a compiler.

UNIT 1 INTRODUCTION TO COMPILERS 9 Hrs.

Structure of compiler – Functions and Roles of lexical phase – Input buffering – Representation of tokens using regular expression –LEX- Properties of regular expression – Finite Automata – Regular Expression to Finite Automata – NFA to Minimized DFA.

UNIT 2 PARSER 9 Hrs.

Role of Parser-Context-free Grammar – Derivations and Parse Tree - Types of Parser –Bottom Up: Shift Reduce Parsing - Operator Precedence Parsing, SLR parser- Top Down: Recursive Decent Parser - Non-Recursive Decent Parser-Error handling and Recovery in Syntax Analyzer-YACC.

UNIT 3 INTERMEDIATE CODE GENERATION 9 Hrs.

Types of Intermediate Code – Representation of three address code - Syntax Directed Translation scheme- Intermediate code generation for: Assignment statements - Boolean statements - Switch-case statement –Procedure call - Symbol Table Generation.

UNIT 4 CODE OPTIMIZATION 9 Hrs.

Principle sources of Optimization - Basic Blocks and Flow Graphs - Loop Optimization & its types – DAG - Peephole optimization - Dominators - Global Data Flow Analysis.

UNIT 5 CODE GENERATION 9 Hrs.

Issues involved in Code generation – Register allocation – Conversion of three address code to assembly code using code generation algorithm – Examples – Procedure for converting assembly code to machine code – Case study.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Describe the various stages involved in the design of a compiler.
CO2: Construct grammars and lexical rules for a programming language.
CO3: Explain the syntactic and semantic structure in compiler design.
CO4: Evaluate various methods of optimizations on intermediate code
CO5: Generate target code for any source code
CO6: Design, develop, and implement a compiler for any programming language.

TEXT / REFERENCE BOOKS

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, 2nd Edition, Pearson Education, 2007.
2. Steven S. Muchnick, “Advanced Compiler Design and Implementation,“Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
3. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA2601	MACHINE LEARNING AND BIG DATA ANALYTICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To configure Big Data Ecosystem
- To work with No SQL Databases
- To process job scheduling
- To analyze and Interpret Data
- To visualize the data insights

LIST OF EXPERIMENTS

1. Data Pre-Processing: Building Good Training Sets
2. Manipulate the Twitter Data Set.
3. Evaluating the results of machine learning algorithms
4. Implement Regression and Correlation Techniques
5. Implement Classification Algorithms
6. No SQL (using Cassandra/MongoDB/Spark)
7. Hadoop – Map Reduce Programs / Commands / Job Scheduling
8. HDFS
9. YARN
10. Working with Pig and Hive
11. Visualization (using Tableau)

COURSE OUTCOMES

On completion of the course the student would be able to

CO1: Able to setup Hadoop in a Cloud / Cluster environment
CO2: Process and schedule the tasks in the Hadoop platform
CO3: To configure nosql databases in the big data ecosystem
CO4: Selection of right visualization method based on the intended audience
CO5: Creates a dashboard and story based on the data analysis

		L	T	P	Credits	Total Marks
SCSA2602	**COMPILER DESIGN LAB**	**0**	**0**	**4**	**2**	**100**

COURSE OBJECTIVES

- To gain in depth knowledge, understanding of compiler design.
- To enrich the knowledge in various phases of compiler ant its use.
- To extend the knowledge of parser by parsing LL parser and LR parser.
- To provide practical programming skills necessary for constructing a compiler.
- To implement NFA and DFA from a given regular expression.

LIST OF EXPERIMENTS

1. Use LEX tool to implement Lexical Analyzer.
2. Use LEX and YACC to implement Parser using Ambiguous Grammar.
3. Use LEX and YACC to implement Parser using Unambiguous Grammar.
4. Use LEX and YACC tool to implement Desktop Calculator.
5. Implement Recursive Descent Parser algorithm.
6. Implement Shift Reduce Parser algorithm.
7. Implement Operator Precedence Parser algorithm.
8. Implement the backend of the compiler to produce three address codes.
9. Implement Symbol Table Management.
10. Construction of NFA and DFA from a regular expression.
11. Implementation of simple code optimization techniques.
12. Construct a Simple compiler.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Apply the LEX tool & YACC tool to develop a scanner & parser.
CO2: Demonstrate the process of lexical analysis, parsing and other compiler design aspects.
CO3: Achieve practical programming skills necessary for constructing a compiler.
CO4: Interpret the symbol table and intermediate code generation.
CO5: Construct Automata for any regular language.
CO6: Test and simulate the compiler system

		L	T	P	Credits	Total Marks
SBAA4002	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	3	0	0	3	100

COURSE OBJECTIVE

- To get a clear understanding of management functions in an organization.

UNIT 1 MANAGEMENT THEORIES 9 Hrs.

Definition of management, science or art, manager vs entrepreneur; Types of managers - managerial roles and skills; Evolution of management-scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

.

UNIT 2 PLANNING, DECISION MAKING AND ORGANISING 9 Hrs.

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes. Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and faculty authority, departmentalization, delegation of authority, centralization and Decentralization, job design.

UNIT 3 FACULTY ING AND LEADING

9 Hrs.

Human resource management , HR Planning, Recruitment selection, training & development, performance management, career planning and management, Directing individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT 4 CONTROLLING AND REPORTING 9 Hrs.

Controlling, system and process of controlling, budgetary and non-budget control technique, use of computer and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting

UNIT 5 VALUES AND ETHICS 9 Hrs.

Human Values – Natural acceptance - Ethics – Definition- Objectives - Virtues – Challenges in the work place - Engineering ethics - Scope - Moral issues and judgment- Moral development theories – Engineers as responsible experimenters - Codes of ethics - Industrial standards- Global Issues: Environmental ethics -Computer ethics - Ethics and codes of business conduct in MNC.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1:** Describe the evolution and development of management concepts
- **CO2:** Understand the functions of management
- **CO3:** Apply the concepts and develop key competencies for managing human resources
- **CO4:** Analyze appropriate management techniques for Controlling and Reporting.
- **CO5:** Evaluate the various aspects of decision making and demonstrate critical thinking
- **CO6:** Elaborate the importance of the ethical dimension in workplace

TEXT / REFERENCE BOOKS

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 11th ed., 2012.
2. Harold Koontz and Heinz Weihrich , 'Essentials of Management' Tata Mcgraw Hill, 10th edition, 2015.
3. Nagaraazan. R. S, 'A text book on human values and ethics', Newage International Publishers, New Delhi, 2018.
4. Stoner James A. F., Freeman. R. E and Gilbert. R. D, 'Management', Pearson Education, 6th edition ,2018
5. Griffin, R. W., 'Management', South-Western College Publication 11th Edition, 2012.
6. Gregory. G. D, Gerry. M. C and Alan. E, 'Strategic Management: Text And Cases' Mcgraw Hill, 8th Edition, 2018.
7. Tripathy. P. C & Reddy. P. N, 'Principles of Management', Tata McGraw Hill, 5th edition, 2012.
8. Gupta C.B., 'Management Theory and Practice', Sultan Chand and Sons, New Delhi 19th Revised and enlarged edition , 2017
9. Tulsian. P.C &Pandey. V, 'Business Organisation& Management', Pearson Education, 2011.
10. Joseph L. Massie, 'Essentials of Management', Pearson Education, 4th edition, 2016
11. Harris Pritchard and Rabins, 'Engineering Ethics' Cengage Learning, New Delhi. 4th edition, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA1701	CYBER PHYSICAL SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

UNIT 1 INTRODUCTION TO INDUSTRY 4.0 & CYBER PHYSICAL SYSTEM 9 Hrs.

Industry 4.0 - Globalization and Emerging Issues, The Fourth Revolution - Smart and Connected Business Perspective, Basics of Industrial IoT - Industrial Processes - Industrial Sensing & Actuation, Industrial Internet Systems - Basic principles of design and validation of CPS - Cyber-Physical Systems (CPS) in the real world- Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT 2 EMBEDDED SYSTEMS MODELING AND DESIGN AND CPS 9 Hrs.

Platform components - Embedded Systems definition, specification, and languages. Concepts, requirements, examples. Embedded system models at different abstraction levels. Test benches, design under test, Intellectual Property components. Discrete event simulation, semantics, algorithms. Design, analysis techniques for decentralized computer architectures, communication, and hardware-software systems. -Cyber Physical System Hardware Platform - Processors, Sensors, Actuators - Network - WirelessHart, CAN, Automotive Ethernet – Software stack -Real-Time Operating system (RTOS) - Scheduling Real Time control tasks.

UNIT 3 SENSORS, ACTUATORS AND SENSOR NETWORKS 9 Hrs.

Sensors, Actuators and Sensor Networks & Real-Time and Distributed Systems - Fundamental principles and applications of sensors, actuators. Smart sensors and micro sensor/micro actuator array devices. Introduction to signal processing and sensor/actuator networks, deployment and architecture, wireless communication, multiple access control layer, data gathering, routing and querying, collaborating signal processing - Time dependent systems, clock synchronization, real-time communication protocols, specification of requirements, task scheduling. Validation of timelines, real-time configuration management. Middleware architecture for distributed real-time and secure services.

UNIT 4 SECURITY OF CYBER PHYSICAL SYSTEMS 9 Hrs.

Security of Cyber Physical Systems -Embedded and CPS security - attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols. Privacy issues - vehicular devices and smart metering. Applications of public key and symmetric cryptography, - digital certificates, credentials. Security and vulnerability of cyber-physical infrastructure networks - Mobile and wireless

network security, Robust wireless infrastructure - Cloud computing and data security, Event Awareness and System Monitoring for Cyber Physical Infrastructure.

UNIT 5 CYBER-PHYSICAL SYSTEMS CASE STUDIES AND PROJECTS 9 Hrs.

Cyber-Physical Systems Case Studies and Projects **-** Automotive: SW controllers for Antilock braking system, Adaptive Cruise Control, Lane Departure Warning, Suspension Control - Healthcare: Artificial Pancreas/Infusion Pump/Pacemaker - Green Buildings: automated lighting, AC control - power distribution grid - robotics - civil infrastructure – avionics – Transportation.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.

CO2: Identify the limitations of some computational models.

CO3: Apply the theoretical knowledge the design of compilers.

CO4: Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.

CO5: Categorize the essential modelling formalisms of Cyber-Physical Systems (CPS)

CO6: Ability to understand cyber modelling system.

TEXT / REFERENCE BOOKS

1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist (Apress)
2. "Industrial Internet of Things: Cyber manufacturingS ystems" Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
3. Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, Second Edition, http://LeeSeshia.org, ISBN 978-1-312-42740-2, 2015.
4. Rajeev Alur. Principles of Cyber-Physical Systems. MIT Press. 2015.
5. K. J. Astrom and R. M. Murray. Feedback Systems: An Introduction for Scientists and Engineers. Prince- ton University Press, 2009. http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page.
6. Sajal Das, Krishna Kant, and Nan Zhang, Securing Cyber-Physical Critical Infrastructure – Foundations & Challenges, Morgan Kaufmann, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SCSA1702	ARTIFICIAL INTELLIGENCE	3	*	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

UNIT 1 INTRODUCTION AND PROBLEM SOLVING 9 Hrs.

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information.

UNIT 2 INFORMED SEARCH AND GAME PLAYING 9 Hrs.

Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance.

UNIT 3 KNOWLEDGE AND REASONING 9 Hrs.

Knowledge based agent – The Wumpus world environment – Propositional logic – Inference rules – First-order logic – Syntax and semantics – Situation calculus – Building a knowledge base – Electronic circuit domain – Ontological Engineering – Forward and backward chaining – Resolution – Truth maintenance system-Mental Events and Mental Objects.

UNIT 4 ACTING LOGICALLY 9 Hrs.

