B.S. Abdur Rahman ™
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2022
Curriculum and Syllabi
(As approved by the 20th Academic Council)
April - 2023

M.Tech.
(Information Technology)

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REGULATIONS 2022

CURRICULUM AND SYLLABI

(As approved by the 20th Academic Council)

APRIL – 2023

M.TECH. INFORMATION TECHNOLOGY

VISION AND MISSION OF THE INSTITUTION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION AND MISSION

VISION

To be a leader in providing quality education and training in the field of Information Technology at Undergraduate and Postgraduate levels and undertake Research activities thereby contributing to the progress of the country.

MISSION

- To impart quality education and inculcate professionalism to suit the needs of the industries and society.
- To involve graduates in undertaking need based research activities and disseminate the knowledge to develop entrepreneurial skills.
- To improve the professionalism through extension activities, industrial visits and in-plant training.
- To improve communicate effectively both in documentation and presentation.
- To create awareness of social, economic responsibilities ethically.

PROGRAMME EDUCATIONAL OBJECTIVES

The students will,

PEO1: Focus efficiently on need-based research in different domains related to Information Technology and carry out research projects of national and social relevance

PEO2: Identify problems and solve them using IT tools and techniques to meet the industry/ societal needs for the sustainable development

PEO3: Communicate effectively, exhibit team spirit, and leadership skills required for a successful professional career

PEO4: Demonstrate professional ethics, independent and life-long learning skills

PROGRAMME OUTCOMES

On completion of the programme, students will be able to:

PO1: Analyse, design, test, and implement software systems required for the IT industry

PO2: Apply relevant tools and techniques to solve software problems and undertake research activities

PO3: Prepare necessary software documentation and present with effective communication skills

PO4: Manage, organize and lead a team of highly competent Information technologists

PO5: Practice professional ethics and learn independently throughout life to contribute for society and sustainable development

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI – 600 048.

REGULATIONS 2022

M.Tech. / MCA / M.Sc. / M.Com. / M.A. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means post graduate degree programme (M.Tech. / MCA / M.Sc. / M.Com. / M.A.)

ii) **"Branch"** means specialization or discipline of programme like M.Tech. in Structural Engineering, Food Biotechnology etc., M.Sc. in Physics, Chemistry, Actuarial Science, Biotechnology etc.

iii) **"Course"** means a theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	
M.A.	

2.2 ADMISSION REQUIREMENTS

2.2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination as specified in the clause 3.2 [Eligible entry qualifications for admission to programmes] of this Institution or any other University or authority accepted by this Institution.

2.2.2 The other conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

3.1. The minimum and maximum period for completion of the programmesare given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA	4	8
M.Sc.	4	8
M.Com.	4	8
M.A.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester end examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
1.	Aeronautical Engineering	M.Tech. (Avionics)	B.E. / B.Tech. in Aeronautical Engineering / Aerospace Engineering / Mechanical Engineering / Mechatronics / EEE / ECE / EIE / or Equivalent degree in relevant field.
2.	Civil Engineering	M.Tech. (Structural Engineering)	B.E. / B.Tech. in Civil Engineering / Structural Engineering or Equivalent degree in relevant field.
		M. Tech. (Construction Engineering and Project Management)	B.E. / B.Tech. in Civil Engineering / Structural Engineering / B.Arch. or Equivalent degree in relevant field.
3.	Mechanical Engineering	M.Tech. (CAD/CAM)	B.E. / B.Tech. in Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Polymer / Plastics / Marine Engineering or Equivalent degree in relevant field.
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engineering)	B.E. / B.Tech. in EEE / ECE / EIE / ICE / Electronics / Instrumentation Engineering or Equivalent degree in relevant field.
5.	Electronics and Communication Engineering	M.Tech. (VLSI and Embedded Systems)	B.E. / B.Tech. in ECE / EIE / ICE / EEE / IT or Equivalent degree in relevant field.
6.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
7.	Information Technology	M.Tech. (Information Technology)	B.E. / B.Tech. in IT / CSE / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
8.	Computer Applications	MCA	BCA / B.Sc. Computer Science / B.E. / B.Tech. / B.Sc. Mathematics, B.Sc. Physics / Chemistry / B.Com. / BBA / B.A. with Mathematics at graduation level or at 10 + 2level or equivalent degree in relevant field.
9.	Mathematics	M.Sc. (Actuarial Science)	Any under graduate degree with Mathematics / Statistics as one of the subjects of study at 10 + 2 level.
10.	Physics	M.Sc.(Physics)	B.Sc. in Physics / Applied Science / Electronics /Electronics Science / Electronics & Instrumentation or Equivalent degree in relevant field.
11.	Chemistry	M.Sc.(Chemistry)	B.Sc. in Chemistry / Applied Science or Equivalent degree in relevant field.
12.	Life Sciences	M.Sc. Biochemistry & Molecular Biology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Biotechnology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Microbiology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Tech. Biotechnology	B.Tech. / B.E. in Biotechnology or Equivalent degree in relevant field.
		M.Tech. Food Biotechnology	B.E. / B.Tech. in Biotechnology / Food Biotechnology / Chemical Engineering / Biochemical Engineering / Industrial Biotechnology or Equivalent degree in relevant field.
13.	Commerce	M.Com	B.Com. / BBA
14.	Arabic and Islamic	M.A. Islamic Studies	B.A. in Islamic Studies / Arabic (or) Afzal-ul-Ulama (or)

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
	Studies		Any under graduate degree with Part 1 Arabic (or) Any under graduate degree with AalimSanad / Diploma / Certificate in Arabic or Islamic Studies.

3.3.STRUCTURE OF THE PROGRAMME

3.3.1 The PG. programmes consist of the following components as prescribed in the respective curriculum:

i. Core courses
ii. Elective courses
iii. Laboratory integrated theory courses
iv. Project work
v. Laboratory courses
vi. Open elective courses
vii. Seminar
viii. Mini Project
ix. Industry Internship
x. MOOC courses (NPTEL-Swayam, Coursera etc.)
xi. Value added courses

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total creditsspecified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum ofprogrammes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	76 -80
MCA	86
M.Sc.	77 - 85
M.Com.	88
M.A.	72

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- ❖ Onecredit for one lecture period per week or 15 periods of lecture per semester.
- ❖ One credit for one tutorial period per week or 15 periods per semester.
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester.
- ❖ One credit for 160 hours of industry internship per semester for all programmes (except M.Com.)
- ❖ Four credits for 160 hours of industry internship per semester for M.Com.

3.3.6 The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 32	18 to 26
MCA	9 to 32	18 to 26
M.Sc.	9 to 32	10 to 26
M.Com.	9 to 32	16 to 28
M.A.	9 to 32	NA

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization ofprogramme, the student can choose a maximum of two electives from any other similar programmes across departments, aliter to open electives, during the entire period of study, with approval of Head of the department offering the course and parent department.

3.4. ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester (in case of M.Tech. M.Sc.

& MCA programmes) with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the project supervisor.

3.5 PROJECT WORK

3.5.1 Project work shall be carried out by the student under thesupervision of a faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist / Competent authority from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last instructional day of the semester in which project is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work and shall re-register in the subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the class throughout their period of study.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

5.0 COURSE COMMITTEE

5.1 Each common theory / laboratory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

6.0 CLASS COMMITTEE

6.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

6.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department
ii) Faculty members of all courses of the semester
iii) All the students of the class
iv) Faculty advisor and class advisor
v) Head of the Department – Ex officio member

6.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessmentshall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

6.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi of courses.

6.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

7.0 REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

7.2 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can enroll for a maximum of 32 credits during asemester including Redo / Predo courses.

8.0 BREAK OF STUDY FROM PROGRAMME

8.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

8.1.1 Medical or other valid grounds

8.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

8.1.3 Debarred due to any act of indiscipline

8.2 The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

8.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

8.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT WORK

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA	22
M.Sc.	18
M.Com	NA
M.A.	NA

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the

extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded “I” grade in that course.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

10.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

10.4 A student who has obtained an “I” grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat all the courses of the semester in the subsequent academic year. However, he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous

semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.5 The student awarded "I" grade, shall enroll and repeat the course when it is offered next. In case of "I" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

10.6 A student who is awarded "U" grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

10.7 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the departmentconcerned, based on the availability of faculty members, and subject to a specified minimum number of students registering for each of such courses.

11.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However, a student shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

12.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by the Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the viva voce examination.

12.8 The assessment of seminar course including its component and its weightage shall be decided by a committee of faculty members constituted by the Head of the Department. This committee shall ensure the conduct of assessment of componentsand award marks accordingly.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab components.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However, there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However, the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise, students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semesters.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall preferably meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10

A	9
B	8
C	7
D	6
E	5
U	0
I	0

"I" denotes inadequate attendance and hence prevented from appearing for semester end examination

"U" denotes unsuccessful performance in the course.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fees tothe Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

"I" grade is excluded for calculating GPA.

"U" and**"I"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

15.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the PG programme within the minimum prescribed period of study (except clause 8.1.1)

15.6.2 Eligibility for First Class

A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 8.1.1)

15.6.3 The students who do not satisfy clause 15.6.1 and clause 15.6.2 shall be classified as second class.

15.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

16.0 DISCIPLINE

16.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTER'S DEGREE

17.1 A student shall be declared to be eligible for the award of the Master's Degree, if he/she has:

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
ii. No disciplinary action is pending against him/her.
iii. Enrolled and completed at least one value added course.
iv. Enrollmentin at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.

M.TECH. INFORMATION TECHNOLOGY
CURRICULUM&SYLLABUS, REGULATIONS2022

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MAE 6181	Applied Algebra and Discrete Algorithms	3	1	0	4
2.	ITE 6101	Advanced Data Structures	3	0	2	4
3.	ITE 6102	Software Development Methodologies	3	0	0	3
4.	CSE 6101	Multicore Computer Architecture	3	0	0	3
5.	CSE 6103	Advanced Computer Networks	3	0	0	3
6.		Professional Elective	3	0	0	3
7.	ITE 6103	Software Development and Testing Laboratory	0	0	2	1
8.	ENE 6181	English for Career Development	1	1	0	2
		Credits				**23**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	GEE 6201	Research Methodology and IPR	2	0	0	2
2.	ITE 6201	Cloud Computing Technology	3	1	0	4
3.	ITE 6202	Machine Learning Algorithms	3	0	0	3
4.	ITE 6203	Machine Learning Laboratory	0	0	2	1
5.	ITE 6204	Cloud Middleware Tools Laboratory	0	0	2	1
6.		Professional Electives				9
7.		Value Added Course				-
		Credits				**20**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Open Elective	3	0	0	3
2.		Professional Electives				6
3.	ITE 7101	Internship#				2
4.	ITE 7102	Project - Phase I				6**
5.		MOOC (Related to Project)				-
		Credits				**11**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1.	ITE 7102	Project Work - Phase II	0	0	36	18
		Credits	6 + 18 = **24**			

Overall Total Credits - 78

Industrial training will be undertaken during first year summer vacation for 30 days. The credit will be awarded in the 3rd Semester.

** Credits for project work phase I in III semester to be accounted along with project work phase II in IV semester

LIST OF PROFESSIONAL ELECTIVE COURSES

SEMESTER I

Sl. No.	Course Code	Course Name	L	T	P	C
1.	ITEY 101	Computer Forensics and Information Security	3	0	0	3
2.	ITEY 102	Multimedia Technology and Applications	3	0	0	3
3.	ITEY 103	High Performance Networks	3	0	0	3
4.	ITEY 104	Internetworking with TCP/IP	3	0	0	3

SEMESTER II

Sl. No.	Course Code	Course Name	L	T	P	C
1.	ITEY 201	Multicore Architectures	3	0	0	3
2.	ITEY 202	Social Network Analysis	3	0	0	3
3.	ITEY 203	Distributed Operating Systems	3	0	0	3
4.	ITEY 204	Applied Cryptography	3	0	0	3
5.	ITEY 205	Cloud Services	3	0	0	3
6.	ITEY 206	Cloud Security	3	0	0	3
7.	ITEY 207	Web Design and Management	3	0	0	3
8.	ITEY 208	Information Visualization Techniques	3	0	0	3
9.	ITEY 209	Agile Software Development	3	0	0	3
10.	ITEY 210	DevOps	3	0	0	3
11.	ITEY 211	Computer Vision	3	0	0	3
12.	ITEY 212	Image and Video Analytics	3	0	0	3
13.	ITEY 213	Mathematical Foundations for Data Science	3	0	0	3

SEMESTER III

Sl. No.	Course Code	Course Name	L	T	P	C
1.	ITEY 111	Deep Learning	3	0	0	3
2.	ITEY 112	Wireless and Mobile Communication	3	0	0	3
3.	ITEY 113	Text, Web and Social Media Analytics	3	0	0	3
4.	ITEY 114	Ontology and Semantic Web	3	0	0	3
5.	ITEY 115	Software Project Management	3	0	0	3
6.	ITEY 116	Data Science and Analytics	3	0	0	3
7.	ITEY 117	Green Computing Technology	3	0	0	3
8.	ITEY 118	Block chain Architecture and Use Cases	3	0	0	3
9.	ITEY 119	Analytics of Things	3	0	0	3

LIST OF OPEN ELECTIVE COURSES – III SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department / School
1.	OEEY 701	Analytical Techniques	3	0	0	3	Chemistry
2.	OEEY 702	Artificial Intelligence and IoT	3	0	0	3	CSE
3.	OEEY 703	Biomaterials	3	0	0	3	Physics
4.	OEEY 704	Biomedical Instrumentation	3	0	0	3	Physics
5.	OEEY 705	Biophotonics	3	0	0	3	Physics
6.	OEEY 706	Data Science and Machine Learning	3	0	0	3	IT
7.	OEEY 707	Electric Vehicle and Battery Storage Technology	3	0	0	3	EEE
8.	OEEY 708	Green Building and Energy Management	3	0	0	3	Civil Engineering

9.	OEEY 709	Industry 4.0 and Applications	3	0	0	3	ECE
10.	OEEY 710	Nanotechnology and Catalysis	3	0	0	3	Chemistry
11.	OEEY 711	Project Management	3	0	0	3	Mechanical
12.	OEEY 712	Real Time Embedded Systems	3	0	0	3	ECE
13.	OEEY 713	Robotic Technology	3	0	0	3	Mechanical
14.	OEEY 714	Soft Computing Techniques	3	0	0	3	EEE
15.	OEEY 715	Structural Interpretation of Materials	3	0	0	3	Chemistry

SEMESTER I

		L	T	P	C
MAE 6181	**APPLIED ALGEBRA AND DISCRETE ALGORITHMS**				
SDG: 4		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

The aim of this course is to

COB1: make understand the concepts of mathematical induction and codes.