Planning – Representation of planning – Partial order planning –Planning and acting in real world – Acting under uncertainty – Bayes's rules – Semantics of Belief networks – Inference in Belief networks – Making simple decisions – Making complex decisions.

UNIT 5 APPLICATIONS 9 Hrs.

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An ability to identify, analyze the search algorithm for the AI problems.
CO2: Represent a problem using first order logic.
CO3: Provide the knowledge based agent to solve the problem.
CO4: Understand the Informed search strategies.
CO5: Apply the baye's rule to solve the problem for societal concern.
CO6: Design user centric applications that use AI concepts

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rdEdition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA2701	CYBER PHYSICAL SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

LIST OF EXPERIMENTS

1. Study about embedded components such as sensors and actuators
2. Study about Industrial Revolution and Cyber physical system opportunities and challenges
3. Create a program that blinks the LED on the development board using MBED software.
4. Pick one-one from the available sensors and actuators and find or create code that will display the sensed data on the PC
5. Create a program that displays data from the sensor in regular intervals in a compact format.
6. To Design Basic weather station using embedded components using Lab view software.
7. Login to devicehub.net and create a project then create a virtual device. Add the corresponding sensor and actuator to the virtual device.
8. Study the MQTT protocol. Examine the components of the protocol.
9. Create a connection from an MQTT capable device/software with an MQTT broker then send and receive data using it.
10. To configuring the gateways and exchange the data to local database using Dream factory
11. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots
12. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.
CO2: Identify the limitations of some computational models.
CO3: Apply the theoretical knowledge the design of compilers.
CO4: Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.
CO5: Categorize the essential modeling formalisms of Cyber-Physical Systems (CPS)
CO6: Implement the real time use case and problem statements

SMEA4001	RESOURCES MANAGEMENT TECHNIQUES	L	T	P	C	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the mathematical tools that are needed to solve optimization problems.
- The purpose of the course is to provide students with the concepts and tools to help them understand the operations research.
- To construct a project network and apply program evaluation review technique and critical path management.
- Illustrate how queuing theory can solve problems with inter-arrival and service time.
- To learn the concepts of operation research applied in decision making.

UNIT 1 INTRODUCTION AND LINEAR PROGRAMMING 9Hrs.

Operations Research(OR)- Nature – Characteristics – Phases - Role of OR in Decision making - Outline of OR Models Linear Programming – Formulation of L.P.problems –Solution by graphical method, simplex method, Two Phase Method, Big M methods, Dual Simplex method (Qualitative)

UNIT 2 TRANSPORTATION AND ASSIGNMENT MODEL 9Hrs.

Transportation problem – Initial Basic feasible solution- Northwest corner method, Least Cost method, Vogel's approximation method – Test for optimality-MODI method. Assignment problems- Hungarian assignment models Travelling salesman problems.

UNIT 3 RESOURCE SCHEDULING AND NETWORK ANALYSIS 9Hrs.

Problem of Sequencing – Problem with N jobs and 2 machines N Jobs 3 machines N Jobs and m machines and 2 Jobs m machines (Graphical method). Project Management -Basic concepts–Network construction and scheduling Critical Path Method (CPM) & Program evaluation review technique (PERT) and resource levelling by network techniques, time – Cost trade off.

UNIT 4 INVENTORY CONTROL 9Hrs.

Inventory Control – Various Types of inventory models – deterministic inventory models – Production model, Purchase model– with and without shortage- Economic Order Quantity (EOQ) – Buffer stock – Shortage quantity, Probabilistic inventory models – Quantity Discount and Price Breaks.

UNIT 5 QUEUEING THEORY, GAME THEORY AND REPLACEMENT MODELS 9Hrs.

Queuing theory – Poisson arrivals and exponential service times, Single channel models only, Game Theory – The formulation of two persons, Saddle point, Maxmini and Minimax principle, Mixed Strategies for 2x2 games, Dominance Principle, Replacement policy for items whose maintenance cost increases with time- Consideration of time value of money - Replacement policy- Individual, Group replacement of items that fail completely and suddenly.

Max.45 Hours

COURSE OUTCOMES

At the end of the course, the students will be able to

CO1: Understand the basic concept of Linear Programming Problems.
CO2: To analyze various types of deterministic models like linear programming, transportation model etc.
CO3: To develop Mathematical skills for formulating networks & Scheduling.
CO4: To apply various types of inventory models in industrial applications.
CO5: Apply various types of models like Inventory model, Queuing model, Replacement model & simulation.
CO6: To facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

TEXT/REFERENCE BOOKS

1. Panneerselvam R,Operation research, 2nd Edn., Prentice Hall, 2011.
2. Sharma S.D, Operation research Theory,Methods and Application, 17th Edn., Kedar Nath Ram Nath Publication, 2010.
3. Nita H Shah, Ravi M Gor & Hardik Soni, Operation research, 4th Edn., PHI, 2010.
4. Hamdy A.Taha, Opeartion Research, 8th Edn, PHI, 2010.
5. Hiller & Liberman., Introduction to Operations Research, 5th Edition, Mc Graw Hill, 2012.
6. Ravindran,Phillips &Solberg, Operations Research: principles and practice, 2nd Edn., Wiley India Lts, 2007
7. Ronald L. Rardin, Optimization in Operations Research, Prentice Hall, 2009

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 Exam **Duration : 3 Hrs.**
PART A : 2 Questions from each unit, each carrying 2 marks **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3001	DATA MINING AND DATA WAREHOUSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Identify the scope and necessity of Data Mining & Warehousing for the society.
- Describe various Data Models and Design Methodologies of Data Warehousing destined to solve the root problems.
- To understand various Tools of Data Mining and their Techniques to solve the real time problems.
- To learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
- To assess the Pros and Cons of various algorithms and analyze their behavior on real datasets.

UNIT 1 DATA MINING **9 Hrs.**

Introduction - Steps in KDD - System Architecture – Types of data -Data mining functionalities - Classification of data mining systems - Integration of a data mining system with a data warehouse - Issues - Data Preprocessing - Data Mining Application

UNIT 2 DATA WAREHOUSING **9 Hrs.**

Data warehousing components - Building a data warehouse - Multi Dimensional Data Model - OLAP Operation in the Multi-Dimensional Model - Three Tier Data Warehouse Architecture - Schemas for Multi-dimensional data Model - Online Analytical Processing (OLAP) - OLAP Vs OLTP Integrated OLAM and OLAP Architecture

UNIT 3 ASSOCIATION RULE MINING **9 Hrs.**

Mining frequent patterns - Associations and correlations - Mining methods - Finding Frequent itemset using Candidate Generation - Generating Association Rules from Frequent Itemsets - Mining Frequent itemset without Candidate Generation - Mining various kinds of association rules - Mining Multi-Level Association Rule-Mining MultiDimensional Association Rule-Mining Correlation analysis - Constraint based association mining.

UNIT 4 CLASSIFICATION AND PREDICTION **9 Hrs.**

Classification and prediction - Issues Regarding Classification and Prediction - Classification by Decision Tree Induction - Bayesian classification - Baye's Theorem - Naïve Bayesian Classification - Bayesian Belief Network - Rule based classification - Classification by Backpropagation - Support vector machines - Prediction - Linear Regression

UNIT 5 CLUSTERING, APPLICATIONS AND TRENDS IN DATA MINING **9 Hrs.**

Cluster analysis - Types of data in Cluster Analysis - Categorization of major clustering methods -Partitioning methods - Hierarchical methods - Density-based methods - Grid-based methods - Model based clustering methods - Constraint Based cluster analysis - Outlier analysis - Social Impacts of Data Mining- Case Studies: Mining WWW- Mining Text Database- Mining Spatial Databases

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Assess Raw Input Data and process it to provide suitable input for a range of data mining algorithm.
CO2: Design and Modeling of Data Warehouse .
CO3: Discover interesting pattern from large amount of data
CO4: Design and Deploy appropriate Classification Techniques
CO5: Able to cluster high dimensional Data
CO6: Apply suitable data mining techniques for various real time applications

TEXT / REFERENCE BOOKS

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, 2nd Edition, Elsevier, 2007
2. Alex Berson and Stephen J. Smith, “ Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill, 2007.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction To Data Mining”, Person Education, 2007.
4. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
6. Daniel T.Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

	ADVANCED JAVA	L	T	P	Credits	Total Marks
SITA3001	PROGRAMMING	3	0	0	3	100

COURSE OBJECTIVES

- To know about Enterprise architecture models
- To introduce the basics of session tracking
- To understand JSP and to write Custom Tags
- To know about the development of Enterprise Java Beans .
- To have knowledge advanced Java programming concepts like struts

UNIT 1 INTRODUCTION AND DATABASE PROGRAMMING 9 Hrs.

J2EE Platform – Enterprise architecture styles – J2EE run times – J2EE API – J2EE architecture – Containers –Introduction to J2EE technologies – Naming and directory services. Database programming with JDBC – JDBC/ODBC bridge – Establishing a connection – Creating and executing SQL statements – Querying – Report statements – Scrollable and updatable result sets – Java.sql packages – JDBC data sources – Connection pooling.

UNIT 2 SERVLET PROGRAMMING 9 Hrs.

Introduction to Servlet Programming - Servlet Implementations - Servlet configuration - Servlet exceptions - Servlet Life Cycle - Servlet Programming - Servlet Security- Servlet communication - Advanced Servlets : Approach to Session Tracking - Demonstrating Session - Lifecycle with Cookies - A simple shopping cart using Sessions - Servlet Context Interface - Servlet Collaboration

UNIT 3 JSP AND JAVA MAIL 9 Hrs.

Java Server Pages : Intro to JSP - JSP Directives - Scripting elements - Standard Auctions - Implicit objects - Scope - JSP pages as XML documents - JSP Sample Program - Design Strategies - JSP tag Extensions-A simple TAG - Writing TAG Extensions. Java Mail API: Introduction to Java Mail - Mail Protocols- Java Mail Overview- Quick, Send me a Email: An example program

UNIT 4 ENTERPRISE JAVA BEANS 9 Hrs.

Overview of EJB-EJB Middleware Architecture - EJB Architecture- EJB Containers and its services - Design of EJB Tier - Session java Beans- Stateless and Stateful Beans, Entity Beans and Persistence - Container Vs Bean Managed Persistence, Message Driven Bean - Relationships, EJB Container Services.

UNIT 5 STRUTS 9 Hrs.

Struts: Development Models-Basic Components of Struts – Struts2 Architecture-Interceptors-Validation- Building simple struts Application.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Implement JDBC connectivity
CO2: Implement Servlets and advanced Servlets
CO3: Implement JSP and Java Mail
CO4: Implement EJB
CO5: Implement Struts
CO6: To develop enterprise java applications thereby meeting the industrial requirements

TEXT / REFERENCE BOOKS

1. Subrahmanyam Allamaraju and Cedric Buest ,"Professional Java Server Programming", A press,J2EE 1.3, 2007.
2. Jim Keogh ,"Completer Reference, J2EE",Tata McGraw Hill, 2007.
3. James Holmes-Structs,"The complete Reference", 2nd Edition, Tata McGraw Hill, 2007.
4. http://www.java.sun.com/tutorial

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3002	QUALITY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To define quality assurance plans
- To apply quality assurance tools & techniques
- To understand the Clean Room Software Engineering activities
- To implement the tools for Quality.
- To learn quality assurance models

UNIT 1 SOFTWARE QUALITY 9 Hrs.

Definition of Software Quality, Quality Planning, Quality system – Quality Control Vs Quality Assurance – Product life cycle – Project life cycle models. The Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development and Quality Plans.

UNIT 2 SOFTWARE ENGINEERING ACTIVITIES 9 Hrs.

Estimation, Software requirements gathering, Analysis, Architecture, Design, development, Testing and Maintenance.

UNIT 3 SUPPORTING QUALITY ACTIVITIES 9 Hrs.

Metrics, Reviews –SCM – Software quality assurance and risk management

UNIT 4 SOFTWARE QUALITY ENGINEERING TOOLS AND TECHNIQUES 9 Hrs.

Seven basic Quality tools – Checklist – Pareto diagram – Cause and effect diagram – Run chart –Histogram – Control chart – Scatter diagram – Poka Yoke – Statistical process control – Failure Mode and Effect Analysis – Quality Function deployment – Continuous improvement tools – Case study.

UNIT 5 QUALITY ASSURANCE MODELS 9 Hrs.

Software Quality Standards, ISO 9000 series – CMM, CMMI – P-CMM – Six Sigma – Malcolm Baldrige Quality - Case study.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1:** Learn software quality factors
- **CO2:** Apply common software testing strategies
- **CO3:** Demonstrate about the project process control and software Metrics
- **CO4:** Implement all the common software testing strategies.
- **CO5:** Understand the SQA standards and software process assessments
- **CO6:** To deploy quality engineering models in projects

TEXT / REFERENCE BOOKS

1. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman McGraw – Hill International Edition, 6th Edition, 2006.
2. Ramesh Gopalswamy, Managing global Projects ; Tata McGraw Hill, 2002.
3. Norman E – Fenton and Share Lawrence P flieger, Software metrics , International Thomson Computer press , 1997.
4. Gordan Schulmeyer. G. and James .L. Mc Hanus , Total Quality management for software, International Thomson Computer press , USA , 1990.
5. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 1990.
6. Metrics and Models in Software Quality Engineering, Stephen, Stephen H. Kan, Pearson education, 2006, Low price edition.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3003	SOFTWARE DEFINED NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN
- To learn the SDN Framework

UNIT 1 INTRODUCTION 9Hrs.

How SDN Works – History and Evolution of Software Defined Networking (SDN)-Separation of Control Plane and Data Plane, IETF Forces, Active Networking.

UNIT 2 OPEN FLOW AND SDN CONTROLLERS 9Hrs.

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, and SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT 3 DATA CENTERS 9Hrs.

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE. Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework (VMWare and others), and Mininet based examples.

UNIT 4 SDN PROGRAMMING 9Hrs.

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

UNIT 5 SDN 9Hrs.

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Centre Orchestration

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Analyse the evolution of software defined networks

CO2: Express the various components of SDN and their uses

CO3: Explain the use of SDN in the current networking scenario

CO4: Design and develop various applications of SDN

CO5: Understand and explain SDN Programming

CO6: An Ability to understand the SDN Framework

TEXT/REFERENCE BOOKS

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.
3. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013.
4. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
5. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3004	ADVANCED COMPUTER ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the evolution of computer architecture.
- To understand the design challenges in building a system.
- To impart knowledge on various types of Architectures.
- To discuss the performance and synchronization issues in multiprocessors.
- To learn about pipelining concepts and Vector processing.

UNIT I BASIC ORGANIZATION AND ARCHITECTURAL TECHNIQUES 9 Hrs.

RISC processors - Characteristics of RISC processors, RISC vs CISC, Classification of Instruction Set Architectures - Review of performance measurements - Metrics and measures for parallel programs, Speedup performance laws, scalability analysis approaches, Amdahl's law, limitation, Benchmark, SIMD, MIMD Performance.

UNIT II INSTRUCTION LEVEL PARALLELISM 9 Hrs.

Introduction – Parallel Processing - Instruction Level Parallelism and its Exploitation - Concepts and Challenges -Compiler Techniques for Exposing ILP - Limitations on ILP for Realizable Processors - Hardware versus Software Speculation - Multithreading: Using ILP Support to Exploit Thread-Level Parallelism.

UNIT 3 MULTI-CORE ARCHITECTURES 9 Hrs.

SMT and CMP Architectures – Design Issues – Intel Multi-Core Architecture – SUN CMP Architecture – IBM cell Architecture - HP Architecture – RISC Architecture-Multicore Organization - Intel x86 Multicore Organization

UNIT 4 MULTIPROCESSORS 9 Hrs.

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues - Performance Issues – Synchronization Issues – Models of Memory Consistency - Interconnection Networks – Buses, Crossbar and Multi- stage Switches

UNIT 5 VECTOR PROCESSING & PARALLEL ALGORITHMS 9 Hrs.

Pipelining – Introduction - Vector Processing – Vector Operations- Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Introduction to Parallel Algorithms – Models of Computation- Selection – Merging on EREW and CREW.

Max.45 Hours

COURSE OUTCOMES

On Completion of course the student will be able to

CO1: Compare RISC and CISC processors and analyze metrics for improving performance of processors.
CO2: Analyze and utilize instruction level parallelism.
CO3: Analyze the design issues of distributed shared memory and explain multiprocessor Architectures.
CO4: Compare SMT and CMT architectures and their performance.
CO5: Describe multi core processors and intel x86 multi core organizations.
CO6: Design and develop Parallel algorithms.

TEXT / REFERENCE BOOKS

1. John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan

Kaufmann / Elsevier, 4th.edition, 2007.
2. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, Fifth edition, 2012.
3. William Stallings, “Computer Organization and Architecture”, Pearson Education,
4. Ninth Edition, 2013.
5. Richard Y. Kain, “Advanced Computer Architecture a Systems Design Approach”,
6. Prentice Hall, Second Edition, 2011.
7. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture : A Hardware/ Software Approach” , Morgan Kaufmann / Elsevier, 2005

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3005	SOFTWARE SYSTEM ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the software process and develop architectural thinking
- To analyze the complex problem using activity, component and deployment diagram
- To explore the knowledge of structural and behavioural patterns of software architecture
- To understand the architectural patterns and different styles
- To gain knowledge of using software design tools.

UNIT 1 SOFTWARE PROCESS 9 Hrs.

Analysis modeling and best practices, process, process modeling; process notations - traditional best practice diagrams such as DFDs and ERDs.

UNIT 2 ARCHITECTURAL MODELING 9 Hrs.

UML diagrams, Structural static modeling, behavioural modeling - interactions - use cases - use case, interaction & Activity diagrams. Component and deployment diagrams - analysis case studies, analysis patterns. Documenting quality attributes.

UNIT 3 SOFTWARE ARCHITECTURE DESIGN 9 Hrs.

Design best practices, Design patterns - Creational patterns - structural patterns - behavioural patterns, Component technology, object oriented frameworks, distributed objects, interoperability standards, and case studies.

UNIT 4 SOFTWARE ARCHITECTURE 9 Hrs.

Architectural styles, architectural patterns, patterns and software architecture, analysis of architectures, formal descriptions of software architectures, Architectural views.

UNIT 5 ARCHITECTURAL DESCRIPTION LANGUAGES ADL AND TOOLS 9 Hrs.

Requirements of Architecture – Need for formal Languages, Description languages, Tools for Architectural design, scalability and interoperability issues, Web application architectures, case studies.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to–

CO1: Analyze software process and process modelling.
CO2: Ability to draw UML diagrams for a given problem statement.
CO3: Understand various design patterns.
CO4: Evaluate the applicability of an architectural style for a product.
CO5: Build web application architecture using ADL tools.
CO6: Compare and contrast formal languages and description languages.

TEXT / REFERENCE BOOKS

1. Lenn Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Third Edition, Addison- Wesley Publication,2011
2. George H. Fairbanks Just, “ Enough Software Architecture: A Risk-Driven Approach”, First Edition, Marshal Publication, 2010
3. Robert C. Martin, “Clean Architecture” Prentice Hall Publication, 2016.
4. Grady Booch, Robert Maksimchuk, Michael Engle, Jim Conallen, Kelli Houston, Young Bobbi.” Object-Oriented Analysis and Design with Applications”, Addison-Wesley Object Technology Series, 3rd Edition, 2007.
5. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides,” Design Patterns, Elements of reusable Object Oriented Software”, Pearson, 2015.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SECA3009	DIGITAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and gain complete knowledge about the fundamentals of digital image processing
- To develop a theoretical foundation of image processing techniques
- To provide analytic skills to process the images

UNIT 1 INTRODUCTION 9 Hrs.

Image Representation, Components of Digital Image Processing Systems, Image Sensing and Acquisition, Elements of Visual Perception, Image formation model, Image Sampling and Quantization, Relationship between pixels.

UNIT 2 IMAGE ENHANCEMENT 9 Hrs.

Enhancement by Point Processing, Histogram Processing, Arithmetic/Logic Operations, Image Averaging, Spatial Filters for Smoothing and Sharpening, Frequency domain filters for Smoothing and Sharpening; Image Degradation & Restoration Model, Noise Models, Inverse Filtering, Geometric Mean Filter.

UNIT 3 IMAGE SEGMENTATION 9 Hrs.

Detection of Discontinuities, Edge Linking and boundary Detection, Thresholding, Region based Segmentation, Coding Redundancy, Inter pixel Redundancy, Image Compression model, Error Free Compression, Variable Length Coding, and Lossy Compression.

UNIT 4 MORPHOLOGICAL AND COLOUR IMAGE PROCESSING 9 Hrs.

Dilation and Erosion, Opening and Closing, Basic Morphological Algorithms: Boundary Extraction, Region Filling, Thickening and Thinning; Colour Image Representation, Colour Models, Pseudo Colour Image Processing, Colour Transformations, Smoothing and Sharpening, Segmentation based on Colour.

UNIT 5 MEDICAL IMAGE PROCESSING 9 Hrs.

Noise Reduction in Nuclear Medicine Imaging, Contrast enhancement of mammograms, Detection of Spinal Canal, Detection of calcifications by multi-tolerance region growing, Shape analysis of calcifications, Analysis of Ligament Healing.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the fundamentals of Digital Image Processing.
CO2: Learn the image enhancement techniques in Spatial and Frequency Domain
CO3: Model the Noises, Restoration and Compression.
CO4: Analyze segmentation and compression techniques.
CO5: Apply various algorithms for Colour Image Processing.
CO6: Apply various algorithms for Medical Image Processing.

TEXT /REFERENCE BOOKS

1. Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", 4th Edition, Pearson Education, 2017.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 4th Edition, Cengage Learning, 4th Edition, 2014.
3. B. Chanda ,D.DuttaMajumdar , "Digital Image Processing and Applications", Prentice Hall of India, 2011.
4. William K Pratt, "Digital Image Processing", 4th Edition, John Willey 2007.
5. Rangaraj M. Rangayyan, “Biomedical Image Analysis”, CRC Press LLC, Boca Raton, FL, 2005
6. Jain A.K., "Fundamentals of Digital Image Processing", Pearson Education, 1989

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA3008	INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Internet of Things .
- To identify the various elements of an IoT System
- To understand the various means of communication from Node / Gateway to Cloud Platforms
- To identify types of data analytics and data visualization tools
- To make students aware of security concerns and challenges while implementing IoT solutions

UNIT 1 INTRODUCTION TO IOT 9 Hrs.

Introduction to IoT, Current technological trends and future prospects, - Evolution of IoT , Business Scope, Relation with embedded system, - Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT, IoT Value Chains, An emerging industrial structure for IoT.

UNIT 2 ELEMENTS OF IOT 9 Hrs.

Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards,

UNIT 3 COMMUNICATION AND CONNECTIVE TECHNOLOGIES 9 Hrs.

IoT Communication Model, Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud, Selecting and Creating cloud service , cloud based IoT platforms - IBM Watson, Google cloud.

UNIT 4 DATA ANALYTICS AND IOT PLATFORM 9 Hrs.

Big Data Analytics , Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache_Storm, Data Visualization, Visualization tools for IoT

UNIT 5 HANDS-ON PROJECTS 9 Hrs.