COB2: motivate to solve the practical engineering problems applying techniques of logic.

COB3: to expose students to the concepts of Formal languages and Automata theory.

COB4: familiarize students with graph theory.

COB5: understand the basic foundation of Cryptography.

MODULE I INTEGERS, COMPUTER ALGEBRA AND CODES 9+3

Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, Octal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

MODULE II LOGIC 9+3

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – Nand, Nor – logic gates - solving word problems - predicate logic - universal and existential quantifiers - proof techniques – direct and indirect – proof by contradiction –applications.

MODULE III MODELING, COMPUTATION AND LANGUAGES 9+3

Finite state machines - deterministic and non-deterministic finite state machines - classes of grammars - phrase structure grammar - context sensitive - context-free - regular grammars - formal languages - ambiguity - Turing machines.

MODULE IV GRAPH THEORY 9+3

Multigraphs - applications of graph theory - classes of graphs - subgraphs and morphisms - Hamilton circuits – planar graphs – shortest paths and spanning trees – minimum spanning tree – fundamental cut sets and fundamental circuits – applications.

MODULE V CIPHERS **9+3**

Cryptography - cryptanalysis - substitution and permutation ciphers – block cipher – the play fair cipher – hill cipher - unbreakable ciphers – applications.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Darel W. Hardy, Fred Richman, Carol L. Walker,"**Applied Algebra: Codes, Ciphers, and Discrete Algorithms", 2nd edition,** CRC Press, Newyork, 2009.
2. Hopcraft, J. E, R. Motwani and Ullman, J. D, "Introduction to Automata theory, Languages and Computation", Narosa publishing House, 4th edition 2006.
3. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2015.
4. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.

REFERENCES:

1. JurajHromkovic, Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication and Cryptography, Springer, 2003.
2. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers and Discrete Algorithms, Second Edition (Discrete Mathematics and Its Applications), CRC Press, Newyork, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, Edition 3,1993.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: authenticate the correctness of the given statement using mathematical induction.

CO2: test and analyze the logic of a program.

CO3: use the concept of finite state machines in their courses and to generate languages.

CO4: solve problems in engineering using the concepts of graph theory.

CO5: apply encryption and decryption techniques to send messages securely.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1					H										
CO2							L								
CO3													M		
CO4								L							
CO5					M										

SDG 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of Applied Algebra And Discrete Algorithms will lead to knowledge of applications in Computer Science and Information Technology Engineering.

ITE 6101	ADVANCED DATA STRUCTURES	L	T	P	C
SDG: 8		3	0	2	4

COURSE OBJECTIVES:

The students have to:

COB1:understand the concept of data structures through abstract data structures including lists, stacks, queues, trees, and graphs.

COB2:understand the concepts of trees and apply the same for applications.

COB3: know the importance of hashing and priority queues for data storage and retrieval.

COB4:solve problems using different sorting, searching and graph algorithms.

COB5:understand the concepts of NP hard and NP completeness.

MODULE I ABSTRACT DATA TYPES **9**

Introduction-The List ADT – Implementation of Lists- Applications of List- The Stack ADT –Stack Model-Implementation of Stacks-Applications of Stack– The Queue ADT – Queue Model-Implementation of Queues– Applications of Queue- Time complexity - Case study for List and Queue ADT.

MODULE II TREES **9**

Preliminaries – Binary Trees – Expression Trees - Tree Traversals - Binary Search Trees – Average case analysis- AVL Trees – Splay Trees – Top-Down Splay Tree- BTrees – Red-Black Trees -Traps – Application of trees.

MODULE III HASHING AND HEAPS **9**

General idea of Hashing – Hash function – Separate Chaining – Hash Tables without Linked lists – Rehashing - Binary Heap – Applications of Priority Queues – d-Heaps.

MODULE IV SORTING AND THE DISJOINT SET CLASS **9**

Insertion Sort – Shell Sort – worst case analysis of shell sort- Heap Sort - analysis– Merge Sort – analysis - Quick Sort – Analysis- External Sort- The Disjoint Sets Class – Equivalence Relations – The Dynamic Equivalence Problem – Basic Data Structure – Path Compression.

MODULE V GRAPH ALGORITHMS 9

Definitions-Representation of Graphs – Topological Sort – Shortest Path Algorithms – Network Flow Problems – Minimum Spanning Tree – Applications of Depth-First Search-Introduction to NP-Completeness-The Class NP-NP-Complete Problems- Dynamic Programming – Bellman – Ford, Greedy Algorithms

PRACTICALS

List of Experiments

1. Implementation of List, Stack, Queue ADTs using array.
2. Implementation of Singly Linked List.
3. Implementation of Stack & Queue ADT using Linked List.
4. Implementation of binary search trees.
5. Implementation of AVL trees.
6. Implementation of Hashing.
7. Implementation of Sorting Techniques.
8. Implementation of Dijkstra's Shortest Path First algorithm.
9. Implementation of Minimum Spanning Tree.
10. Implementation of real-world applications using List, Stack, Queue, Tree & Graph.

L – 45 ; P – 30 ; TOTAL HOURS – 75

REFERENCES:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition., Addison Wesley, 2014.
2. T.H. Cormen, C.E.Lieserson, R.L. Rivest and C.Stein, “Introduction to Algorithms”, Third edition, MIT Press, 2009.
3. Horowitz, Sahni, Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2008.
4. Jon Kleinberg, Eva Tardos, “Algorithm Design”, Pearson, first edition, 2013.
5. Aaron M. Tanenbaum, YedidyahLangsam, Moshe J. Augenstein, “Data Structures using C”, Pearson Education, 2011.
6. NarasimhaKarumanchi, “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, 5th Edition, Career Monk Publications, 2016.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Choose appropriate data structures and algorithms, understand theADT/libraries, and use it to design algorithms for a specific

problem.

CO2: Implement the concept of trees and perform average case analysis.

CO3: Identify the importance of different types of hashing principles and its applications in real time.

CO4: Analyse the efficiency and proofs of correctness for various data structure algorithms.

CO5: Discuss on the various graphs and greedy algorithms

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H	M			
CO2	H	H			
CO3	M				
CO4	H				
CO5	M				

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The linear and nonlinear data structures are used to implement efficient algorithms for real world applications. The analysis of algorithms provides an efficient methods for data storage & retrieval.

ITE 6102	SOFTWARE DEVELOPMENT METHODOLOGIES	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: learn various software process model

COB2: understand the requirements analysis concept and techniques

COB3: learn design concept

COB4: familiar with the DevOps concept

COB5: learn how to improve the software development process

MODULE I SOFTWARE PROCESS MODELS 9

Software Life Span Models – Software Technologies – Software Models – Specialized Process Models – The Unified Process – Agile Development – Software Processes – Team Iterative Processes – Initial Development – Final Stages.

MODULE II SOFTWARE REQUIREMENTS ANALYSIS 9

Unified Modeling Language – Object Oriented Analysis Process: Identifying Classes – Object Analysis: Classification – Identifying Object Relationships, Attributes and Methods.

MODULE III Software Design 9

Designing Classes - Component-Level Design - User Interface Design - Wasp Design - Mobileapp Design.

MODULE IV DevOps 9

Introduction to DevOps - DevOps Framework - DevOps – Continuous Integration and Delivery - DevOps Continuous Deployment.

MODULE V SOFTWARE PROCESS IMPROVEMENT 9

Testing Conventional Applications – Testing Web Applications – Software Process Improvement – Emerging Trends in Software Engineering

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Roger S. Pressman, “software engineering” 9th edition, Mc Graw Hill Education, 2019
2. Vaclav Rajlich, “The Software Engineering Current Practice”, CRC Press, 2012
3. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill,

1999

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Choose most appropriate software process model

CO2: Analyze the given requirements and prepare the SRS document

CO3: Develop the complete software design

CO4: Describe the concept of DevOps

CO5: Test the given software using suitable software testing techniques

CO6: Outline the different methods for software process improvement

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	-	M	-	-	-
CO2	M	-	-	-	-
CO3	M	M	-	-	-
CO4	-	M	-	-	-
CO5	M	-	-	-	-
CO6	-	-	-	M	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of the Software Development Methodologies leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

CSE 6101	MULTICORE COMPUTER ARCHITECTURE	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To get familiar with the principles of parallel computing

COB2: To learn the fundamentals of multicore system architecture.

COB3: To provide the methods of developing programming for parallelsystems.

COB4: To comprehend the multicore software development concepts.

COB5: To educate case studies using three mainstream parallelismsapproaches – Open MPP, MPI and Open CL

MODULE I PARALLEL COMPUTING 9

Concurrency Vs Parallelism – Symmetric and Asymmetric multiprocessing – Parallelism saves power – Key challenges of parallel computing - Need for parallel programming – History of parallel computing, systems and programming – Modeling parallel computation.

MODULE II MULTICORE SYSTEM ARCHITECTURE 9

Origin of the multicore architecture – Parallel computers – Shared memory multicore systems – Cache coherency –Shared data synchronization – Distributed memory – Symmetric multiprocessing – Asymmetric multiprocessing – Hybrid approaches – Graphical Processing Units (GPU).

MODULE III PARALLEL PROGRAMMING 9

Limits on parallel program performance – Parallel programming models – Shared memory parallel programming – Steps in parallel programming –Dependence Analysis – Identifying parallel tasks in loop structures – Parallel programming for linked data structures – Programming multicore and shared memory multiprocessors using OpenMP.

MODULE IV MULTI CORE SOFTWARE ARCHITECTURES 9

Multicore software architectures – Decision tree approach to select multicore architecture – Multicore programming models – A Case study of Multicore development – Multicore virtualization – Performance and Optimization of multicore systems – Sequential to parallel migration of software applications.

MODULE V CONCURRENCY ABSTRACTIONS 9

Language Extension Example: Open MP – Framework Example: Open CL - Libraries Example: Thread building examples – Thread safety – Message passing Multicore Models: MPI and MCAPI- Language support – Parallel computation of the number : Open MP, MPI and OpenCL.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Roman Trobec, BoštjanSlivnik, Patricio Bulić, BorutRobič , “Introduction to Parallel Computing”, Springer International Publishing, ISBN: 9783319988337,2018.
2. Robert Oshana, “Multicore Software Development Techniques”,ElsevierScience, ISBN: 9780128010372,2015.

REFERENCES:

1. Yan Solihin, “Fundamentals of Parallel Multicore Architecture”, CRC Press, ISBN: 9781482211191, 2015.
2. Pranabananda Chakraborty, “Computer Organisation and Architecture”, CRC Press, ISBN: 9781000190380, 2020.

COURSE OUTCOMES:

CO1: Describe the fundamentals of parallel systems.

CO2: Develop parallel program for the software applications.

CO3: Analyze the need for parallel computing through case studies.

CO4: Identify the method to design the multi-core programming models.

CO5: Solve the problems using three mainstream parallelismsapproaches OpenMPP, MPI and Open CL.

Board of Studies (BoS): **Academic Council:**

16th BoS of IT held on 18.08.2022 | 19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	L				L	
CO2		L			L	
CO3		M				M
CO4			M		M	
CO5				M		M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Sustainable Industry, innovation and Infrastructure.