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), DIY Kits – Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

Max.45 Hours

COURSE OUTCOMES

On Completion of course the student will be able to

CO1: To learn and understand the technology and current trends in Internet of things.
CO2: To understand the various elements of IoT system and hardware devices.
CO3: To learn the programming languages and platforms for building IoT applications.
CO4: To understand the cloud computing and its relevance for developing IoT applications.
CO5: To design and implement IoT applications that manages big data with data analytics and visualization tools.
CO6: To implement hands-on projects using an appropriate software and hardware devices in various applications.

TEXT / REFERENCE BOOKS

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi
2. Architecting the Internet of Things, Springer publications. Author(s):Dieter Uckelmann, Mark Harrison, Florian Michahelles
3. Internet of Things with Arduino Cookbook, Packt Publications. Author(s): Marco Schwatrz
4. Internet of Things and Data Analytics, Wiley Publications.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3006	GREEN COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

UNIT 1 GREEN COMPUTING FUNDAMENTALS 9 Hrs.

Information Technology and Environment - Green Enterprise Characteristics- Green Vision-Green Value-Green IT Opportunity-Environmental Intelligence--Envisioning the Green Future.

UNIT 2 GREEN IT STRATEGIES AND ASSETS 9 Hrs.

Introducing Green IT Strategies-Green ITDrivers-GreenITBusinessDimensions-GreenITMetrics and Measurements- Green IT Readiness and CMM-Green Assets–Buildings-Green IT Hardware- Green Data Centers- Networking and Communication Infrastructure-Managing Devices for Central Green Services.

UNIT 3 SOCIO CULTURAL ASPECTS OF GREEN IT 9 Hrs.

GreenIT'sSocialImpact-GreenSocialstakeholders-RolebasedviewofGreenIT-GreenUserpractices-GreenITEthicsandCodeConduct-PrivacyandsecurityofgreenInformation -Green IT project - Green Virtual Communities.

UNIT 4 EMERGENT CARBON ISSUES – TECHNOLOGIES AND FUTURE 9 Hrs.

Future Carbon Landscape - Green ICT and Technology Trends - Nanotechnologies- QuantumComputing–Ecodesign–NewRenewableEnergies-GreenICT- Business and Economic Trends.

UNIT 5 CASE STUDIES 9 Hrs.

Applying Green IT Strategies and Application to a Hospital -Packing Industry and Industrial Sector.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2: Enhance the skill in energy saving practices in their use of hardware.
CO3: Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4: Understand the ways to minimize equipment disposal requirements.
CO5: Satisfy societal requirements
CO6: Apply green computing concepts in real time

TEXT/REFERENCE BOOKS

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —Green Home computing for dummies, August 2012.
3. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.
4. John Lamb, —The Greening of IT, Pearson Education, 2009.
5. Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008
6. Carl speshocky, —Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
7. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiency, CRC Press.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3007	INTRODUCTION TO VISUAL COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of Visual Computing
- Modeling and solving image and video processing and analysis problems.
- Exploiting high level knowledge about human visual perception
- To contribute state-of-the-art solutions for multimedia applications
- To learn the field of visualisation,determining how best to turn data into information

UNIT 1 VISUAL COMPUTING INTRODUCTION 9 Hrs.

Physiological Foundations-Representation of Light and Color-Image and Noise Models- Basics of Fourier series, Sampling Theorem-Vector Quantization- k-Means Clustering- Mixture Models- Gray Level and Color Quantization-Relationships between Pixels- Camera Geometry- 2D and 3DTransforms, Projections

UNIT 2 DIGITAL IMAGE PROCESSING 9 Hrs.

Digital Image Filtering-Image Transforms-Image Enhancement and Restoration, Wiener Filters, Nonlinear Image Processing (Median filtering)-Nonlinear Diffusion, Gauss-Laplace Pyramid, Wavelets-Scale Space, (Image and Video Compression Image Segmentation-Optical Flow-Stereo Vision-Template Matching, Point Matching

UNIT 3 DIGITAL IMAGE GENERATION 9 Hrs.

The Graphics Pipeline- Lighting and Reflection Models- Shading-Texture Analysis and Texture Mapping-Aliasing- Global Illumination-Radiosity-Ray Tracing-Graphics Systems- APIs-3D Graphics Hardware

. **UNIT 4 REPRESENTATION OF GEOMETRY 9 Hrs.**

Parametric Curves-Bézier Curves-B-Splines-NURBS- Tensor Product Surfaces, Triangle Meshes-Subdivision Methods-Shape Models, linear (Gaussian) Diffusion

. **UNIT 5 LEARNING METHODS IN VISION 9 Hrs.**

Classifier Learning-Support Vector Machines-Radial Basis Function Networks-Dimension Reduction: PCA, ICA- Linear Discriminant Analysis-Graphical Models- Markov Random Fields-Maximum Entropy Inference and Bayesian Image Analysis

MAX. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1:** Acquaint students with core knowledge in visual information processing and learning
- **CO2:** Implement Digital Image Processing Mechanisms. .
- **CO3:** Analyze and design Digital Image Generation Mechanisms
- **CO4:** Representation of geometry and subdivision methods.
- **CO5:** Describe the Learning Methods in Vision
- **CO6:** Comprehend the concepts related three dimensional object representations

TEXT / REFERENCE BOOKS

1. Donald D Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education.
2. Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, OpenGL Programming Guide: The Official Guide to Learning OpenGL, (2013).
3. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles & Practice in C, Addison Wesley Longman
4. Zhigang Xiang, Roy A Plastock, Computer Graphics, Schaums Outline, TMH.
5.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3008	DISTRIBUTED DATABASE AND INFORMATION SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the role of databases and database management systems in managing organizational data and information.
- To understand the techniques used for data fragmentation, replication and allocation during the distributed database design process.
- To discuss the issues involved in resource management and process.
- To Perceive the building blocks and design of information systems
- To acquire knowledge of information systems on Business operations

UNIT 1 INTRODUCTORY CONCEPTS AND DESIGN OF (DDBMS) 9 Hrs.

Data Fragmentation - Replication and allocation techniques for DDBMS - Methods for designing and implementing DDBMS - designing a distributed relational database - Architectures for DDBMS - Cluster federated - parallel databases and client server architecture - Overview of query processing.

UNIT 2 DISTRIBUTED SECURITY & DISTRIBUTED DATABASE APPLICATION TECHNOLOGIES 9 Hrs.

Overview of security techniques - Cryptographic algorithms - Digital signatures - Distributed Concurrency Control - Serializability theory - Taxonomy of concurrency control mechanisms - Distributed deadlocks – Distributed Database Recovery - Distributed Data Security - Web data management - Database Interoperability.

UNIT 3 ADVANCED IN DISTRIBUTED SYSTEMS 9 Hrs.

Authentication in distributed systems - Protocols based on symmetric cryptosystems - Protocols based on asymmetric cryptosystems - Password-based authentication - Unstructured overlays - Chord distributed hash table - Content addressable networks (CAN) - Tapestry - Some other challenges in P2P system design - Tradeoffs between table storage and route lengths - Graph structures of complex networks - Internet graphs - Generalized random graph networks.

UNIT 4 FUNDAMENTALAS OF INFORMATION SYSTEMS 9 Hrs.

Defining information – Classification of information – Presentation of information systems – Basics of Information systems – Functions of information systems – Components of Information systems- Limitations of Information systems – Information System Design.

UNIT 5 ENTERPRISE COLLOBRATION SYSTEMS 9 Hrs.

Groupware – Types of groupware – Enterprise Communication tools – Enterprise Conferencing tools – Collaborative work management tools – Information System for Business operations – transaction processing systems – functional Information Systems – Decision Support systems – Executive Information systems – Online Analytical processing.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Identify the introductory distributed database concepts and its structures.
CO2: Produce the transaction management and query processing techniques in DDBMS..
CO3: To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
CO4: Critiques on each type of databases.
CO5: Analyse, Design and present the information systems.
CO6: Designing of decision support system and tools for Business operations.

TEXT /REFERENCE BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education Asia, 2012.
2. Ajay D. Kshemkalyani, MukeshSinghal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2008.
3. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 2006.
4. Ralph Stair and George Reynolds. , “Principles of Information Systems” Course Technology, Inc.,2006

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3009	SOFT COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the various types of soft computing frameworks.
- To understand the knowledge about Genetic Algorithms.
- To design various types of neural networks.
- To understand the concepts of neuro fuzzy.
- To gain knowledge on Fuzzy Logic.

UNIT 1 NEURAL NETWORKS 9Hrs.

Introduction to ANS - Adaline - Back propagation network - Hopfield network - Boltzman machine - Self organizing maps- Support Vector Machines-Spike Neuron Models.

UNIT 2 FUZZY LOGIC 9Hrs

.Fuzzy sets - Fuzzy rules and fuzzy reasoning –Defuzzification- Fuzzy inference system - Mamdani fuzzy model - Sugenofuzzy model - Tsukamoto fuzzy model.

UNIT 3 NEURO FUZZY 9Hrs.

Adaptive Neuro Fuzzy Inference System - Coactive neuro-fuzzy modelling - Classification and regression trees - Data Clustering Algorithm - Rule based structure - Neuro - Fuzzy control I - Neuro -Fuzzy control II - Fuzzy decision making.

UNIT 4 GENETIC ALGORITHM 9Hrs.

Introduction - Implementation of GA - Reproduction - Crossover - Mutation - Coding - Fitness scaling - Application of GA.

UNIT 5 ARTIFICIAL INTELLIGENCE 9Hrs.

Introduction - Searching techniques - First order Logic - Forward reasoning - Backward reasoning - Semantic – Frames.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Describe human intelligence and how intelligent system works.

CO2: Apply basics of Fuzzy logic and neural networks.

CO3: Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.

CO4: Discuss about Neuro Fuzzy concepts.

CO5: Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

CO6: Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

TEXT / REFERENCE BOOKS

1. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
2. S.R.Jang, C.T. Sun And E.Mizutani, “Neuro-Fuzzy And Soft Computing”, PHI / Pearson Education 2004.
3. David E. Goldberg, “Genetic Algorithm In Search Optimization And Machine Learning” Pearson Education India, 2013.
4. Stuart J. Russel, Peter Norvig, “Artificial Intelligence A Modern Approach”, 2nd Edition, Pearson Education, 2003.
5. S.N.Sivanandam , S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011.
6. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3010	PERFORMANCE EVALUATION OF COMPUTERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of performance Evaluation of Computers.
- To discuss appropriate evaluation techniques, performance metrics and workloads for a system field

UNIT 1 INTRODUCTION AND BASIC CONCEPTS 9Hrs.

Background, Performance Evaluation Viewpoints and Concepts, Goals of Performance Evaluation, Applications of Performance Evaluation, Techniques, Metrics of Performance, Workload characterization, Benchmarking

UNIT 2 PROBABILITY THEORY REVIEW 9Hrs.

Basic Concepts on Probability Theory, Sample Space and Events, Conditional Probability and Independence, Mean and Median use, Geometric, and Harmonic Mean, Variance, and Standard Deviation, Random Variables, Expectation and Variance, Density and Distribution Functions, Comparing Systems Using Sample Data, Regression Models

UNIT 3 MEASUREMENT/TESTING TECHNIQUE 9Hrs.

Event and Measurement Strategies, Event Tracing, Hardware Monitor, Software Monitors. Hybrid Monitors, Traffic Issues and Solutions, Accounting Logs. Benchmarking and Capacity Planning-Types of Benchmark Programs ,Common Mistakes in Benchmarking, Example Benchmark Programs, Procedures of Capacity planning, Problems in Capacity Planning.

UNIT 4 DATA REPRESENTATION AND GAME RATIO 9 Hrs.

Guidelines for Preparing Plots, Charts Used for Data Presentation, Program Profiling, Common Mistakes in Charts Construction, Errors in Experimental Measurements.