Statement: Learning various techniques in applied algebra and discrete algorithms will lead to the knowledge required for applying in Computer Science projects.

CSE 6103	ADVANCED COMPUTER NETWORKS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the students to the understanding of Computer networks with OSI Reference Model, Protocol at different layers.

COB2: To special emphasis on IP, TCP & UDP and Routing algorithms

COB3: To Identify the different types of network devices and their functions within a network.

COB4: To study major topics such are TCP/IP implementation,LANs/WANs, internetworking technologies, Routing andAddressing.

COB5: To analyze the identified research work in building ComputerNetworks.

MODULE I INTRODUCTION, PROTOCOLS AND STANDARDS 9

Definition and Uses of Computer Network, Classification of Computer network, Network Architecture, Internet Standards, Internet Administration; Overview of reference models: The OSI model, The OSI Reference Model, TCP/IP protocol Suite, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models, Addressing, IP versions.

MODULE II MULTIPLEXING AND LOCAL AREA NETWORKS 9

Multiplexing - Types of Multiplexing- FDM, TDM, SM – Ethernet - token ring – FDDI - switching - circuit switching - packet switching - multicasting. Connectors - Transceivers and Media converters - Network interface cards and PC cards – Repeaters – Hubs – Bridges – Switches - Routers and Gateways H/W selection - Telephone networks - networking principles.

MODULE III PACKET SWITCHING PROTOCOL AND ROUTING PROTOCOL 9

X.25, theory of Operation and Network Layer functions, X.75, Internetworking protocols, SMDS, Subscriber Interface and Access Protocol, Addressing and Traffic Control Common Protocols, Routing Protocols: RIP, OSPF, BGP; Multicast Routing Protocols: MOSPF, DVMRP, Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes.

MODULE IV WEB SECURITY AND TRAFFIC MANAGEMENT BASICS 9

Introduction, Web Security Requirements, Secure Socket Layer (SSL), Traffic Management, Quality characteristics and requirements. Introduction, Applications and Quality of service, Queue Analysis, Queue Management Algorithms.

MODULE V ENTERPRISE NETWORK SECURITY 9

DMZ – NAT – SNAT – DNAT - Port Forwarding – Proxy - Transparent Proxy - Packet Filtering and Layer 7 Filtering - Backbone Network Design - Backbone Requirements - Network Capacities Topologies - Topologies Strategies - Tuning Network.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. L. Peterson and B. Davie, Morgan Kaufman, "Computer Networks, A Systems Approach", Fifth Edition,2012.

REFERENCES:

1. A. Tanenbaum and David Wetherall, “Computer Networks”, Fifth Edition, Pearson Prentice-Hall, 2011.
2. W.S. Stallings, "Data and Computer Communications", Ninth Edition, Pearson Prentice-Hall, 2011.
3. J. Kurose and K. Ross, “Computer Networking, A Top-Down Approach”, Addison Wesley, 2010.
4. Y-D. Lin, R-H. Hwang and F. Baker, “Computer Networks, An Open-Source Approach", McGraw Hill, 2012.
5. Morgan Kaufman, “The Illustrated Network, How TCP Works in a Modern Network”, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Illustrate reference models with layers, protocols and interfaces.

CO2: Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.

CO3: Describe Subletting and Addressing of IP V4.

CO4: Identify the different types of network devices and them functions within a network.

CO5: Conducting experiments to analyze the identified research working building Computer Networks.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PSO1	PSO2
CO1	M					
CO2			M			
CO3		H				M
CO4					H	
CO5						M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement:
By learning “Advanced Computer Networks” the students will be able to analyze the identified research work in building Computer Networks with guidelines and frameworks for various real time applications which leads to sustainable economic growth and provide productive employment.

ITE 6103	SOFTWARE DEVELOPMENT AND TESTING LABORATORY	L	T	P	C
SDG: 8		0	0	2	1

COURSE OBJECTIVES:

Students have to

COB1: practice software engineering concepts using automated tools.

COB2: practice object-oriented system development methodologies.

PRACTICALS

List of Sample Exercises

1. Health Insurance Management System
2. Mobile Recharging System
3. Tour Management System
4. Conference Management System
5. Recommender System

Develop the following for the above applications using Object Oriented System Development Methodologies:

1. Project Planning
2. Software Requirement Specification (Use Case Based)
3. Software Cost Estimation
4. Object Oriented Software Design
5. Data Modeling & Implementation
6. Test Case Specification
7. Software Testing
8. Software Debugging
9. Software Testing Report

P – 30; TOTAL HOURS – 30

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Prepare a software project plan.

CO2: Develop software requirements specifications document

CO3: Perform requirements analysis and prepare a design document for the given software

CO4: Develop software code for the assigned requirements

CO5: Develop a test case specification document

CO6: perform testing and debugging the code

Board of Studies (BoS):	**Academic Council:**
16th BoS of IT held on 18.08.2022	19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1			M		
CO2			M		
CO3	M	M			
CO4	M	M			
CO5	L		M		
CO6	M				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement : The proper learning of the Software Development techniques leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ENE 6181	ENGLISH FOR CAREER DEVELOPMENT	L	T	P	C
SDG: 4, 8		1	1	0	2

COURSE OBJECTIVES:

COB1: To enable students to learn about the job search, application, and interview process

COB2: To give them an opportunity to explore their global career path, build vocabulary and improve language skills to achieve professional goals

COB3: To produce a professional-looking resume

COB4: To understand networking and interview skills

COB5: To understand the key skills and behaviors required to facilitate a group discussion.

MODULE I ENTERING THE JOB MARKET 3+2

Introduction to the Career Development -Job Search Overview-Identifying Your Interests and Skills

Language Focus: Vocabulary and Word Forms Related to Jobs-Choosing the Job that's the Best Fit

Language Focus: Verb Tenses (Present vs. Present Progressive) Understanding Job Descriptions: Reading a Job Advertisement

Language Focus: Phrases to Compare Similarities

Online Learning Opportunities to Extend Your Skills

MODULE II RESUMES 3+2

What is a resume? Why do you need one?

Parts of a Resume-Writing a Resume, Part 1: Name and Contact Information Listening: Connecting Employers with Job Seekers in Today's Economy

Language Focus: Key Words

Writing a Resume, Part 2: Headline and Summary

Writing a Resume, Part 3: Work Experience

Writing a Resume, Part 4: Education

Language Focus: Action Verbs

Writing a Resume, Part 5: Complete your Resume

MODULE III WRITING A COVER LETTER 3+2

What is a Cover Letter?

Professional Writing: Letter Format

Cover Letter: Paragraph 1- Introducing Yourself

Cover Letter: Paragraph 2- Highlighting Your Skills in the Cover letter
Cover Letter: Paragraph 3- Closing
Language Focus – Present Perfect vs. Past Tense
Professional Writing: Level of Formality
Language Focus: Using Modal Verbs to Write politely
Writing a Cover Letter for a Specific Job

MODULE IV INTERVIEWING FOR A JOB 3+5

Overview of the Job Interview: Answering Typical Interview Questions
Language Focus: Asking for Clarification in an Interview-
Sample Interview: Do's and Don'ts Part 1
Sample Interview: Do's and Don'ts Part 2
Sample Video: Responding to an Interview Question

MODULE V GROUP DISCUSSION 3+4

Introduction to Group Discussion - Participating in group discussions – understanding group dynamics - brainstorming the topic - questioning and clarifying - GD strategies- activities to improve GD skills

L - 15, T - 15; TOTAL HOURS - 30

REFERENCES:

1. R. Byrne, D. Teaching Oral Skill. London: Longman. 1975.
2. Byrne, D.Teaching Writing, London: Longman. 1975.
3. Rani Asoka, DeviVimala. English for Career development: A Course in Functional English. Orient Longman Pvt. Ltd., India,2004.
4. Anderson, K., Maclean, J. & Lynch, T. Study speaking: A Course in Spoken
5. English for Academic Purposes. Cambridge University Press, UK, 2004.
6. Withrow, J., Brookes, G.& Cummings, M.C.Inspired to write. Reading and Tasks to Develop Writing Skills. Cambridge University Press, U.K., 2004.
7. Shinde, Maithryetal.Life Skills & Personality Development, Cambridge University Press India Pvt. Ltd, New Delhi
8. Fernandez, Agna Generic Skills for Employability, Cambridge University Press India Pvt. Ltd, New Delhi

COURSE OUTCOMES:

CO1: Identify the steps in the job search process

CO2: Describe themselves and their experiences in a résumé

CO3: Build their job-related vocabulary

CO4: Write a clear cover letter that tells employers why they are the right person for the job

CO5: Take part in Group discussion confidently.

Board of Studies (BoS):	**Academic Council:**
16th BoS of IT held on 18.08.2022	19th Academic Council meeting held on 29.09.2022

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: This course ensures that the students acquire quality education and are also made eligible to obtain productive and decent employment.

SEMESTER II

GEE 6201	RESEARCH METHODOLOGY AND IPR	L	T	P	C
SDG: 4, 8, 9		2	0	0	2

COURSE OBJECTIVES:

COB1: To apply a perspective on research

COB2: To analyze the research design, information retrieval and problem formulation techniques.

COB3: To select the appropriate statistical techniques for hypothesis construction and methods of data analysis and interpretation

COB4: To execute the effective communications of research findings and apply the ethics in research.

COB5: To describe the research findings as research reports, publications, copyrights Patenting and Intellectual Property Rights.

PREREQUISITES:

- Basics of core engineering, probability and statistics.
- Basics of flowchart and algorithm techniques.

MODULE I RESEARCH PROBLEM FORMULATION AND RESEARCH DESIGN 6

Research - objectives – types - Research process, solving engineering problems -Identification of research topic - Formulation of research problem, literature survey and review. Research design - meaning and need - basic concepts - Different research designs, Experimental design - principle, Design of experimental setup, Mathematical modeling - Simulation, validation and experimentation.

MODULE II DATA COLLECTION, ANALYSIS AND INTERPRETATION OF DATA 8

Sources of Data, Use of Internet in Research, Types of Data - Research Data Processing and analysis - Interpretation of results- Correlation with scientific facts - repeatability and reproducibility of results - Accuracy and precision – limitations, Application of Computer in Research- Spreadsheet tool - Basic principles of Statistical Computation. Importance of statistics in research - Concept of probability - Popular distributions - Sample design. Hypothesis testing, ANOVA, Design of experiments - Factorial designs - Orthogonal arrays.

MODULE III OPTIMIZATION TECHNIQUES 8

Use of optimization techniques - Traditional methods – Evolutionary Optimization Techniques. Multivariate analysis Techniques, Classifications, Characteristics, Applications - correlation and regression, Curve fitting.

MODULE IV INTELLECTUAL PROPERTY RIGHTS 8

The Research Report - Purpose of written report - Synopsis writing - preparing papers for International Journals, Software for paper formatting like LaTeX/MS Office, Reference Management Software, Software for detection of Plagiarism –Thesis writing, - Organization of contents - style of writing- graphs, charts and Presentation tool - Referencing, Oral presentation and defense - Ethics in research - Patenting, Intellectual Property Rights - Patents, Industrial Designs, Copyrights, Trade Marks, Geographical Indications-Validity of IPR, Method of Patenting, procedures, Patent Search.

L –30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Ganesan R., “Research Methodology for Engineers”, MJP Publishers, Chennai, 2011.
2. George E. Dieter., “Engineering Design”, McGraw Hill – International edition, 2020.
3. Kothari C.R., “Research Methodology” – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2020.
4. Kalyanmoy Deb., “Genetic Algorithms for optimization”, Kangal report, No.2001002.
5. Rajkumar S. Adukia, “Handbook on Intellectual Property Rights in India”, TMH Publishers, 2020.
6. PrabhuddhaGanguli.” Intellectual Property Rights”. 1st Edition, TMH Publishers, 2012.

REFERENCES:

1. Holeman, J.P., ”Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2017.
2. Govt. of India, ”Intellectual Property Laws; Acts, Rules & Regulations”, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2020.
3. R Radha Krishnan & S Balasubramanian,” Intellectual Property Rights”. 1st Edition, Excel Books, 2012.
4. Derek Bosworth and Elizabeth Webster. ” The Management of Intellectual Property”, Edward Elgar Publishing Ltd., 2013.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Formulate the research problem

CO2: Design and Analyze the research methodology

CO3: Apply statistical techniques for hypothesis construction

CO4: Analyze and interpret the data to construct and optimize the research hypothesis

CO5: Report the research findings as publications, copyright, trademarks and IPR

Board of Studies (BoS) :

23rd BOS of ECE held on 13.07.2022

Academic Council:

19th Academic Council held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	L	L	L	L	L	L	L	H	H	H
CO2	H	H	H	H	M	-	-	-	-	-	-	-	H	H	H
CO3	H	H	H	H	M	L	L	L	L	L	L	-	H	H	H
CO4	H	H	H	H	M	-	M	M	M	M	M	-	H	H	H
CO5	H	H	H	H	M	-	M	M	M	M	M	-	H	H	H

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 4: Analysis and design of core field design promotes engineering skills and quality education.

Statement: This course enables the student to analyze the existing technology for further solution and its qualitative measures in terms of societal requirements.

SDG 8: Development of new technologies with core field design provides sustainable economic growth and productive employment.

Statement: To apply the hybrid techniques and concepts for different applications provides sustainable economic growth and productive employment.

SDG 9: Creative and curiosity of core field design fosters innovation and sustainable industrialization.

Statement: This course plays major roles through innovative ideas in industry towards modern infrastructures and sustainability.

ITE 6201	CLOUD COMPUTING TECHNOLOGY	L	T	P	C
SDG: 9		3	1	0	4

COURSE OBJECTIVES:

Students have to

COB1: Understand the basic concepts of cloud computing and its enabling technologies

COB2: Be familiar with various cloud infrastructure and management mechanisms

COB3: Have knowledge in various cloud Architectures.

COB4: Learn about various service providers and the different types of cloud services provided.

COB5: Understand the privacy and security issues in cloud environments.

MODULE I CLOUD COMPUTING BASICS 9

Cloud Computing – Basic Concepts and terminology – Goals and benefits – Risks and challenges –Roles and Boundaries – Cloud Characteristics – Cloud Delivery Models – Cloud Deployment Models – Cloud Enabling Technologies.

MODULE II CLOUD COMPUTING MECHANISMS 9

Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication – Specialized Cloud mechanisms: Load Balancer, SLA Monitor, Hypervisor, Fail over system – Cloud Management Mechanisms: Remote Administration, Resource, SLA and Billing Management.

MODULE III CLOUD COMPUTING ARCHITECTURES 9

Fundamental Cloud Architectures: Workload distribution, Dynamic Scalability, Elastic Resource capacity, Redundant Storage - Advanced Cloud Architectures: Hypervisor clustering, Non-disruptive service relocation, Dynamic Failure detection and Recovery – Specialized Architectures: Dynamic Data Normalization, Elastic Network capacity, Load balanced Virtual switches.

MODULE IV CLOUD COMPUTING SERVICES 9

Service Providers – Amazon, Google, Microsoft, IBM, Salesforce.com – Cloud Services – collaborating on: Task Management, Event Management, Project Management, Word Processing, Spreadsheets,

Presentations, Databases, Storing and Sharing files and other online contents.

MODULE V CLOUD SECURITY AND PRIVACY 9

Security terms relevant to Cloud computing – Threat Agents – Cloud Security Threats – Cloud Security Mechanisms – Infrastructure Security: Network Level, Host Level, Application Level –Data Security and Storage – Identity and Access Management – Privacy.

L –45 ;T-15: TOTAL HOURS – 60

REFERENCES:

1.Thomas Erl, Zaigham Mahmood, and Ricardo Puttini "Cloud Computing Concepts, Technology & Architecture" Prentice Hall Publication, 2019.

2. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter," Cloud Computing:A Practical Approach", McGraw Hill publication ,2010.

3.Michael Miller, "Cloud Computing", Pearson Publication, 2009.

4.Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy", Oreilly, 2009.

5.RajkumarBuyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms" John Wiley & Sons, Inc Publications, 2011

6.RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, "Mastering Cloud Computing", McGraw-Hill Education Private Ltd.,2013.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Demonstrate the fundamentals of cloud computing, its delivery, deployment models and enabling technologies.

CO2: Deal with the various cloud computing mechanisms.

CO3: Explain the various cloud computing Architectures

CO4 : Discuss the various cloud providers and the services provided by them.

CO5: Enlighten the challenges behind securing the confidentiality, Integrity and Privacy of the database in the cloud.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H				
CO2		H			
CO3	M				
CO4				L	
CO5					M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Cloud computing is a new way that drives economic development in any country. Business users of computers, systems administrators, freelancers, and IT students have to learn it. Cloud computing is impacting business, careers, and people worldwide.

ITE 6202	MACHINE LEARNING ALGORITHMS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to,

COB1: Understand the principles and application of machine learning

COB2: Learn the theoretical basis for algorithms and techniques.

COB3: Know the various supervised learning models.

COB4: Understand the different unsupervised learning algorithms

COB5: Learn advanced learning models like reinforcement learning and neural networks

MODULE I INTRODUCTION 9

Introduction- Machine learning – Examples of machine learning applications- Linear associations – Classification - Regression – Unsupervised learning – Reinforcement learning.

MODULE II BAYESIAN DECISION THEORY 9

Supervised learning - Learning a class – Learning multiple classes – Regression- Bayesian decision – Classification – Losses and risks - Discriminant functions- Association rules.

MODULE III SUPERVISED LEARNING 9

Classification – Binary classifier – Multiclass classification – Multilabel classification – Linear Regression – Gradient descent – logistic regression – SVM.

MODULE IV UNSUPERVISED & ADVANCED LEARNING 9

Unsupervised learning techniques – clustering - K-Means Clustering - Hierarchical Clustering – Gaussian mixtures - Dimensionality Reduction - Reinforcement Learning – Representation Learning - Ensemble Learning.

MODULE V KERNEL MACHINES 9

Optimal separating hyperplane - Soft margin hyperplane - v-SVM – Kernel trick - Multiple kernel learning - Multiclass kernel machines – Kernel machines for regression and ranking - Kernel dimensionality reduction

L –45 ; TOTAL HOURS – 45

REFERENCES:

1. Alpaydin Ethem, “Introduction to Machine Learning”, 3rd edition, PHI Learning Pvt. Ltd, 2015.

2. Tom M. Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2017
3. AurélienGéron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, Second edition, O'Reilly Media, 2019.
4. Andreas C. Muller and Sarah Guido, “Introduction to Machine Learning with Python: A guide for data scientists”, First edition,O'Reilly, 2017.
5. Sebastian Raschka, “Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2”, 3rdedition, PacktPublishing , 2019.
6. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
7. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, first edition, Chapman and Hall/CRC, 2009.

COURSE OUTCOMES:

CO1: Explain the fundamentals of machine learning and their applications.
CO2: Discuss about the learning and Bayesion Decision making processes.
CO3: Implement the classification and regression algorithms.
CO4: Use appropriate learning algorithms for any real time application.
CO5: Apply advanced methods for parameter evaluation and tuning.

Board of Studies (BoS):
16thBoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	L				
CO2	M				
CO3		L	L		
CO4	M	L	L		
CO5		H	L		

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement :The Learning algorithms helps to design and develop solutions for solving real world application in any engineering domain.

ITE 6203	MACHINE LEARNING LABORATORY	L	T	P	C
SDG: 8		0	0	2	1

COURSE OBJECTIVES:

Students have to,

COB1: Understand the principles of machine learning

COB2: Know the python libraries for machine learning

COB3: Understand the decision tree classifier for data analysis.

COB4: Learn the supervised learning algorithms

COB5: Explore the univariate and multivariate trees for statistical analysis of a data.

PRACTICALS

List of Experiments:

1. Anaconda &Jupyter Installation
2. Use of NumPy and Pandas
3. Use of Scipy for Image Manipulation
4. Decision tree classification
5. Linear Regression
6. Bayesian decision
7. Univariate trees
8. Multivariate trees
9. SVM
10. Feature representation
11. Machine learning for predicting Sales of a product

P –30 ; TOTAL HOURS – 30

REFERENCES:

1. AurélienGéron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”,Second edition, O'Reilly Media, 2019.
2. Andreas C. Muller and Sarah Guido, “Introduction to Machine Learning with Python: A guide for data scientists”, First edition,O′Reilly, 2017.
3. Sebastian Raschka, “Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2”, Third edition, PacktPublishing , 2019.

COURSE OUTCOMES:

CO1: To have a knowledge on the implementation tools of learning algorithms.

CO2: To apply the concept of decision trees for a real time application.

CO3: To identify the relationship between variables and forecasting using regression techniques

CO4: To work with support vector machines algorithms for classification and regression problems

CO5: To perform analysis on a single data set using single or multiple variables.

Board of Studies (BoS):
16thBoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2	M	L			
CO3		L			
CO4	L	L			
CO5	L	L			

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The machine learning algorithms can aid in statistical analysis of data and provide solutions to real time problems using classification and regression techniques.

ITE 6204	CLOUD MIDDLEWARE TOOLS LABORATORY	L	T	P	C
SDG:9		0	0	2	1

COURSE OBJECTIVES:

Students have to

COB1: Understand the concepts of AWS and Azure.

COB2: Install and create cloud environment and virtual machine using open nebula.

COB3: Study the comments used to create VM in Eucalyptus cloud Environment

COB4: Develop client Server machine using Google App Engine .

COB5: Develop an application for resource allocation using cloud sim.

PRACTICALS

List of Experiments:

1. Develop an application for cloud storage using AWS.
2. Develop an application for cloud storage using Azure.
3. Setup/Install Open Nebula Cloud Environment and create a virtual Machine.
4. Study the comments used to create VM in Eucalyptus Cloud Environment.
5. Create Server and Client Machine in Google App Engine.
6. Install cloud sim and develop an application for resource allocation.

P –30 ; TOTAL HOURS – 30

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Familiar with concepts of AWS and Azure.

CO2: Create a VM using the Open Nebula cloud middleware tool.

CO3: Discuss the use of Eucalyptus to create VM.

CO4: Demonstrate the Client Server Machine using Google App engine.

CO5: Implement the cloud Sim and develop an application for resource allocation.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2		H			
CO3			M		
CO4	H	M			
CO5	M	M			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Middleware acts as a bridge between diverse technologies, tools, and databases so that we can integrate them seamlessly into a single system. The single system then provides a unified service to its user.

PROFESSIONAL ELECTIVES

SEMESTER I (3 CREDITS)

		L	T	P	C
ITEY 101	**COMPUTER FORENSICS AND**				
SDG: 11	**INFORMATION SECURITY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

Students have to

COB1: Understand the fundamental of Computer Forensics and to apply appropriate skills and knowledge in solving computer forensics problems.

COB2: Know the impact of various cybercrimes and cyber offenses.

COB3: Understand the basics of Information Security.

COB4: Know the technological aspects of Information Security.

COB5: Learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, viewpoints, and trade-offs.

MODULE I INTRODUCTION TO COMPUTER FORENSICS 9

History of Forensics – Computer Forensic Flaws and Risks – Rules of Computer Forensics – Legal issues – Digital Forensic Principles – Digital Environments – Digital Forensic Methodologies-Forensic Hardware and Software-Case study.

MODULE II CYBER SECURITY 9

Cyber Crime and security-– Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyber offenses – Categories – Planning the attacks – Cyberstalking – Cyber cafe and Cybercrimes – Botnets- Security tools-Social Engineering.

MODULE III CRYPTOGRAPHY AND HASH FUNCTION 9

Security problem in computing – Elementary Cryptography – Symmetric Key Encryption -Public Key Encryption –Hash function.

MODULE IV PROGRAM SECURITY 9

Security Programs – Non-malicious program Errors – Virus and other Malicious Code – Targeted Malicious Code – Control against program threats.

MODULE V NETWORK SECURITY& WEB SECURITY 9

Threats in Networks– TLS/SSL- Network Intrusion detection and prevention systems- firewalls-– Secure E-Mail- Cross Site Scripting, Cross Site Request Forgery, SQL Injection .

L –45 ; TOTAL HOURS – 45

REFERENCES:

1. Anthony Reyes, Jack Wiles, 'Cybercrime and Digital Forensics', Elsevier publications, 2007.
2. John Sammons, 'The Basics of Digital Forensics', Elesvier 2012.
3. William Stallings, 'Cryptography and Network Security – Principles and Practices', Sixth Edition, Pearson Education 2013.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, Fourth Edition, 'Security in Computing', Pearson Education, 2006.
5. Nina GodboleSunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley, 2011.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Have a fundamental understanding of Computer Forensics and how resultant evidence can be applied within legal cases.

CO2: Display their competence in the various forensic computing fields.

CO3: Select appropriate techniques to tackle and solve problems in the discipline of information security.

CO4: Discuss various cybercrimes and offences.

CO5: Perform competitively as a technical support in any organization.

Board of Studies (BoS) :

16th BoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	-	M	-	-	-
CO2	H	-	-	-	-
CO3	M	-	-		
CO4		-		-	M
CO5				M	

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Statement: Forensics role overlaps in information at cyber-incidence response and security operations, especially when a crime has been committed and management wants to acquire evidence to prosecute the criminal. Computer forensics experts can operate effectively as security practitioners with much security training and certifications.

ITEY 102	MULTIMEDIA TECHNOLOGY AND APPLICATIONS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

Students have to:

COB1: Learn the various multimedia elements along with the theoretical underpinnings and to expose them to integration of these elements.

COB2: Understand the technological knowledge necessary for creating multimedia content for the web, video, DVD and cellular phones, 2D and 3D graphics, sound and programming.

COB3: Familiar digital technologies, media authoring, storage and distribution tools.

COB4: Learn the current development of contemporary systems of multimedia technology.