UNIT 5 BASICS OF QUEUEING THEORY AND QUEUEING NETWORKS 9Hrs.

Introduction, Queueing Modelling Notations, Rules for all Queues, Single-Queue, Single (M/M/ 1) System, Single-Queue, Multiple Server (M/M/c) System, Other Queues, Little's Law.Queueing Networks- Definitions, Open Queueing Networks, Closed Queueing Networks, Product-Form Queueing Networks, Case Studies

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Develop both analytical and simulation modelling of computer systems
CO2: Compute probabilities
CO3: Infer properties of samples and associate confidence measures to sampled statistics.
CO4: Extract the salient features from a sample and to present them
CO5: Follow a scientific approach to understanding
CO6: Recognize why the performance of a system varies with some fact.

TEXT / REFERENCE BOOKS

1. Raj Jain, The Art of Computer System Performance Analysis: Techniques for Experimental Design Measurements Simulation and Modelling, Wiley, (2015).
2. Mor Harchol-Balter, Performance Modelling and Design of Computer Systems, Cambridge, (2013).
3. Peter G. Harrison, Naresh M. Patel, Performance Modelling of Communication Networks and Computer Architectures, Addison-Wesley Longman, (1993).
4. K. S. Trivedi, Probability and Statistics with Reliability Queueing and Computer Science Applications, Wiley, (2001).

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3011	HARDWARE INTERFACES AND ITS APPLICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the components on the motherboard
- To understand different storage media
- Install and Repair computer system
- Install Network devices, configuration, optimization
- Understand the features of different I/O peripheral devices and their interfaces.

Unit 1 INTRODUCTION TO PC AND MEMORY 9Hrs.

Evolution of Personal Computers - Overview of Systems and Components - Processor Modes - Modern CPU Concepts - Architectural Performance Features - Intel Core X-Series Processor - CPU Over Clocking - Essential Memory Concepts - Memory Packages - Logical Memory Organizations - Memory Considerations - Memory Types - SSD - OPTANE Memory - Memory Techniques - Selecting and Installing Memory - CPU Coolers.

Unit 2 MOTHERBOARD DESIGNS 9Hrs.

Motherboard Form Factors - IBM PC XT -IBM PC AT - The Baby AT - Micro-AT -LPX and Mini-LPX - ATX - Mini-ATX - NLX - Active Motherboards - Sockets and Expansion Slots – DIMM.2 - M.2 Expansion Card – PCIE GEN3 M.2 - Intel D850GB - Upgrading a Mother Board -DDR4 BOOST - Chipsets - Intel -Non-Intel Chipsets - North Bridge - South Bridge - CMOS - Motherboard BIOS - RGB Headers - Live Dash OLED - NEXT GEN Connectivity 802.11 AD WIFI - USB 3.1 GEN2 Controller.

UNIT 3 POWER SUPPLIES AND STORAGE DEVICES 9Hrs.

Power Supplies and Power Management - Modular – Non-Modular - Concepts of Switching Regulation - Potential Power Problems - Power Management -The Floppy Drive - Magnetic Storage - Floppy Drive - Hard Drive - SSD- CD-ROM Drive - DVD-ROM - DVD Media - DVD Drive and Decoder.

Unit 4 I/O PERIPHERALS AND BUS ARCHITECTURE 9Hrs.

Parallel Port - Signals and Timing Diagram - IEEE1284 Modes - Asynchronous Communication - Serial Port Signals - Video Adapters - Mice - Keyboards - Sound Cards – ISA - PCI - AGP.

Unit 5 NETWORK COMPONENTS 9Hrs.

Introduction of Network Cable - Ethernet Cable - FIBER Optics – HUB - Unmanageable Switch - Manageable Switch – Router – Modem - Wi-Fi - Access Point - PCI Wireless Card - USB Wireless Device - Print Server

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Explain the relationship between hardware and software
CO2: Classify and explain the function of different computer hardware components
CO3: Understand purpose and functions of networking
CO4: Understand the purpose and functions of the computer peripherals
CO5: Understand diagnostic procedures and troubleshooting techniques to personal computers, portable devices, operating systems and computer peripherals.
CO6: Simulate various Hardware intetfaces

TEXT / REFERENCE BOOKS

1. Stephen J Bigelow, “Trouble Shooting, maintaining and Repairing PCs”, Tata McGraw-Hill.
2. Ron Gilster, “PC Hardware: A Beginner's Guide”, Tata McGraw-Hill.
3. Craig Zacker and John Rourke, “The complete reference: PC hardware”, Tata McGraw-Hill.
4. Mike Meyers, “Introduction to PC Hardware and Troubleshooting”, Tata McGraw-Hill.
5. B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, Tata McGraw-Hill.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

	CYBER FORENSICS AND CYBER LAW	**L**	**T**	**P**	**Credits**	**Total Marks**
SITA3009		**3**	**0**	**0**	**3**	**100**

COURSE OBJECTIVES

- To introduce Cyber Forensic Theory and cyber laws.
- To understand the concept of data and recovery evidence for different platforms.
- To designed Forensics Investigation and laws.
- To understand the concepts of cyber security and legal systems of information technology.
- To gain knowledge on reverse engineering and cracking techniques.

UNIT 1 CYBER FORENSIC BASICS 9 Hrs.

Cyber Forensic Basics- Introduction to Cyber Forensics, Storage Fundamentals, File System Concepts, Data Recovery, Operating System Software and Basic Terminology.

UNIT 2 DATA AND EVIDENCE RECOVERY 9 Hrs.

Introduction to Deleted File Recovery, Data Recovery Tools, Data Recovery Procedures and Ethics, Preserve and safely handle original media, Document a "Chain of Custody", Complete time line analysis of computer files based on file creation, file modification and file access, Recover Internet Usage Data, Recover Swap Files/Temporary Files/Cache Files, Introduction to Encase Forensic Edition, Forensic Tool Kit (FTK) etc.

UNIT 3 CYBER FORENSICS INVESTIGATION 9 Hrs.

Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.

UNIT 4 CYBER LAWS 9 Hrs.

Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security etc.

UNIT 5 CYBER SECURITY 9 Hrs.

Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards, Assessing Threat Levels, Reporting Cyber-crime, Operating System Attacks, Application Attacks, Reverse Engineering & Cracking Techniques and Financial Frauds

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the definition of computer forensics fundamentals.
CO2: Describe the types of computer forensics technology.
CO3: Analyse various computer forensics systems.
CO4: Illustrate the methods for data recovery, evidence collection and data seizure.
CO5: Summarize duplication and preservation of digital evidence.
CO6: To apply the concepts in engineering system.

TEXT / REFERENCE BOOKS

1. ChristofPaar, Jan Pelzl, Understanding Cryptography: A Textbook for Students and Practitioners,2nd Edition, Springer's, 2010
2. Ali Jahangiri, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures forEthical Hackers & IT Security Experts, Ali Jahangiri, 2009
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics), 2010.
4. Guide to Computer Forensics and Investigations Perfect Paperback, by Christopher Steuart , Bill Nelson , Amelia Phillips, 2013.
5. Digital Forensic and Cyber Crime Hardcover – 2016, by R K Jha.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3012	KNOWLEDGE MANAGEMENT SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation.
- To learn the technologies to use and manage the knowledge.
- To understand how to apply and integrate appropriate components and functions of various knowledge management systems.
- To know the core concepts, methods, techniques, and tools for computer support of knowledge management.
- To be prepared for further study in knowledge generation and engineering.

UNIT 1 INTRODUCTION 9Hrs.

Overview of Knowledge Management: The Nature of Knowledge - Data, Information and Knowledge with Examples - Types of Knowledge-Subjective View of knowledge-Objective View of knowledge-Procedural vs. Declarative Knowledge-Tacit vs. Explicit Knowledge - General vs. Specific Knowledge - Technically vs. Contextually Specific Knowledge - Knowledge and Expertise - Types of Expertise - Codifiability and Teachability of Knowledge - Specificity of Knowledge - Reservoirs of Knowledge - Characteristics of Knowledge.

UNIT 2 COMPONENTS AND TECHNOLOGIES IN KMS 9Hrs.

Major components of KMS-Categories of KMS-Technologies to Manage Knowledge-Digital Libraries- Repositories-Cognitive Psychology - Kinds of Knowledge- Expert Knowledge-Thinking and Learning in Humans -Knowledge vs. Intelligence - Knowledge Based Systems for KM :dumb search, Heuristic search .

UNIT 3 KNOWLEDGE ARCHITECTURE 9Hrs.

Knowledge Management Systems Life Cycle-Challenges in KM Systems Development-Conventional Vs KM Systems Life Cycle (KMSLC)-Key Differences-Key Similarities and KMSLC Approaches - Knowledge Architecture- Knowledge Creation-Nonaka's Model of Knowledge Creation & Transformation-Knowledge Architecture-Acquiring the KM System.

UNIT 4 KMS TOOLS AND TECHNIQUES 9Hrs.

Knowledge Discovery: Systems that Create Knowledge -Knowledge Capture Systems: Systems that Preserve and Formalize Knowledge - Concept Maps, Process Modelling, RSS-Wikis-Delphi Method-Knowledge Sharing Systems-Systems that Organize and Distribute Knowledge- Ontology Development Systems-Categorization and Classification Tools - XML-Based Tools - Capturing Techniques- On-Site Observation (Action Protocol) -Brainstorming, Electronic Brainstorming - Protocol Analysis (Think-Aloud Method) - Consensus Decision Making, Repertory Grid - Nominal Group Technique (NGT) - Delphi Method - Concept Mapping - Black boarding .

UNIT 5 APPLICATION AND FUTURE TRENDS 9Hrs.

Components Of A Knowledge Strategy – Case Studies - Discovering New Knowledge - Data Mining - Classical statistics & statistical pattern recognition - Induction of symbolic rules -Induction trees - Artificial Neural Networks - Supervised Learning - Back Propagation -Unsupervised Learning - Kohonen Network -The Future of Knowledge Management - Protecting Intellectual Property (IP)

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An ability to create and represent knowledge to solve a problem.
CO2: Interpret data for knowledge management systems.
CO3: Identify the various knowledge architectures.
CO4: Apply the theoretical knowledge to acquire new systems.
CO5: Use the knowledge management tools.
CO6: Develop Knowledge Management Applications

TEXT /REFERENCE BOOKS

1. Elias M. Awad, Hassan M. Ghaziri (2004). Knowledge Management. Prentice Hall. ISBN: 0-13-034820-1.
2. Ian Watson (2002). Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.
3. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
4. Amrit Tiwana (2002). The Knowledge Management Toolkit: Orchestrating IT, Strategy, and Knowledge Platforms (2nd Edition). Prentice Hall. ISBN: 013009224X.
5. Stuart Barnes (ed) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.
6. Stuart Russell, Peter Norvig (2003). Artificial Intelligence: A Modern Approach (2nd Edition). ISBN: 0-13-790395-2.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3013	SYSTEM MODELING AND SIMULATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce various system modeling and simulation techniques and highlight their applications in different areas.
- To discuss about modeling, design, simulation, planning, verification and validation.
- To understand various mathematical models.
- To validate and verify the simulated model.
- To understand simulation programming.

UNIT 1 INTRODUCTION TO SIMULATION 9Hrs.

Introduction – Simulation Terminologies - Application areas - Model Classification - Types of Simulation - Steps in a Simulation study - Concepts in Discrete Event Simulation - Simulation Examples .

UNIT 2 MATHEMATICAL MODELS 9 Hrs.

Statistical Models - Concepts – Discrete Distribution- Continuous Distribution - Poisson Process- Empirical Distributions - Queuing Models – Characteristics- Notation– Queuing Systems - Markovian Models - Generation of Pseudo Random numbers- Properties of random numbers - Techniques for generating random numbers - Testing random number generators - -Generating Random-Variates- Inverse Transform technique– Acceptance- Rejection technique - Composition & Convolution Method.