COB5: Understand knowledge in applications of multimedia technology.

MODULE I MULTIMEDIA COMPONENTS 9

Introduction to Multimedia: Multimedia Elements - Multimedia System Architecture - Evolving technologies for Multimedia - Defining objects for Multimedia systems - Multimedia Data interface standards - Multimedia Databases.

MODULE II MULTIMEDIA REPRESENTATIONS & COMPRESSION TECHNIQUES 9

Overview of Text and Character representations - Audio: Basic Concepts - Data acquisition and digitization - Audio Formats - Image: Image Representation Formats and compression techniques - Color Schemes - Video: Analogue and Digital Video - Recording Formats and Standards - Transmission of Video Signals - Video Capture - Video compression techniques.

MODULE III DOCUMENT ARCHITECTURE & CONTENT MANAGEMENT 9

Content Management: Content Design and Development - General Design Principles - Hypertext Concepts - Open Document Architecture (ODA) - Multimedia and Hypermedia Coding Expert Group (MHEG) - Standard Generalized Markup Language (SGML) - Document Type Definition (DTD) - Hypertext Markup Language (HTML) in Web Publishing.

MODULE IV MULTIMEDIA NETWORKS 9

Multimedia Networks: Basics of Multimedia Networks - Multimedia Network Communications and Applications - Quality of Multimedia Data Transmission –

Reliable Transport Protocols-RTP, RTCP-Multimedia Over IP – Media- on -Demand (MOD)-Resource Reservation – Protocol: RTSP - Voice & Video Over IP - Multimedia Over ATM Networks-Transport of MPEG4.

MODULE V APPLICATIONS 9

Multimedia in the Real World: Video conferencing - Virtual reality - Interactive video - video on demand - Training and Education -Kiosks – Image Processing - The Multimedia Office -Multimedia in the Home - Case Study: Application for Industrial - Educational and Medical Domains.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Ralf Steinmetz and KlaraNahrstedt, “Multimedia: Computing, Communications and Applications”, Prentice - Hall, India. 2008.
2.Tay Vaughan, “Multimedia: Making it work”, Tata McGraw Hill, Eighteen, 2011.
3.Ze-Nian Li and Mark S. Drew, “Fundamentals of Multimedia”,PearsonEducation, 2008.
4 Andleigh P.K., Thakrar K., Multimedia Systems Design (PHI), 2003.
5.Fred Halsall, “Multimedia Communications: Applications, Networks, protocols and Standards”, Pearson Education, Asia,Second Indian reprint, 2002.

COURSE OUTCOMES:

At the end of course students will be able to:

CO1: Outline and critically analyze the different elements of multimedia systems.

CO2: Apply and demonstrate the features of text, audio, images, video and active contents of multimedia elements.

CO3: Outline the concepts of document architecture and develop user Friendly web pages using HTML and DTD.

CO4:Discuss the multimedia network communications and Applications.

CO5: Apply the various multimedia technologies to design real world applications.

CO6: Create a well-designed, interactive Website with respect to current standards and practices.

Board of Studies (BoS):

16thBoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5

CO1	H		H		H
CO2		H		M	
CO3	H				H
CO4			H		
CO5		H		H	
CO6			H		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

The modules and topics of this course are designed to ensure all-inclusive and through knowledge about Multimedia technology and applications.

ITEY 103	HIGH PERFORMANCE NETWORKS	L	T	P	C
SDG: 08		3	0	0	3

COURSE OBJECTIVES:

The students have to

COB1: Get an introduction about ATM and Frame relay.

COB2: Know the up-to-date survey of developments in High-Speed Networks.

COB3: Learn techniques involved to support real-time traffic and congestion control.

COB4: Understand the different levels of Quality of Service (QoS) for different applications.

COB5: Learn to identify the QoS for high-speed networks.

MODULE I HIGH SPEED NETWORKS 9

Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fiber Channel - Wireless LAN's: applications, requirements - Architecture of 802.11.

MODULE II CONGESTION AND TRAFFIC MANAGEMENT 9

Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.

MODULE III TCP ANDATM CONGESTION CONTROL 9

TCP Flow control - TCP Congestion Control - Retransmission - Timer Management -Exponential RTO back off - KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Requirements - Attributes - Traffic Management Frame work, Traffic Control - ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations - GFR traffic management.

MODULE IV INTEGRATED AND DIFFERENTIATED SERVICES 9

Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services.

MODULE V PROTOCOLS FOR QoS SUPPORT 9

RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching - Operations, Label Stacking,

Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. William Stallings, 'High Speed Networks and Internet', Pearson Education, Second Edition, 2002.
2. IrvanPepelnjk, Jim Guichard and Jeff Apcar, 'MPLS and VPN architecture', Cisco Press, Volume 1 and 2, 2003.
3. Warl and PravinVaraiya, 'High Performance Communication Networks', Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.

COURSE OUTCOMES:

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

CO1: Discuss the various high-speed networking technologies and their design issues.

CO2: Manage projects involving any of the high-speed networking technologies.

CO3: Design high speed networks with quality of service (QoS).

CO4: Use the techniques involved to support real-time traffic and congestion control.

CO5: Optimize and troubleshoot high-speed networks using appropriate protocols.

Board of Studies (BoS): 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M				
CO2	H	M				
CO3	H	M				
CO4	H	M				
CO5	H	M				

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The knowledge of the High Performance Networks leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITEY 104	INTERNETWORKING WITH TCP/IP	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce basics of computer networks, OSI model, layers of TCP/IP, types of addressing and Switching

COB2: To present the protocols of network layers and subletting / super netting

COB3: To introduce the protocols of transport and application layers

COB4: To impart basics of ns simulator

MODULE I INTRODUCTION 9

Standards – Internet – History- OSI model – TCP/IP Protocol suite – Addressing – Switching – Connecting devices – IP addressing.

MODULE II INTERNET PROTOCOL 9

Sub netting – Super netting – IP packets – Delivery – Routing – Routing module – Routing table – Datagram – Fragmentation – Checksum – IP Design – ARP –RARP – Internet control message protocol – Multicasting - Internet group management protocol.

MODULE III TRANSMISSION CONTROL PROTOCOL 9

User Datagram protocol – UDP operation – Use – UDP design – TCP services – Flow control – Error control – TCP operation and design – Connection –Congestion control.

MODULE IV APPLICATION LAYER AND CLIENT SERVER MODEL 9

Concurrency – BOOTP – DHCP – Domain name system – Name space – Distribution – Resolution – Messages – Telnet – Rlogin – Network Virtual Terminal – Character Set – Controlling the server – Remote login.

MODULE V APPLICATION PROTOCOLS 9

File Transfer Protocol – Connections – Communication – Simple Mail Transfer Protocol – Simple Network Management Protocol – Hyper Text Transfer Protocol – Transaction – Request and Response messages - Introduction to ns simulator .

L –45 ; TOTAL HOURS – 45

REFERENCES:

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Tata McGraw Hill, 4thEd., 2010.
2. Douglas E. Comer, David L. Stevens, “Internetworking with TCP/IP – Volume I, II and III”, Prentice - Hall of India Pvt. Ltd., 6th Edition 2015.

3. Mahbub Hassan and Raj Jain, “High Performance TCP/IP Networking Concepts, Issues and Solutions”, Prentice - Hall of India Pvt. Ltd, 2015.

COURSE OUTCOMES:

At end of the course, the student will be able to:

CO1: Describe the history, the need and the purpose of TCP/IP and basics of computer networks and its layers

CO2: Design networks using subnet and superset concepts and explain the working of IP, ARP, RARP, ICMP & IGMP protocols and multicasting.

CO3: Discuss about the working of transport layer protocols (TCP and UDP).

CO4: Illustrate working of application layer protocols such as BOOTP,DHCP, DNS, TELNET.

CO5: Illustrate working of application layer protocols such as FTP, SMTP, SNMP, HTTP and create a network topology using ns simulator and monitor the performance of the network.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2	H				
CO3	M				
CO4	M				
CO5	M	H			

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: TCP/IP protocols are used to implement modern Internet. This course will substantially help the students who have relevant technical skills in the TCP/IP protocol suite for employment, decent job and entrepreneurship.

SEMESTER II

ITEY201	MULTICORE ARCHITECTURES	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The students have to:

COB1: Learn the recent trends in the field of Computer Architecture and identify performance related parameters.

COB2: Understand the need for parallel processing.

COB3: Study the different types of multicore architectures.

COB4: Expose the problems related to multiprocessing.

COB5: Expose about warehouse-scale and embedded architectures.

MODULE I FUNDAMENTALS OF QUANTITATIVE DESIGN & ANALYSIS AND TYPES OF PARALLELISM 9

Quantitative Principles of Computer Design -Measuring and Reporting Performance – Types of Parallelism - ILP, DLP, TLP and RLP – Instruction Level Parallelism (ILP) and its Exploitations- Multithreading – Thread-Level Parallelism (TLP), Simultaneous Multi-threading (SMT) and Chip-multiprocessor (CMP) Architectures – Limitations of Single Core Processors - The Multicore era – Case studies of Multicore Architectures.

MODULE II DLP IN VECTOR, SIMD AND GPU ARCHITECTURES 9

Vector Architecture – Data Level Parallelism (DLP) - SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units - Detecting and Enhancing Loop Level Parallelism - Case Studies.

MODULE III MULTIPROCESSOR ARCHITECTURE AND PERFORMANCE ISSUES 9

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues -performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-Stage Interconnection Networks.

MODULE IV RLP AND DLP IN WAREHOUSE-SCALE ARCHITECTURES 9

Introduction to Warehouse-Scale Computers –RLP (Request-Level Parallelism) and DLP in warehouse-scale architectures-Physical Infrastructure and Costs – Cloud Computing – Architectures and Issues.

MODULE V ARCHITECTURES FOR EMBEDDED SYSTEMS 9

Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – The Digital Signal Processor – Embedded Multiprocessors - Case Studies.

L – 45; TOTAL HOURS – 45

REFERENCES:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, 6thedition, 2017.Yan Sohilin, “Fundamentals of Parallel Multicore Architecture”, Chapman and Hall/CRC Computational Sciences, Apple Academic Press Inc., ISBN 978148211184, 2015.
2. Shameem Akhter and Jason, “Multi-core Programming”, Intel Press, 2006.
3. Darryl Gove, “Multicore Architecture Programming: For Windows, Linux, and Oracle Solaris”, Pearson, 2011.
4. Tammy Noergaard, “Embedded Systems Architecture”, 2nd Edition, 2013.
5. Daniele Lacamera, “Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems”, 2018.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Identify the limitations of Instruction-level parallelism and the need for multi-core architectures.

CO2: Discuss the different vector architectures.

CO3: Critically analyze the problems in shared memory multiprocessors.

CO4: Analysis the features of warehouse scale architecture and how they exploit RLP & DLP.

CO5: Discuss the architecture of embedded processors.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2	M				

CO3	H				
CO4	H				
CO5	M				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of concepts of Multicore Architectures lead to inclusive and sustainable economic growth, full and productive employment for the students.

ITEY 202	SOCIAL NETWORK ANALYSIS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

Students have to :

COB1: Learn the model and visualize the social network.

COB2: Analyze to mine the users in the social network.

COB3: Understand the evolution of the social network.

COB4: Familiar with the interest of the user.

COB5: Formalize different types of entities and relationships as edges and nodes and represent this information as relation data.

MODULE I INTRODUCTION 9

Introduction to Web – Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical properties of Social Networks – Network analysis – Development of Social Network Analysis – key concepts and measures in network analysis – Discussion networks – Blogs and online communities – Web – based networks.

MODULE II MODELING AND VISUALIZATION 9

Visualizing Online Social Networks – A Taxonomy of Visualizations – Graph Representation – Centrality Clustering – Node-Edge Diagrams – Visualizing Social Networks with Matrix-Based representations – Node-link Diagrams – Hybrid Representations – Modeling and aggregating social network data – Random walks and their applications – Use of Hadoop and Map Reduce – Ontological representation of social individuals and relationships.

MODULE III INVESTIGATION 9

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web community from a series b Archive – Detecting Communities in Social Networks – Evaluating Communities – Core Methods for Community Detection & Mining – Applications of Community Mining Algorithms – Node Classification in Social Networks.

MODULE IV SOCIAL NETWORKS 9

Evolution in Social Networks – Framework – Tracing Smoothly Evolving Communities – Models and Algorithms for Social Influence Analysis – Influence Related Statistics – Social Similarity and Influence – Influence

Maximization in Viral Marketing – Algorithms and Systems for Expert Location in Social Networks – Expert Location without Graph Constraints – with Score propagation – Expert Team Formation – Link Prediction in Social Networks – Feature based Link Prediction – Bayesian Probabilistic Models – Probabilistic Relational Models.

MODULE V APPLICATIONS 9

Twitter as a Source for Time and Domain Dependent Sentiment Lexicons - The Anatomy of Malicious Pages on Facebook - Diversity and Influence as Key Measures to Assess Candidates for Hiring or Promotion in Academia - Novel Methods of Subscription Type Prediction in Mobile Phone Services - Dynamic Pattern Detection for Big Data Stream Analytics - Combining Feature Extraction and Clustering for Better Face Recognition.

L – 45; TOTAL HOURS - 45

REFERENCES:

1. Charu C. Aggarwal, “Social Network Data Analytics”, Springer, 2011.
2. Mehmet Kaya, Jalal Kawash, SuheilKhoury, Min-Yuh Day, Social Network Based Big Data Analysis and Applications, Springer, 2018
3. BorkoFurht, “Handbook of Social Network Technologies and Applications”, Springer, First Edition, 2010.
4. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, First Edition, 2011.
5. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer 2010.
6. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.

COURSE OUTCOMES:

At the end of course students will be able to:

CO1: Work on the internal components of the social network.

CO2: Model and visualize the social network.

CO3: Mine the behavior of the users in the social network.

CO4: Perform statistical analysis of social networks.

CO5: Collect and preprocess network data.

Board of Studies (BoS) :

16th BoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held

on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H		H		
CO2		H		M	H
CO3	H		H		
CO4		H	H		H
CO5	H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG4:Ensuring inclusive and equitable quality education for all persons and promotes lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough knowledge about social network analysis.

ITEY203	DISTRIBUTED OPERATING SYSTEMS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The students have to:

COB1: Understandthe importance of communication in distributed environment and the actual implementation of various communication mechanisms.

COB2: Studyhow a distributed operating system works and how it differs from the single processor OS.

COB3: Learnhow to manage the resources in a distributed environment.

COB4: Learnhow to make a distributed system fault tolerant.

COB5: Studyhow the above-mentioned techniques have been used in actual, real-life distributed systems.

MODULE I COMMUNICATION IN DISTRIBUTED ENVIRONMENT 9

Introduction - Client-Server Paradigm - Threads in distributed Systems - Remote Procedure Call - Remote Object Invocation - Message-Oriented Communication – Stream-Oriented Communication - Multicast Communication.

MODULE II DISTRIBUTED OPERATING SYSTEMS 9

Issues in Distributed Operating System – Clock Synchronization - Lamport's Logical clock - Vector Clock - Distributed Mutual Exclusion – Global Positioning of Nodes - Election Algorithms - Distributed Transaction - Distributed Deadlock.

MODULE III CONSISTENCY AND REPLICATION 9

Introduction - Data-Centric Consistency Models - Client-Centric Consistency Models – Replica Management - Distribution Protocols - Consistency Protocols - IVY - Munin - Atomic Transaction.

MODULE IV FAULT TOLERANCE AND DISTRIBUTED FILE SYSTEM 9

Introduction to fault Tolerance – Process Resilience - Distributed Commit Protocol – Recovery - Distributed File Systems - Architecture - Issues in Distributed File Systems - Sun NFS.

MODULE V CASE STUDIES **9**

Distributed Object-Based System - CORBA - COM - Distributed Coordination-Based System – JINI - Distributed Web-Based System - Google.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. A.S. Tanenbaum, M. Van Steen, “Distributed Systems: Principles and Paradigms”, Pearson Education, Second Edition, 2006.
2. M.L. Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, First Edition, 2019.
3. A.S. Tanenbaum, “Distributed Operating Systems”, Pearson Education, 2002.
4. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems Concepts and Design”, Third Edition, Pearson Education Asia, 2012.
5. MukeshSinghal and Niranjan G. Shivaratri , “Advanced Concepts in Operating Systems”, McGraw Hill Series in Computer Science, 2017.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Identify the communication issues in the distributed systems and how it can be used in remote procedure calls, remote objects and message-oriented communication.

CO2: Analyze the principles of distributed operating systems through various algorithms.

CO3: Select suitable consistency model for distributed shared memory.

CO4: Predict the faults and find the solutions in distributed systems and create the distributed file system architecture for real world needs.

CO5: Compare and demonstrate various case studies in distributed systems.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5

CO1	M				
CO2	H				
CO3	H				
CO4	H	M			
CO5	H	H			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of Distributed Operating Systems leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITEY204	APPLIED CRYPTOGRAPHY	L	T	P	C
SDG: 16		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Understand the classical cryptographic algorithms.

COB2: Study the block cipher and advanced encryption standard.

COB3: Learn RSA cryptosystem and issues in key distribution.

COB4: Analyze the identification and authentication mechanisms.

COB5: To understand the various secret sharing schemes .

MODULE I CLASSICAL CRYPTOGRAPHY 9

The Shift Cipher, The Substitution Cipher, The Affine Cipher Cryptanalysis-Cryptanalysis of the Affine Cipher, Cryptanalysis of the Substitution Cipher, Cryptanalysis of the Vigenere Cipher, Shannon's Theory.

MODULE II BLOCK CIPHER AND THE ADVANCED ENCRYPTION STANDARD 9

The Data Encryption Standard, The Advanced Encryption Standard, Modes of Operation, Cryptography Hash Function - Hash Function and Data Integrity, Security of Hash Function, Iterated Hash Functions, Message Authentication Codes.

MODULE III RSA CRYPTOSYSTEM AND FACTORING INTEGERS 9

Introduction to Public –key Cryptography, Number theory, The RSA Cryptosystem, Other Attacks on RSA, The ElGamal Cryptosystem, Shanks' Algorithm, Finite Fields, Elliptic Curves over the Reels, Elliptical Curves Modulo a Prime, Signature Scheme –Digital Signature Algorithm.

MODULE IV IDENTIFICATION SCHEME AND ENTITY AUTHENTICATION 9

Challenge and Response in the Secret-key Setting, Challenge and Response in the Public Key Setting, The Scour Identification Scheme, Key distribution-Daffier-Hellman Key, Predistribution, Unconditionally Secure key Predistribution, Key Agreement Scheme Daffier-Hellman Key agreement, Public key infrastructure-PKI, Certificates, Trust Models.

MODULE V SECRET SHARING SCHEMES 9

The Shamir Threshold Scheme, Access Structure and General Secret key sharing, Information Rate and Construction of Efficient Schemes, Multicast

Security and Copyright production - Multicast Security, Broadcast Encryption, Multicast Re-keying, Copyright Protection, Tracing illegally redistribution keys.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall / CRC, 2006.
2. Menezes A. J, Oorschot P, Vanstone S.A, “Handbook of Applied Cryptography” CRC Press, 1997.
3. William Stallings, “Cryptography and Network Security: Principles and Practices”, Third Edition, Pearson Education, 2006.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fourth Edition, Pearson Education, 2007.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Apply the suitable substitution cipher algorithm for a real world problem.

CO2: Compute the security of data using DES and AES.

CO3: Use the RSA algorithm and factoring integers for secured data transfer.

CO4: Analyze the challenges and responses in secret key distribution.

CO5: Evaluate the secret sharing schemes as per the real world needs.

Board of Studies (BoS) :

16th BoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		H			
CO2	M				
CO3					M
CO4	H				
CO5				L	

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Statement: Cryptography helps to manage the flow of information between two parties better. Nobody will able to do spoofing and forgery using your personal information.

ITEY 205	CLOUD SERVICES	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: learn about cloud computing basics.

COB2: know the functionalities of Elastic Compute Cloud in AWS

COB3: understand the compute and storage services of Microsoft Azure.

COB4: build an application and host in any of the cloud platforms.

COB5: know the basic concept of VMWare Simulator

MODULE I CLOUD COMPUTING OVERVIEW 9

Origins of Cloud Computing – Cloud components - Essential characteristics - Comparing cloud providers with traditional IT service providers - Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption - Cloud deployment model.

MODULE II AWS 9

Amazon web services cloud platform – EC2 – Elastic container service – Storage -Simple storage service – Elastic file system – Migration and transfer – Developer tools.

MODULE III MICROSOFT AZURE 9

Getting access to Microsoft azure – Azure compute – Azure storage services – Virtual networks -Monitoring and Security – Managing Azure.

MODULE IV CLOUD SIMULATORS - CLOUDSIM AND GREENCLOUD 9

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to Green Cloud – Case Study.

MODULE V Introduction to VMWare Simulator 9

Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, creating a new virtual machine on a local host, cloning virtual machines, virtualizing a physical machine, starting and stopping a virtual machine – Case Study.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Richard Derry, “AWS: AMAZON WEB SERVICES: The Complete Guide from Beginners For Amazon Web Services”, Independently published, 2019.
2. Raoul Alongi,“AWS: The Most Complete Guide to Amazon Web Services from Beginner to Advanced Level”, Independently published , 2019.
3. Jim Cheshire, “Exam Ref AZ-900 Microsoft Azure Fundamentals”, second edition, Microsoft Press, 2020.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Discuss the core concepts of cloud computing paradigm.

CO2: Implement EC2 and S3 of AWS for a user application.

CO3: Analyze the components of Microsoft azure platform.

CO4: Deploy an application with necessary compute and storage resources.

CO5: Design an application with VMware tool.

Board of Studies (BoS) :

16th BoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				L
CO2		M			
CO3		H			
CO4	M				
CO5			M		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No. 8

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement : Developing cloud based solutions and implementing in any cloud platforms like AWS, Microsoft Azure or Google cloud platforms provides a shift from conventional computing to emerging technologies.

ITEY 206	CLOUD SECURITY	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to,

COB1: Learn the fundamentals of cloud computing architectures based on current standards and protocols.

COB2: Understand the different cloud security standards and architectures.

COB3: Know the different techniques adopted for data security.

COB4: Understand the importance of security controls in cloud community.

COB5: Know the implementation from architecture to secure operations in cloud.

MODULE I CLOUD AND SECURITY 9

Introduction - Architectural and Technological Influences of Cloud Computing – Scope of Saas, Paas and Iaas – risks and security concerns – Security design principles of cloud – data protection – end to end access control – monitoring and auditing – common attacks and threats – real world cloud usage scenarios.

MODULE II SECURITY ARCHITECTURES 9

Security requirements – cloud security standards – security patterns and architectural elements – cloud security architectures – Key strategies for secure operation – commercial cloud architectures – cloud personnel and cloud customers.

MODULE III DATA SECURITY 9

Data security – overview – Data control and public cloud – data ownership – common risks with cloud data security – Data encryption – Cryptographic techniques – Sensitive data categorization – Authentication and identity – access control techniques - data deletion – data masking.

MODULE IV SECURITY CONTROLS AND MONITORING 9

Risk management – stages and activities – Security controls – unclassified models – classified models – limits of security controls – security monitoring – purpose – CIA for security monitoring – Best practices for cloud community.

MODULE V SECURE OPERATIONS 9

Building Internal cloud – Selecting external cloud provider - Architecture to secure operations – planning – Physical access, security and ongoing cost – Logical and virtual access – Personnel security – Backup and recovery –

Managing changes in operational environments – Resilience in operations.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Vic (J.R.) Winkler, “Securing The Cloud: Cloud Computing Security Techniques and Tactics”, Syngress; 1st edition, 2011
2. John R.Vacca, “Cloud Computing Security” , CRC Press, O’Reilly, 2016.
3. Chris Dotson, “Practical Cloud Security: A Guide for Secure Design and Deployment”, first edition, O'Reilly, 2019.
4. Eyal Estrin, “Cloud Security Handbook: Find out how to effectively secure cloud environments using AWS, Azure, and GCP”, Packt Publishing, 2022.
5. Ted Coombs, “Cloud Security for Dummies”, 1st edition, For Dummies (publishers), 2022.

COURSE OUTCOMES:

CO1: Explain the security design principles and end to end access controls

CO2: Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.

CO3: Analyze the risks and cloud data security mechanisms for internal and external cloud providers.

CO4: Design security architectures that assures secure isolation of physical and logical infrastructures

CO5: Assess the end to end security requirements in operational environments of cloud computing.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	L				
CO2	M	L			
CO3	L	L	L		
CO4	M				
CO5	M	L			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The course provides an in depth knowledge on providing end to end security solutions from the perspective of cloud providers and cloud consumers which reduces the overall operational cost of cloud infrastructures.

ITEY 207	WEB DESIGN AND MANAGEMENT	L	T	P	C
SDG: 08		3	0	0	3

COURSE OBJECTIVES:

The students have to

COB1: Familiarize the web page authoring fundamentals.

COB2: Explore the web languages using client-side script.

COB3: Learn the configuration of web servers and discuss the services.

COB4: Know the website design with different designing methodology.

COB5: Learn how to publish the website by applying design technologies.

MODULE I WEB PAGE AUTHORING FUNDAMENTALS 9

Introduction to Web Site Development -Markup Language and Site Development Essentials-XHTML Coding - Elements -Hyperlinks -Tables -Web Forms -Image Techniques -Frames -GUI HTML 5 Editors- Introduction to Networking -TCP/IP Suite and Internet Addressing.