UNIT 3 ANALYSIS OF SIMULATION DATA 9 Hrs.

Input Modeling - Data collection - Assessing sample independence- -Hypothesizing distribution family with data - Parameter Estimation – Goodness-of-fit tests - Selecting input models in absence of data - Output analysis for a Single system - Terminating Simulations– Steady state simulations.

UNIT 4 VERIFICATION AND VALIDATION 9 Hrs.

Model Building – Verification of Simulation Models - Calibration and Validation of Models - Validation of Model Assumptions – Validating Input – Output Transformations

UNIT 5 SIMULATION OF COMPUTER SYSTEMS AND CASE STUDIES 9 Hrs.

Simulation Tools - Model Input - High level computer system simulation - CPU Memory Simulation - Comparison of systems via simulation - Simulation Programming techniques - Development of Simulation models .

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Describe the components of continuous and discrete systems and simulate them.
CO2: Explain the need for the development process to initiate the real problem.
CO3: Simulate any discrete system using queuing systems.
CO4: Implement numerical algorithm to meet simple requirements.
CO5: Discuss the simulation methods and select the suitable technique on the problems
CO6: Model any system from different fields.

TEXT / REFERENCE BOOKS

Jerry Banks and John Carson, “Discrete Event System Simulation”, Fourth Edition, PHI, 2005.
Geoffrey Gordon, “System Simulation”, Second Edition, PHI, 2006 .
Frank L. Severance, “System Modeling and Simulation”, Wiley, 2001.
Averill M. Law and W. David Kelton, “Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
Sheldon M. Ross: Introduction to Probability Models 7th Edition, Academic Press, 2002.

Donald E. Knuth: The Art of Computer Programming - Volume 2: Semi Numerical Algorithms, 2nd Edition, PEARSON Education, Reading MA, USA 2000.
Sheldon M. Ross: Simulation 3rd Edition, Academic Press, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3014	OPEN SOURCE SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand open source licenses and learn the implications for users, developers and the software community.
- To Understand the motivation, theory, strengths and weakness of open source software.
- To become familiar with and become adapt using the tools of open source development.
- To learn GNU.
- To practice open source programming techniques.

UNIT 1 OVERVIEW OF FREE/OPEN SOURCE SOFTWARE 9 Hrs.

Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/Linux and the free software movement -Advantages of free software and GNU/Linux –Licensing - Types of licensing , Intellectual Proprietary Right, Commercial License vs. Open source license- Open Source Licensing, Contract and Copyright Law: Basic principles of copyright law, contract and copyright, open source software licensing, Issues with copyrights and patents, warranties . The FOSS Philosophy, usage -Trends and potential -global and Indian –. FOSS Licenses – GPL- AGPL- LGPL – FDL – Implications – FOSS examples . Review of common programming practicies and guidelines for GNU/Linux and FOSS.

Unit 2 LINUX 9 Hrs.

Linux OS Installation and Hardware Configuration - Configure disk partitions & file systems and install a GNU/Linux distribution -Basic shell commands - Logging in, Listing files, editing files, copying/moving files, viewing file contents, changing file modes and permissions, process management User and group management -File ownerships and permissions -PAM authentication -Introduction to common system configuration files & log files -Configuring networking - Basics of TCP/IP networking and routing -Connecting to the Internet ,System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

UNIT 3 OPEN SOURCE TOOLS AND TECHNOLOGIES FOR HARDWARE AND E-MAIL SERVER 9 Hrs.

Configuring additional hardware -Sound cards -Displays & display cards-Network cards -Modems -USB drives -CD writers -The OS boot up process -Performing every day tasks using GNU /Linux - Accessing the Internet -Playing music -Editing documents and spreadsheets -Sending and receiving email -Copy files from disks and over the network -Playing games - Writing CDs -X Window system configuration and utilities -Configure X windows -Detect display devices -Installing software -From source code as well as using binary packages -Setting up email servers-Using postfix -(SMTP services) -Courier (IMAP & POP3 services) -Squirrel mail (web mail services) -Setting up web servers -Using apache (HTTP services) -PHP (server-side scripting) -Perl (CGI support) -Setting up file services -Using samba (file and authentication services for windows networks) –Using NFS (file services for gnu/Linux / Unix networks) -Setting up proxy services -Using squid (http / ftp / https proxy services) – Printer Installation.

UNIT 4 UNDERSTANDING GNU LIBC LIBRARIES, COMPILERS AND LINKER 9 Hrs.

GNU compiler tools - The C compiler (gcc) and the C++ compiler (g++) - Linking against object archives (.a libraries) and dynamic shared object libraries (.so libraries) -Generating statically linked binaries and libraries -Generating dynamically linked libraries -Using the GNU debugging tools -Gdb to debug programs -Graphical debuggers like ddd - Memory debugging/profiling libraries mpatrol and valgrind -Introduction to Bash, sed & awk scripting.

UNIT 5 OPEN SOURCE PROGRAMMING TECHNIQUES 9 Hrs.

Application Programming -Basics of the X Windows server architecture -Qt programming -Gtk+ programming -Python programming - Execution Environment - Programming GUI applications with localisation support, Open Source Equivalent of existing commercial software.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understands the importance of open source and how it can be used in efficient manure.

CO2: Understands the importance of licensing, legal impacts.
CO3: Configured Hardware using OPEN SOURCE TOOLS AND TECHNOLOGIES
CO4: Get experience with python programming language.
CO5: Understand various system software tools
CO6: Implement various applications using open source software.

TEXT / REFERENCE BOOKS

1. N. B. Venkateshwarlu (Ed), "Introduction to Linux: Installation and Programming", B S Publishers; 2005. (NRCFOSS Publication
2. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, OReilly Media, 2009

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SCSA3015	DEEP LEARNING	3	0	0	3	100

COURSE OBJECTIVES

- To present the mathematical, statistical and computational basis of neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT 1 INTRODUCTION 9 Hrs.

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT 2 DEEP NETWORK 9 Hrs.

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

UNIT 3 DIMENTIONALITY REDUCTION 9Hrs.

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

UNIT 4 OPTIMIZATION AND GENERALIZATION 9 Hrs.

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT 5 CASE STUDY AND APPLICATIONS 9 Hrs.

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

Max.45 Hours

COURSES OUTCOMES

On completion of the course the student will be able to

- **CO1:** Understand basics of deep learning
- **CO2:** Implement various deep learning models
- **CO3:** Realign high dimensional data using reduction techniques
- **CO4:** Analyze optimization and generalization in deep learning
- **CO5:** Explore the deep learning applications
- **CO6:** Design and creation of data models

TEXT/REFERENCE BOOKS

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3016	DATA SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the mathematical foundations required for data science
- To describe a flow process for data science problems
- To introduce basic data science algorithms and data visualization
- To learn machine tools and techniques.
- To learn the ideas and tools for data visualization.

UNIT 1 LINEARALGEBRA 9 Hrs.

Algebraic view – vectors 2D, 3D and nD, matrices, product of matrix & vector, rank, null space, solution of over determined set of equations and pseudo-inverse.
Geometric view - vectors, distance, projections, eigenvalue decomposition, Equations of line, plane, hyperplane, circle, sphere, Hypersphere.

UNIT 2 PROBABILITY AND STATISTICS 9Hrs.

Introduction to probability and statistics, Population and sample, Normal and Gaussian distributions, Probability Density Function, Descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates

UNIT3 EXPLORATORY DATA ANALYSIS AND THE DATA SCIENCE PROCESS 9 Hrs.

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Data Visualization - Basic principles, ideas and tools for data visualization - Examples of exciting projects- Data Visualization using Tableau

UNIT4 MACHINE LEARNING TOOLS, TECHNIQUES AND APPLICATIONS 9 Hrs.

Supervised Learning, Unsupervised Learning, Reinforcement Learning, Dimensionality Reduction, Principal Component Analysis, Classification and Regression models, Tree and Bayesian network models, Neural Networks, Testing, Evaluation and Validation of Models

UNIT5 INTRODUCTION TO PYTHON 9Hrs.

Data structures-Functions-Numpy-Matplotlib-Pandas- problems based on computational complexity-Simple case studies based on python (Binary search, common elements in list), Hash tables, Dictionary

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Explain the basic terms of Linear Algebra and Statistical Inference
CO2: Describe the Data Science process and how its components interact
CO3: Apply EDA and the Data Science process in a case study
CO4: Classify Data Science problems
CO5: Analyse and correlate the results to the solutions
CO6: Simulate Data Visualization in exciting projects

TEXT / REFERENCE BOOKS

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Introduction To Linear Algebra - By Gilbert Strang, Wellesley-Cambridge Press, Fifth Edition.2016.
3. Applied Statistics And Probability For Engineers – By Douglas Montgomery.2016.
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

5. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.
6. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. ISBN 0123814790. 2011.
7. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3017	WIRELESS SENSOR NETWORK AND ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To Learn basics of Sensor and Network technology
- Learn key routing protocols for sensor networks and main design issues
- Learn transport layer protocols for sensor networks, and design requirements
- Understand the medium access control protocols and address physical layer issues
- To learn the security features in WSN.

UNIT 1 INTRODUCTION AND OVERVIEW OF WIRELESS SENSOR NETWORKS 9Hrs.

Introduction, Brief Historical Survey of Sensor Networks, and Background of Sensor Network Technology, Ah-Hoc Networks, Applications of Wireless Sensor Networks: Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Another Taxonomy of WSN Technology, Basic Sensor Network Architectural Elements, Home Control, Medical Applications.

UNIT 2 ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9 Hrs.

Designing issues, classification of routing protocols, table driven routing protocols, on demand routing protocol, Hybrid routing protocol, Hierarchical routing protocols. Multicast routing in Ad Hoc wireless networks: Operations and classification of multicast routing protocols, Tree based multicast routing protocol, Mesh based multicast routing protocol.

UNIT 3 SYSTEM ARCHITECTURE AND DESIGN ISSUES 9Hrs.

Design Constraints for Routing in Wireless Sensor Networks, Classification of Routing Protocols in Wireless Sensor Networks-Hierarchy Role of Nodes in the Network, Data Delivery Model, Optimization Techniques for Routing in Wireless Sensor Networks, Application of the Optimization Techniques: Routing Protocols.

UNIT 4 ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORKS 9 Hrs.

Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion, Geographical Routing.

UNIT 5 TRANSPORT LAYER SECURITY PROTOCOLS FOR AD HOC WIRELESS NETWORK 9 Hrs.

Designing issues, classification of transport layer solutions, feedback based TCP, TCP bus, Ad Hoc TCP, Security in Ad hoc wireless networks, Issues and challenges in security provisioning, Key management, Secure routing in Ad hoc wireless networks. Quality of Service: Issues and challenges in providing QoS in Ad Hoc wireless networks, classification of QoS solutions

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An Ability to understand the concepts of sensors.
CO2: An Ability to analyse modelling and simulation of various communication networks.
CO3: Demonstrate knowledge of MAC protocols developed for WSN.
CO4: Demonstrate knowledge of routing protocols developed for WSN.
CO5: Understand and explain mobile data-centric networking principles
CO6: An Ability to understand the security features in WSN

TEXT/REFERENCE BOOKS

1. Ibrahiem M.M. El Emary, Ramakrishnan.S, “Wireless Sensor Networks From Theory to Applications”, CRC Press, 2013.
2. Fei Hu, Xiaojun Cao, “Wireless Sensor Networks Principles and Practice”, CRC Press, 2010.
3. Mounir Frikha, “ Ad hoc Networks Routing, Qos and Optimization”, Wiley, 2011.
4. Raheem, Beyah, Janise McNair, Cherita Corbett, Security in Ad hoc and Sensor Networks”, World Scientific, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA1601	MOBILE APPLICATION DEVELOPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop applications for current and emerging mobile computing devices, performing tasks at all stages of the software development life-cycle.
- To learn how to utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- To understand the programming languages and platform for developing mobile applications.
- To design, implement and deploy mobile applications using an appropriate software development environment.
- To upload the developed application into the website.