MODULE II WEB LANGUAGES 9

JavaScript Introduction -Functions, Methods and Events -Program Flow -Object Model - Browser Objects -Language Objects -Interactive Forms -Cookies and JavaScript Security -Client-Side JavaScript Getting Started with Perl- Intro-Arrays - Matching and Substitution -Subroutines –References-Packages –Modules-J query - Bootstrap - Angular Java Script.

MODULE III SERVICES, SERVERS, INTEGRITY 9

Web servers - IIS & Apache -Windows 2000 DNS Server -Configuring DNS in Windows NT –NetBIOS -Managing WINS -Introduction to FTP -Virtual FTP Servers -FTP Access -Telnet -Xinetd -Web Applications -Perl and E-Commerce Web Servers -Web Servers and Gateways Web Server and Gateway Overview -Streaming Media Servers -Configuring a News Server -Optimizing Servers-Introduction to Security -SSL -Proxy Servers -Introduction to Fault Tolerance -Disaster Assessment and Recovery.

MODULE IV DESIGN METHODOLOGY 9

Overview of Web Design Concepts -Web Project Management Fundamentals -Web Page Layout and Elements -Web Site Usability and Accessibility -Navigation Concepts -Web Graphics -Multimedia and The Web -Ethical and Legal Issues in Web Development -XML and XHTML -Web Page Structure -Tables and Framesets -Cascading Style Sheets -Site Content and Metadata -JSON.

MODULE V DESIGN TECHNOLOGY 9

Development with Macromedia Dream weaver 10 - Advanced Features -Image Editing with Macromedia Fireworks -Multimedia with Macromedia Flash 11 - Timeline, Layers, Symbols and Buttons - Tweens - Movie Clips - Action script, Masks and Practical Uses -JavaScript and DHTML Fundamentals -Plus-ins and Java Applets -HTTP Servers and Web Applications -Databases -Web Site Publishing and Maintenance.

L- 45; TOTAL HOURS – 45

REFERENCES:

1. L. Mohler, Flash 8 Graphics, 'Animation and Interactivity by James', Onword Press, Thomson Learning, 2006.
2. H. M. Deitel**,** P. J. Deitel and T. R. Nieto– How to program', PHI/Pearson Education Asia, November 2011**.**
3. William Stallings, 'Data and Computer Communications', Pearson, 2007.
4. J. Hunter and William Crawford, 'Java Servlet Programming', O'Reilly Pub1999.
5. Anders Miller, Michael Schwartzbach, 'An Introduction to XML and Web Technologies', Addison Wesley, 2006.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Discuss the web authoring fundamentals.

CO2: Demonstrate web languages and implement client-side scripting.

CO3: Configure web servers and evaluate services.

CO4: Design the website by using specific methodologies.

CO5: Publish the website by applying design technologies.

Board of Studies (BoS): 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M				
CO2	H	H				
CO3	H	H				
CO4	H	H				
CO5	H	H				

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The knowledge of Web Design and Management leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITEY 208	**INFORMATION VISUALIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The students have to

COB1: To understand the needs of data visualization

COB2: To learn data preparation and pre-processing.

COB3: To learn data visualization techniques

COB4: To acquire knowledge in views

COB5: To study about real-time problems

MODULE I INTRODUCTION TO DATA VISUALIZATION 9

Data visualization- Need of data visualization- Data – Types of data- Qualitative data - Nominal data - Ordinal data - Quantitative data -Interval data - Ratio data- Qualitative data representation: Word Clouds- Concept map – Quantitative data representation: Pie chart- Bar chart - Scatter plot.

MODULE II DATA MANIPULATION 9

Introduction to Pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries-Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership-Reading and Writing Data in Text Format-Data pre-processing- Handling of missing data-data imputation- outlier detection and removal.

MODULE III DATA VISUALIZATION 9

Python packages for visualization – Matplotlib – Seaborn- Plotly. Defining Plot types- Bar Chart-Column chart- Scatter plot- Histogram- Box plot- Stacked bar chart- Line chart- Area Chart-Pie chart- Defining axis lengths, limits, plot lines-plot Properties-Adding Labels, ticks, legends, annotation – creating interactive visualizations using Plotly package.

MODULE IV VIEWS 9

Single views – Overall perceptual concerns – measures – group of items – attributes of items – Multiple and coordinated views.

MODULE V CASE STUDY 9

Visualizing Telemetry to Improve Software - Visualizing Biological Data - Geographic Visualizations - Visualizing Urban Data for Social Change

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Ossama Embarak.,"Data Analysis and Visualization Using Python (Analyze Data to Create Visualizations for BI systems)", A press publisher,2019, (ISBN:9781484246528).
2. Danyel Fisher and Miriah Meyer, "Making Data Visual", O'Reilly Media Inc., 2018
3. https://mschermann.github.io/data_viz_reader/index.html
4. Purna Chander Rao Kathula, "Hands on Data Analysis and visualization with pandas", bpb Publications, 2020.
5. Bharathi Motwani, "Data Analytics using Python", Wiley Publication, 2020

COURSE OUTCOMES:

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

CO1: Identify the role of data visualization in data science.

CO2: Explain the data extraction and handling in real time data.

CO3: Describe different charts and packages used for visualization.

CO4: Explain various types of views

CO5: Provide solutions for the given problem using the visualization techniques

Board of Studies (BoS) :

16thBoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2		M			
CO3	M	M			
CO4		M			
CO5		M			L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of the Information Visualization Techniques leads to developing software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 209	AGILE SOFTWARE DEVELOPMENT	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Learn Agile principles and process.

COB2: Understand the SCRUM process model

COB3: Gain knowledge about Extreme Programming

COB4: Understand various automated tools

COB5: Gain knowledge about Lean thinking, Magical thinking and Fast delivery concepts.

MODULE I INTRODUCTION 9

The Flaw in the Plan - Traditional Software Development - Lean Software Development - Project Management 2.0 – The Agile Principles – Agile Manifesto – Scrum - Test Driven Development - Extreme Programming - Rational Unified Process.

MODULE II SCRUM 9

Kanban – Scrum Essential – Scrum Day by Day – Agile in the Organization – Support – Mechanism – A Call to Action.

MODULE III EXTREME PROGRAMMING 9

The Primary Practices of XP - The XP Values Help the Team Change Their Mindset - An Effective Mindset Starts with the XP Values - Understanding the XP Principles Helps You Embrace Change - XP, Simplicity, and Incremental Design.

MODULE IV TOOLS AND CONSIDERATIONS 9

Project Management Tools - Collaboration Tools - Development Infrastructure and Environment - Considerations on Teaming and Leadership - Considerations on Planning and Architecture.

MODULE V LEAN 9

Lean Thinking - Creating Heroes and Magical Thinking - Eliminate Waste - Gain a Deeper Understanding of the Product – Fast Delivery – The Agile Coach.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Andrew Stellman and Jennifer Greene, "Learning Agile", O'reilly, 2021.
2. Olga Filipova and RuiVilão, “Software Development From A to Z: A Deep Dive into all the Roles Involved in the Creation of Software”, Apress

Publishers, 2018.

REFERENCES:

1. Ivan Lukovic and Yen Ying Ng, "Lean and Agile Software Development, 6th International Conference, Springer, 2022.
2. Peggy Gregory, Casper Lassenius, Xiaofeng Wang and Philippe Kruchten, "Agile Processes in Software Engineering and Extreme Programming", 22nd International Conference, Springer, 2021.
3. Juan Garbajosa, Xiaofeng Wang and AdemarAguiar, "Agile Processes in Software Engineering and Extreme Programming", 19th International Conference, Springer, 2018.
4. Jeff Sutherland, "Scrum: The Art of Doing Twice The Work in Half The Time", Crown Business, 2014.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Apply agile principles in software development

CO2: Design and develop software using SCRUM model

CO3: Practice the Extreme Programming concept in software development

CO4: Use the automated to tools for fast development

CO5: Describe the lean thinking, magical thinking and fast delivery concept

CO6: Develop any software using agile concept

Board of Studies (BoS) :

16th BoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		M			
CO2	M				
CO3		M			
CO4		M			
CO5				M	
CO6	H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement : The proper learning of the Agile Software Development leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 210	DevOps	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Understand the fundamentals of DevOps

COB2: Learn scrum and agile concepts

COB3: Gain knowledge about DevOps for the enterprise

COB4: Understand the customization process and various metrics.

COB5: Gain knowledge about DevOps adoption

MODULE I INTRODUCTION 9

An overview – Practices – Culture Developing the Playbook - Developing a Business Case for a DevOps Transformation - Application Life Cycle Management.

MODULE II SCRUM AND AGILE CONCEPTS 9

The Scrum Framework – Kanban - Scaling Agile - NEXUS–SPS - Large-Scale Scrum - Agile Maps to ALM.

MODULE III THE ENTERPRISE 9

Scaling DevOps for the Enterprise - Leading DevOps Adoption in the Enterprise: DevOps as a Transformation - Developing a Culture of Collaboration and Trust - DevOps Thinking for the Line of Business - Starting with Pilot Projects - Rearing Unicorns on an Aircraft Carrier.

MODULE IV PROCESS TEMPLATES AND METRICS 9

ALM Revisited – Traceability - The Process in Azure DevOps - Process Customization - Agile Testing - TDD and Automated Testing - Continuous Integration/Continuous Delivery - Metrics in Agile Projects.

MODULE V CASE STUDY 9

DevOps Adoption - Organization Background - Roadmap Structure - Adoption Roadmap.

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Joachim Rossberg, "Agile Project Management with Azure DevOps", Academic Press, 2019.
2. Sanjeev Sharma, "The DevOps Adoption Playbook: A Guide to Adopting DevOps in a Multi-Speed IT Enterprise", John Wiley & Sons, Inc., 2017.

3. John Arundel and Justin Domingus, "Cloud Native DevOps with Kubernetes", O'Reilly Media, Inc., 2019
4. Suren Machiraju and Suraj Gaurav, "DevOps for Azure Applications Deploy Web Applications on Azure", Academic Press, 2018.

COURSE OUTCOMES:

Upon Completion of course the students will be able to :

CO1: Explain the DevOps concepts

CO2: Describe the Scrum and Agile concepts

CO3: Apply the DevOps concepts in an enterprise

CO4: Describe the customization process and to measure the software development.

CO5: Apply theDevOps concepts in the real-time applications

CO6: Manage the any software project

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		M			
CO2	M				
CO3	M	M			
CO4		M			
CO5				M	L
CO6				M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of the DevOps leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 211	COMPUTER VISION	L	T	P	C
SDG 4:		3	0	0	3

COURSE OBJECTIVES:

Students have to:

COB1: Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us.

COB2: Understand the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis, visual geometric modeling, stochastic optimization.

COB3: Explore and contribute to research and further developments in the field of computer vision.

COB4: Familiar the applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering.

COB5: Develop object recognition applications.

MODULE I INTRODUCTION TO COMPUTER VISION 9

Image Processing, Computer Vision and Computer Graphics, Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

MODULE II IMAGE REPRESENTATION AND ANALYSIS 9

Image representation, Image processing techniques like color and geometric transforms, Edge-detection Techniques, Filtering, Mathematical operations on image and its applications like convolution, filtering.

MODULE III MOTION ESTIMATION 9

Introduction to motion, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion and models.

MODULE IV OBJECT RECOGNITION 9

Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

Module V IMAGE ANALYSIS 9

Region growing-Edge based approaches to segmentation-Graph-Cut-Mean-Shift.

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
4. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA).Springer, 2010.
6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
7. E. R. Davies, Computer & Machine Vision, 4thEdition, Academic Press,2012
8. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
9. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

COURSE OUTCOMES:

On completion of course students will be able to:

CO1: Implement fundamental image processing techniques required forComputer Vision.

CO2: Understand Image formation process.

CO3: Perform various analyses on images to extract features from Images.

CO4: Develop applications using computer vision techniques.

CO5:Suggest a design of a computer vision system for a specific problem.

Board of Studies (BoS) :
23rd BOS of ECE held on 13.07.2022

Academic Council:
19th Academic Council held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H			H	
CO2			H		H
CO3		H			M
CO4	H				
CO5		H			L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG4:Ensuring inclusive and equitable quality education and promotes lifelong learning opportunities for all.

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough knowledge about social network analysis.

ITEY 212	IMAGE AND VIDEO ANALYTICS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1:describe and explain basic principles of digital image processing.

COB2: discuss image processing techniques.

COB3:design and implement algorithms for image analysis

COB4:compare various optimization techniques for image processing.

COB5: assess the performance of image processing algorithms.

MODULE I DIGITAL IMAGE FUNDAMENTALS 9

Review of Digital Image Processing fundamentals- Elements of visual perception, Image sampling & quantization, Color image models-Image transforms-DFT, DCT, Haar, Hadamard transform.

MODULE II IMAGE PROCESSING TECHNIQUES 9

Image Enhancement- Filters & Histogram techniques, Pseudo color processing, SEM analysis application, Morphological image processing, Image restoration techniques- Remote sensing application, Image Compression-Scalar & Vector Quantization, Wavelet based compression.