UNIT 1 INTRODUCTION TO ANDROID 9 Hrs.

Introduction to mobile technologies, mobile operation systems, Mobile devices - pros and cons, Introduction to Android, Versions, Features, Architecture, UI Widgets and Events handling, Layouts, Required tools - Eclipse, ADT, AVD, Application structure, Android Manifest file, Creating Android applications.

UNIT 2 BUILDING BLOCKS AND DATABASES 9 Hrs.

Introduction to Activities and Intents - Understanding Activity life cycle, Linking Activities, Passing Data, Toast, Displaying a Dialog Window and Notifications. Content Provider, Services, Broadcast receivers, accessing databases, Location and sensors, Multimedia audio, video and camera, Deploying and publishing application.

UNIT 3 OBJECTIVE C PROGRAMMING 9 Hrs.

Objective C - Objects and Classes, Property, Messaging, Categories and Extensions, Fast Enumeration - NSArray, NSDictionary, Methods and Selectors, Static & Dynamic objects, Exception handling, Memory management, Swift language essentials: Arrays, Dictionaries, functions.

UNIT 4 INTRODUCTION TO iOS 9 Hrs.

Introduction to iPhone, MVC Architecture, View Controller - Building the UI and Event handling, Application life cycle, Tab Bars, Story Boards and Navigation Controllers, Table View, Push Notification, Database handling, Introduction to icloud, Webkit framework in iOS8, Deploying and publishing application.

UNIT 5 WINDOWS MOBILE APP DEVELOPMENT 9 Hrs.

Introduction to Windows Phone 8, Application Life cycle, UI Designing and events, Building, Files and Storage, Network Communication, Push Notification, Background Agents, Maps and Locations, Data Access and storage, Introduction to Silverlight and XAML, Data Binding, Deploying and Publishing.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Learn and understand the technology and business trends impacting mobile applications.
CO2: Understand and remember the components of android, iOS and Windows mobile applications.
CO3: Learn the programming languages and techniques for developing mobile applications.
CO4: Design the mobile application by using Eclipse with ADT / Android Studio, Objective-C and Swift.
CO5: Develop mobile application with compelling user interface and database connectivity for real time applications.
CO6: Deploy mobile applications using an appropriate software development and finally, upload the developed App it into the web.

TEXT / REFERENCE BOOKS

1. Reto Meier, “Professional Android Application Development”, Wrox Edition.
2. http://www.tutorialspoint.com/android/index.htm
3. http://developer.android.com/training/index.html
4. Stephen G. Kochan, “Programming in Objective C”, Addition Wesley, 4th Edition.
5. David Mark, Jack Nutting and Jeff LaMarche, “Beginning iOS 5 Development”, Apress Edition.
6. Baijian Yang, Pei Zheng, Lionel M. Ni, “Professional Microsoft Smartphone Programming”, Wrox Edition.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SEIA3006	ROBOTICS AND AUTOMATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce basic concepts of various dynamics processes
- To educate on the effect of various power sources and sensors.
- To impart knowledge on the manipulators , grippers and robot dynamics

UNIT 1 BASIC CONCEPTS 9 Hrs.

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for Automation - types of automation - fixed, programmable and flexible automation.

UNIT 2 POWER SOURCES AND SENSORS 9 Hrs.

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic, fiber optic and tactile sensors.

UNIT 3 MANIPULATORS, ACTUATORS, GRIPPERS and ROBOT DYNAMICS 9 Hrs.

Construction of manipulators - manipulator dynamics and force control - electronic and pneumatic manipulator control circuits - end effectors - various types of grippers - design considerations. Introduction to Robot Dynamics - Lagrange formulation - Newton Euler formulation - Properties of robot dynamic equations.

UNIT 4 KINEMATICS AND PATH PLANNING 9 Hrs.

Forward Kinematics – Denavit Hartenberg Representation. multiple solution jacobian work envelop, Inverse Kinematics - Geometric approach. Hill climbing techniques.

UNIT 5 PROGRAMMING LANGUAGES AND APPLICATIONS 9 Hrs.

Robot programming - Fixed instruction, sequence control, General programming language, Specific programming languages.Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non-manufacturing applications - Robots for nuclear and chemical plants.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- **CO1:** Understand the concepts of Robotics.
- **CO2:** Define the laws of robotics and identify the types.
- **CO3:** Classify the different types of sensors and summarize the techniques of image processing
- **CO4:** Choose the type of gripper as per requirement and explain the dynamics of robots.
- **CO5:** Compare the different kinematic techniques.
- **CO6:** Develop a robot

TEXT / REFERENCE BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996.

2. Ghosh, “Control in Robotics and Automation: Sensor Based Integration”, Allied Publishers, Chennai, 1998.
3. Deb.S.R., “Robotics technology and flexible Automation”, John Wiley, USA 1992.
4. Asfahl C.R., “Robots and Manufacturing Automation”, John Wiley, USA 1992.
5. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering - An integrated approach”, Prentice Hall of India, New Delhi, 1994.
6. McKerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3018	QUANTUM COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the basics of Quantum Computing
- To understand Quantum state transformation and classical computation versions
- To know various Quantum Computation Algorithms.
- To have knowledge on Generalizations and advanced quantum computation algorithms
- To be proficient on the concepts of robust computation and error correction

UNIT 1 QUANTUM BUILDING BLOCKS-I **9 Hrs.**

Introduction - Single Qubit Quantum Systems - Multiple Qubit Systems.

UNIT 2 QUANTUM BULDING BLOCKS-2 **9 Hrs**.

Measurement of multiple Qubit Systems-Quantum State Transformations-Quantum versions of Classical Computations.

UNIT 3 BASIC ALGEBRA FOR QUANTUM ALGORITHMS. **9 Hrs**.

Introduction-Numbers and Strings-Basic linear algebra-Boolean Functions, Quantum, Bits and Feasibility, Special Matrices, Tricks.

UNIT 4 QUANTUM ALGORITHMS **9 Hrs**.

Phil's algorithm, Deutsch's algorithm, Jozsa Algorithms, Simon's Algorithm, Shor's Algorithms, Grover's Algorithms.

UNIT 5 ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATIONS **9 Hrs**.

Quantum subsystems and properties of entangled states-Quantum error correction-Fault tolerance and Robust

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: An ability to identify, analyse Quantum Building Blocks.
CO2: Know Quantum state transformations.
CO3: Identify the advantages and limitations of some Quantum Computation Algorithms
CO4: Apply advanced quantum computation algorithms
CO5: Proficiency on the concepts of robust computation and error correction
CO6: Analyze error correction mechanisms

TEXT /REFERENCE BOOKS

1. Quantum Computing A Gentle Introduction, Eleanor Rieffel and Wolfgang Polak, The MIT Press Cambridge, Massachusetts London.
2. Quantum Algorithms Via Linear Algebra, Richard J. Lipton, Kenneth W. Regan, The MIT Press Cambridge, Massachusetts London, England, 2014.
3. Quantum Computing Devices: Principles, Designs And Analysis, Goong Chen, David A. Church , Berthold-Georg Englert , Carsten Henkel, Bernd Rohwedder , Marlan O. Scully, M. Suhail Zubairy, Hapman and Hall/CRC

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA3010	NATURAL LANGUAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamentals of natural processing
- To understand the way to measure one or more qualities of an algorithm or a system
- To gain knowledge of the linguistics concerned with the interactions between computers and human.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction and challenges of natural language processing, Phases in natural language processing, An outline of English syntax - Grammars and parsing - Features and Augmented Grammar.

UNIT 2 SYNTACTIC PROCESSING 9 Hrs.

Grammar for natural language - Toward efficient parsing - Ambiguity resolution - Statistical Methods, Feature Structure

UNIT 3 SEMANTIC INTERPRETATION 9Hrs.

Semantic and logical form - Linking syntax and semantics - Ambiguity resolution - Other strategies for semantic interpretation - Scoping for interpretation of noun phrases, Semantic attachments-Word senses, Relations between the senses.

UNIT 4 CONTEXT AND WORLD KNOWLEDGE 9 Hrs.

Knowledge representation and reasoning - Using World Knowledge, Discourse Structure, Local discourse context and reference.

UNIT 5 WORLD KNOWLEDGE AND SPOKEN LANGUAGE 9 Hrs.

Using world knowledge - Discourse structure - Defining conversational agent - An introduction to logic model - Theoretic semantics - Symbolic computation - Speech recognition and spoken Language, Applications: Machine Translation, Information Retrieval.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand NLP problems and survey the literature about that problem
CO2: Understand language modeling
CO3: Describe automated natural language generation and machine translation
CO4: Learn the natural language generation.
CO5: Analyze and compare the use of different statistical approaches for different types of NLP applications.

TEXT / REFERENCE BOOKS

1. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
2. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition,Chapman and Hall/CRC Press, 2010.
3. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**
PART A : 10 Questions of 2 marks each-No choice **20 Marks**
PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3019	PARALLEL SYSTEM PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Parallel computing and Algorithm Design
- To learn the two popular parallel programming paradigms (Message passing and Shared memory).
- To understand major performance issues for parallel systems and programs.
- To reiterate hot topics in research on parallel Programming

UNIT 1 INTRODUCTION TO PARALLEL COMPUTING 9 Hrs.

Motivating Parallelism- Scope of Parallel Computing- The von Neumann architecture- Modifications to the von Neumann Model- Parallel Hardware: SIMD systems- MIMD systems-Interconnection networks- Cache coherence – Shared memory versus distributed memory. Parallel Software: Caveats- Coordinating the processes/threads- Shared-Distributed-memory -Programming hybrid systems.

UNIT 2 PRINCIPLES OF PARALLEL ALGORITHM DESIGN 9 Hrs.

Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations.

UNIT 3 PROGRAMMING USING MESSAGE PASSING 9 Hrs.

Principles of Message-Passing Programming - The Building Blocks: Send and Receive Operations- MPI: the Message Passing Interface -Topologies and Embedding Section - Overlapping Communication with Computation - Collective Communication and Computation Operations - Groups and Communicators.

UNIT 4 PROGRAMMING USING SHARED MEMORY 9 Hrs.

Shared Memory Programming with Pthreads: Processes, Threads, and Pthreads - Matrix-Vector Multiplication – Critical Sections- Producer-Consumer Synchronization and Semaphores- Barriers and Condition Variables-Read-Write Locks-Caches, Cache Coherence, and False Sharing.

Shared Memory Programming with OpenMP: Compiling and running OpenMP programs-The Trapezoidal Rule-Scope of Variables-The Reduction Clause-The parallel for Directive-Scheduling Loops-Producers and Consumers

UNIT 5 PROGRAMMING PARALLEL PROCESSORS 9 Hrs.

Introduction to CUDA – CUDA Threads – CUDA Memories – Performance and Floating Point Considerations-Parallel Programming and Computational Thinking- Introduction to OPENCL.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Recognize various parallel computing requirement

CO2: Describe the basic concepts of Shared Memory and Message Passing

CO3: Design solutions for Parallel Processor based Architecture

CO4: Analyse a problem, design a solution, and test their implementation

CO5: Design and implement large scale machine as well as applications

CO6: Implement parallel computing to a variety of applications in Mathematics and Engineering

TEXT / REFERENCE BOOKS

1. Ananth Grama and George Karypis, “Introduction to parallel computing”, Addison-Wesley 2009.
2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SCSA3020	AUGMENTED AND VIRTUAL REALITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To make students know the basic concept and framework of virtual reality.
- To teach students the principles and multidisciplinary features of virtual reality.
- To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
- To teach students the technology for managing large scale VR environment in real time.
- To provide students with an introduction to the VR system framework and development tools.

UNIT 1 INTRODUCTION OF VIRTUAL REALITY 9 Hrs.

Fundamental Concept and Components of Virtual Reality- Primary Features and Present Development on Virtual Reality - VR systems - VR as a discipline-Basic features of VR systems-Architecture of VR systems-VR hardware -VR input hardware: tracking systems, motion capture systems, data gloves-VR output hardware: visual displays.

UNIT 2 I/O INTERFACE & TECHNIQUES IN VR 9 Hrs.

Multiple Modals of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual / Auditory / Haptic Devices. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT 3 VISUAL COMPUTATION IN VIRTUAL REALITY 9 Hrs.

Fundamentals of Computer Graphics-Software and Hardware Technology on Stereoscopic Display-Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering -Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtoolsetc

UNIT 4 INTRODUCTION OF AUGMENTED REALITY 9 Hrs.

System Structure of Augmented Reality-Key Technology in AR-- AR software development - AR software. Camera parameters and camera calibration. Marker-based augmented reality. Pattern recognition. AR Toolkit

UNIT 5 APPLICATION OF VR IN DIGITAL ENTERTAINMENT 9 Hrs.

VR Technology in Film & TV Production.VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.3D user interfaces - Why 3D user interfaces. Major user tasks in VE. Interaction techniques for selection, manipulation and navigation.3DUI evaluation.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1: Design and implement the VR system.
CO2: Implement the Augmented Reality software.
CO3: Analyze and design the framework in VR using various software development tools in VR.
CO4: Design the multi modal user interface.
CO5: Describe the principles and features of VR and AR.
CO6: Recognize the technologies used to manage the large scale VR environment in real time.

TEXT / REFERENCE BOOKS

1. Sherman, William R. and Alan B. Craig. Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
2. Fei GAO. Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
3. Guangran LIU. Virtual Reality Technology, Tsinghua Press, Jan. 2011.
4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SITA3011	BLOCK CHAIN TECHNOLOGIES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce Bit coin and other crypto currencies.
- To study the algorithms and techniques in block chain.
- To understand the practical aspects in the design of crypto currency
- To understand the function of Block chains as a method of securing distributed ledgers.
- To design, code, deploy and execute a smart contract.

UNIT 1 INTRODUCTION TO BLOCKCHAIN 9 Hrs.

Basics of blockchain-Public Ledgers-Block Chain as Public Ledgers-Types of Block chains- Pillars of Block chain-Government Initiatives of BlockChain-Bitcoin-SmartContracts

UNIT 2 ARCHITECTURE AND CONCEPTUALIZATION OF BLOCK CHAIN, CRYPTO CURRENCIES 9 Hrs.

Block in a Block chain-find Transactions-Distributed Consensus-Proof of work, Stake, Space-Attacks on POW-Ethereum-Pos/POW Hybrids-Crypto currency to block chain 2.0, Model of Blockchain-Algorand

UNIT 3 CRYPTO PRIMITIVES, SECURING AND INTERCONNECTING PUBLIC AND PRIVATE BLOCK CHAINS 9 Hrs.

Hash Function and Merle Tree-Security Properties-Security Considerations for block chain-Digital Signature-Public Key Cryptography-Bit coinblock chain incentive structures- Nash Equilibriums- evolutionary stable strategies,-and Pareto¬ efficiency (game theory) Weaknesses and news Points of Failure¬ Mitigation Methods¬ Redundancies and fall-back methods

UNIT 4 MINING AND CRYPTO CURRENCIES - HOW TO USE AND INTERACT 9 Hrs.

Mining-Pools-Impact of CPU and GPU-Transaction in Bit coin Network- Block Mining-Block propagation and block relay

UNIT 5 USE CASES-APPLICATIONS IN DIFFERENT AREAS 9 Hrs.

Industry applications of Blockchain-Blockchain in Government-Government use cases-Preventing Cybercrime through block chain-Block Chain in defense, tax payments

COURSE OUTCOMES :

On completion of the course the student will be able to

CO1: Explain the structure of a block chain.
CO2 : Analyze the incentive structure in a block chain based system.
CO3 : Judge the scenario where "smart" contract is most appropriate.
CO4 : Identify Basic knowledge of Bitcoin, Ethereum.
CO5 : Apply Blockchain in future use cases for security.
CO6 : Understand the various Block Chain applications.

TEXT / REFERENCE BOOKS :

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos O'Reilly, First Edition, 2014.
2. Blockchain by Melanie Swa, O'Reilly Media 2015
3. Zero to Block chain - An IBM Redbooks course, by Bob Dill, David Smits -

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. marks:100 Exam Duration:3 Hrs.
Part A: 10 question of 2 marks each – No choice 20 marks
Part B: 2 questions from each unit of internal choice, each carrying 16 marks 80 marks

SCSA3021	COMPUTATIONAL COMPLEXITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the notions in computational complexity theory and the importance of complexity classes.
- To understand the modes of computations such as deterministic, non-deterministic, parallel, randomized and alternating.
- To understand the NP and NP completeness and Turing Problems.
- To analyze the computational complexity.
- To introduce the applications of complexity theory to cryptography.

UNIT 1 INTRODUCTION 9Hrs.

Basic Complexity Classes: Class P, Class NP – Computational Model – Turing Machines NP and NP Completeness: Cook-Levin Theorem – coNP – EXP – NEXP – NP Diagonalization: Time Hierarchy Theorem – Space Hierarchy Theorem – Nondeterministic Time Hierarchy Theorem – Ladners Theorem.

UNIT 2 SPACE COMPLEXITY, POLYNOMIAL HIERARCHY AND CIRCUITS 9Hrs.

Space Complexity: PSPACE Completeness – NL Completeness.Polynomial Hierarchy and Alternations: Properties of Polynomial Hierarchy – Complete Problems for levels of PH – Alternating Turing Machines – Time Versus Alternations.
Circuits: Boolean Circuits – Karp Lipton Theorem – Circuit Lower Bounds – Non-uniform hierarchy theorem – Parallel Computation and NC – P-Completeness – Circuits of Exponential Size.

UNIT 3 RANDOMIZED COMPUTATION 9Hrs.

Randomized Computation – Probabilistic Turing Machines – Probabilistic Primality Testing – Polynomial Identity Testing – Perfect Match in a Bipartite Graph – One Sided and Zero-sided Error – Randomness Efficient Error Reduction – Randomized Reductions – Randomized Space Bounded Computation.

UNIT 4 IP, CRYPTOGRAPHY AND DECISION TREES 9Hrs.

Interactive Proofs: The Class IP - Public Coins and AM – IP, PSPACE – Multiprover Interactive Proofs Complexity of Counting: Class #P - #P Completeness – Todas Theorem.
Cryptography: One way functions and pseudorandom random generators – Applications.
Decision Trees: Randomized Decision Theory – Lower bounds on Randomized Complexity – Comparison Trees and Sorting Lower bounds – Yao's MinMax Lemma.

UNIT 5 DECISION TREES, COMPUTATION COMPLEXITY AND LOWER BOUNDS 9Hrs.

Computation Complexity – Lower Bound Methods – Multiparty Communication Complexity – Probabilistic Communication Complexity.
Circuit Lower Bounds – Circuits with Counters – Lower bounds for monotone circuits – Circuit complexity, Algebraic Computation Models – Algebraic circuits – Algebraic Computation Trees – Blum-Shub-Smale Model – Complexity Classes over the Complex Numbers - Hilbert's Nullstellensatz.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: To formulate computational models with resource constraints, and to describe relationships between these models.
CO2: To analyse computational problems from a complexity perspective.
CO3: To apply mathematical skills and knowledge from the historic data to concrete problems in computational complexity.
CO4: The importance of P, NP, Space and complexity classes
CO5: Concept of interactive proofs in optimization problems.
CO6: To analysis various space complexity.

TEXT / REFERENCE BOOKS

1. Sanjeev Arora and Boaz Barak, Computational Complexity: A ModernApproach, Cambridge University Press, Edition I, 2009
2. O. Goldreich. Computational complexity: a conceptual perspective. Cambridge University Press, 2008
3. O. Goldreich. P, NP, and NP-completeness. Cambridge University Press, 2010.
4. Christos H. Papadimitriou, Computational complexity. Addison-Wesley, 1994.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**

		L	T	P	Credits	Total Marks
SCSA3022	FAULT TOLERANCE SYSTEM	3	0	0	3	100

COURSE OBJECTIVES

- To become familiar with general and state of the art techniques in fault tolerance system
- To learn the design and analysis of fault-tolerant digital systems.
- Study and investigate existing fault-tolerant systems.
- To Learn both Hardware and software methods
- To Learn new research topics in the fault tolerance system

UNIT 1 DEPENDABILITY CONCEPTS AND FAULT TOLERANT STRATEGIES 9Hrs.

Dependable system, techniques for achieving dependability, dependability measures, fault, error, failure, faults and their manifestation, classification of faults and failures. Fault detection, masking, containment, location, reconfiguration, and recovery. Fault tolerant design techniques and Testing: Hardware redundancy, software redundancy, time redundancy, and information redundancy. Testing and Design for Testability

UNIT 2 INFORMATION REDUNDANCY AND FAULT TOLERANCE IN DISTRIBUTED SYSTEMS 9Hrs.

Coding techniques, error detection and correction codes, burst error detection and correction, unidirectional codes, Byzantine General Problem, consensus protocols, check pointing and recovery, stable stoage and RAID architectures, and data replication and resiliency.

UNIT 3 DEPENDABILITY EVALUATION TECHNIQUES AND TOOLS 9Hrs.

Fault trees, Markov chains; HIMAP tool. Analysis of fault tolerant hardware and software architectures. System-level fault tolerance and low overhead high-availability technique

UNIT 4 FAULT TOLERANCE IN REAL-TIME SYSTEMS 9Hrs.

Time-space tradeoff, fault tolerant scheduling algorithms, Dependable communication: Dependable channels, survivable networks, fault-tolerant routing.

UNIT 5 FAULT TOLERANT INTERCONNECTION NETWORKS 9Hrs.

Hpercube, star graphs, and fault tolerant ATM switches. Case studies of fault tolerant multiprocessor and distributed systems.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: To became familiar with general and state of the art techniques in fault tolerance system
CO2: To design and analysis of fault-tolerant digital systems.
CO3: To investigate existing fault-tolerant systems.
CO4: To Understand both Hardware and software methods
CO5: To develop new research topics in the fault tolerance system

TEXT/REFERENCE BOOKS

1. Avizienis and J. Laprie, ``Dependable Computing: From Concepts to Design Diversity," Proc. IEEE, vol.74, no.5, pp.629-638.

2. A.K. Somani and N.H. Vaidya, ``Understanding fault-tolerance and reliability,'' IEEE Computer, vol.30, no.4, pp.45-50.

3. M. Pease, R.Shostak, and L. Lamport, ``Reaching Agreement in the Presence of Faults,'' M. Pease, R.Shostak, and L. Lamport, Journal of ACM, #27 (180), pp.228-234.

4. The Byzantine Generals Problem, ACM Trans. Prog. Languages and Systems, 4(1982) pp. 382-401.

5. S. Ghosh, R. Melhem, and D. Mosse, ``Fault-tolerance through scheduling of aperiodic tasks in hard real-time multiprocessor systems,'' IEEE Trans. Parallel and Distributed Systems, vol.8, no.3, pp.272-284.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100 **Exam Duration : 3 Hrs.**

PART A : 10 Questions of 2 marks each-No choice **20 Marks**

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks **80 Marks**