MODULE III IMAGE ANALYSIS 9

Image segmentation-types- Graph theory for segmentation -Object Recognition-Parametric & Non-parametric method-Pattern matching, Neural networks & deep learning, Image fusion-types,3D image visualization, image analysis for medical images.

MODULE IV OPTIMISATION TECHNIQUES FOR IMAGE PROCESSING 9

Need for optimization-Types of optimization techniques-Swarm intelligence based-Ant Colony Optimization (ACO), Harmony Search Algorithm (HSA) and Artificial Bee Colony (ABC) algorithm and Particle Swarm Optimization (PSO) and Evolution based-Genetic Algorithm(GA).

MODULE V APPLICATIONS OF IMAGE PROCESSING 9

Fingerprint classification-face recognition-Iris recognition- Digital watermarking for image-Medical image processing-Industrial machine vision applications-remote sensing application.

L - 45; TOTAL HOURS – 45

REFERENCES:

1. R. C. Gonzalez and R. E. Woods, “Digital Image Processing”, Fourth Edition, Pearson, 2018.
2. By Joshi, Madhuri A. Digital Image Processing: an Algorithmic Approach, PHI learning private limited,2017
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4. Rick S.Blum, Zheng Liu, “Multisensor image fusion and its Applications“, Taylor&Francis, 2006.
5. Vishal Monga, “Handbook of Convex Optimization Methods in Imaging Science”, Springer,2017.
6. Handbook of Image and Video processing – Al Bovik (Alan C Bovik), Academic Press, Second Edition, 2005.

REFERENCES:

1. John C. R., “The Image Processing Handbook”, 6thEdition, CRC Press, 2011.
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education, 2009.Pvt Ltd, New Delhi.
3. David Salomon: Data Compression- The Complete Reference, Springer Verilog New York Inc., 2nd Edition, 2001.

COURSE OUTCOMES:

CO1: Acquire the knowledge of fundamental concepts of a digital image processing system & image transform

CO2: Describe various techniques for image enhancement, restoration& compression.

CO3: Recognize and apply suitable optimization techniques for image processing applications

CO4: Identify and use appropriate performance metrics for various image processing applications

CO5: Describe about applications of image processing concepts

CO6: Explore the possibility of applying image processing concepts in various applications

Board of Studies (BoS):
16thBoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H	M		L	
CO2			H		H
CO3	H	M		M	
CO4	M		H		
CO5		L			
CO6	H	M	M	L	

Note: L- Low Correlation M - Medium Correlation H - High Correlation

SDG 8:Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: Sustainable Goals and their universality can only be attained through readily available data from affordable sources such as satellite images and similar commonly available sources to achieve the economic growth.

ITEY 213	MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

The students have to

CO1: Understand the basics of data science.

CO2: Understand the fundamental concepts of linear algebra.

CO3: Understand the basic concepts of Probability.

CO4: Understand the Linear regression.

CO5: Understand the approximation algorithms.

MODULE I BASICS OF DATA SCIENCE 9

Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems.

MODULE II LINEAR ALGEBRA 9

Matrices and their properties (determinants, traces, rank, nullity, etc.); Eigenvalues and eigenvectors; Matrix factorizations; Inner products; Distance measures; Projections; Notion of hyperplanes; half-planes.

MODULE III PROBABILITY, STATISTICS AND RANDOM PROCESSES 9

Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White-noise process.

MODULE IV OPTIMIZATION 9

Unconstrained optimization; Necessary and sufficiency conditions for optima; Gradient descent methods; Constrained optimization, KKT conditions; Introduction to non-gradient techniques; Introduction to least squares optimization; Optimization view of machine learning. Introduction to Data Science Methods: Linear regression as an exemplar function approximation problem; Linear classification problems.

MODULE V NP HARD PROBLEMS 9

Turing Machines, Recursive and Recursively Enumerable languages. Cantor's Diagonalization theorem. Complexity classes - NP-Hard and NP-complete

Problems - Cook's theorem NP completeness reductions. Approximation algorithms

L –45 ; TOTAL HOURS – 45

REFERENCES:

1. G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016.
2. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010.
3. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
4. David G. Luenberger . Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969.
5. Cathy O'Neil and Rachel Schutt . Doing Data Science, O'Reilly Media, 2013.
6. H. Cormen, C. E. Leiserson, R. L. Rivest, C Stein, Introduction to Algorithms, PrenticeHall India.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Ability to use the mathematical concepts in the field of data science.

CO2: Employ the techniques and methods related to the area of data science in variety of applications.

CO3: Apply logical thinking to understand and solve the problem in context.

CO4: Apply prediction techniques to solve real world problems.

CO5: Apply Approximation algorithms.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M	-	-	-	-
CO2	M	M	-	-	
CO3	M	H	-	-	M
CO4	H	M	-	-	M
CO5	M	L	-	-	

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This course is an introduction to the mathematical foundations of data science and machine learning. The central theme of the course is the use of linear algebra and optimization in posing and solving modern problems leveraging data focusing on various applications

ELECTIVES
SEMESTER III

ITEY111	DEEP LEARNING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: understand the theoretical foundations, algorithms and methodologies of Neural Network.

COB2: learn the various types of neural architecture models.

COB3: know about the architecture of deep feedforward networks.

COB4: learn the convolution functions and algorithms.

COB5: understand deep recurrent networks and deep learning applications.

MODULE I MACHINE LEARNING BASICS **9**

Introduction – Machine Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality –Training neural networks with back propagation - Practical issues in neural network training.

MODULE II NEURAL ARCHITECTURES **9**

Neural architectures for binary classification models - Least squares regression – Logistics regression- Support vector machines - Neural architectures for multiclass models- Multiclass perceptron - Weston Watkins SVM - Nonlinear activations -Application of simple neural architecture.

MODULE III DEEP FEEDFORWARD NETWORKS **9**

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

MODULE IV CONVOLUTION NETWORKS **9**

Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet – Applications – Data types – Efficient convolution algorithms – Random / unsupervised features – Convolution networks and deep learning.

MODULE V RECURSIVE NETS **9**

Recurrent neural networks (RNN) – Bidirectional RNN – Encoder- Decoder – Deep recurrent networks – Recursive neural networks – Echo state networks – Applications – Large scale deep learning – Computer vision – Natural language Processing.

L- 45; TOTAL HOURS – 45

REFERENCES:

1. Eugene Charniak, “Introduction to Deep Learning”, The MIT Press, 2019.
2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer Publications, 2018.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016.
4. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Recognize the characteristics of deep learning models that are useful to solve real-world problems.

CO2: Explain the types of regression techniques and SVM.

CO3: Discuss about the different learning algorithms for feed forward networks

CO4: Identify the appropriate convolution algorithms for an application

CO5: Write a case study on a real world deep learning application.

Board of Studies (BoS):

16thBoS of IT held on 18.08.2022

Academic Council:

19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				H
CO2		M		M	
CO3		H			H
CO4	H			H	
CO5		M			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No. 8

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Understanding of Deep Learning that includes mastery of essential academic content, thinking critically and solving complex problems; working collaboratively and communicating effectively, having an academic mindset, and being empowered through self-directed learning.

ITEY112	WIRELESS AND MOBILE COMMUNICATION	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

The students have to

COB1: Understand the different cellular systems and their advancements from one generation to other.

COB2: Know the different basic propagation mechanisms.

COB3: Have a knowledge about designing a mobile system.

COB4: Recognize various multipath propagation models

COB5: To study the various mobile modulation and demodulation techniques.

COB6: Realize how to alleviate fading effects, and multiple access techniques.

MODULE I INTRODUCTION TO MOBILE COMMUNICATION SYSTEMS **9**

Evolution of Mobile Radio Communications – Present Day mobile communication – Fundamental Techniques – Modern Mobile communication systems – 1G, 2G, 3G, Beyond 3G – Wireless Transmission Protocols.

MODULE II MOBILE SYSTEM DESIGN FUNDAMENTALS AND RADIO WAVE PROPAGATION **9**

Frequency reuse – Channel assignment strategies – Handoff strategies – Interference and system capacity – Trunking and Grade of service – Improving coverage and capacity in cellular systems – Free Space Propagation Model – The Three Basic Propagation Mechanisms: Reflection, Diffraction and Scattering – Link Budget Design – Outdoor Propagation Models – Indoor Propagation Models.

MODULE III WAVE PROPAGATION AND FADING **9**

Multipath Propagation – Multipath and Small Scale Fading – Types of Small Scale Fading – Multipath Channel Parameters – Statistical Models for Multipath Propagation – Simulations of Clarke and Games Fading Model.

MODULE IV MOBILE MODULATION TECHNIQUES **9**

Amplitude Modulation – Angle Modulation – Digital Modulation – Line coding – Pulse Shaping Techniques – Linear Modulation Techniques – Spread Spectrum Modulation Techniques – Modulation Performance in Fading and Multipath Channels.

MODULE V TECHNIQUES TO ALLEVIATE FADING EFFECTS AND MULTIPLE ACCESS TECHNIQUES **9**

Equalization: – Linear and Non-linear Equalization – Algorithms for Adaptive Equalization Diversity: Polarization Diversity, Frequency Diversity, Time Diversity – Channel Coding: Fundamentals, Block Codes, Convolutional Codes, Coding Gain – Multiple Access Techniques: FDMA, TDMA, SSMA, SDMA.

L - 45; TOTAL HOURS – 45

REFERENCES:

1. Theodore S. Rappaport, "Wireless Communications Principles and Practice", Second Edition, Pearson, 2014.
2. Andreas F.Molich, "Wireless Communications", 2nd Edition, John Wiley, 2011.
3. Jorge L.OleneWA, "Guide to Wireless Communications", Fourth Edition, Cengage Learning, 2018.
4. Cory Beard and William Stallings, "Wireless Communication Networks and Systems", Third Edition, Pearson, 2018.
5. NishithTripathi and Jeffrey H. Reed, **"**Cellular Communications: A Comprehensive and Practical Guide", Wiley, 2014.
6. Ramjee Prasad and AlbenaMihovzka, "Horizons in Mobile and Wireless Communications Radio Interfaces" Artech House Mobile Communication Series, 2021.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO 1: Explain the fundamentals of cellular radio system design and increase the coverage capacity.

CO 2: Discuss various multipath propagation models and different types of fading.

CO 3: Demonstrate various mobile transmitter and receiver techniques.

CO 4: Apply various techniques to mitigate fading effects.

CO 5: Compare and contradict various multiple access techniques.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M	L	L	-	-
CO2	M	L	L	-	-
CO3	M	L	L	-	-
CO4	M	L	L	-	-
CO5	M	L	L	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Understanding the cellular radio communication systems and the various mobile transmission and reception techniques enable both the genders to get a quality education and promote their lifelong learning opportunities in the fastly growing internet field.

ITEY 113	TEXT, WEB AND SOCIAL MEDIA ANALYTICS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Learn text analysis and text pre-processing concepts

COB2: Understand various text analysis techniques

COB3: Acquire knowledge about sentimental analysis

COB4: Be familiar with social data mining concepts

COB5: Understand web data mining concepts

MODULE I INTRODUCTION 9

Introduction to Text Analytics - The Fundamentals of Content Analysis - Planning for Text Analytics - Text Preprocessing - Term-Document Representation.

MODULE II TEXT ANALYSIS TECHNIQUES 10

Semantic Space Representation and Latent Semantic Analysis - Cluster Analysis: Modeling Groups in Text - Probabilistic Topic Models - Classification Analysis: Machine Learning Applied to Text - Modeling Text Sentiment: Learning and Lexicon Models - Visualizing Analysis Results.

MODULE III SENTIMENT ANALYSIS 10

Sentiment Analysis of Movie Reviews - Latent Semantic Analysis (LSA) - Learning-Based Sentiment Analysis - SAS Visual Text Analytics.

MODULE IV SOCIAL DATA MINING 8

Mining Twitter - Mining Facebook - Mining Instagram - Mining LinkedIn

MODULE V WEB DATA MINING 8

Mining Text Files - Mining Web Pages - Mining Mailboxes - Mining GitHub

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Murugan Anandarajan, Chelsey Hill and Thomas Nolan, "Practical Text Analytics: Maximizing the Value of Text Data", Springer Nature, 2019.
2. Matthew A. Russell and Mikhail Klassen, "Mining the Social Web", O'Reilly Media, Inc., 2019
3. ChengXiangZhai and Sean Massung, "Text Data Management and Analysis", ACM, 2016.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Discuss text analysis and text pre-processing concepts

CO2: Explain various text analysis techniques

CO3: Discuss sentimental analysis concepts

CO4: Apply machine learning concepts for text mining

CO5: Extract useful information from the social media

CO6: Describe various web data mining concepts

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		M			
CO2		M			
CO3		M			
CO4		M			
CO5		M			
CO6		M			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of the text, web and social media data leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 114	ONTOLOGY AND SEMANTIC WEB	L	T	P	C
SDG: 08		3	0	0	3

COURSE OBJECTIVES:

The students have to

COB1: Know the basics of semantic web and ontology architectures.

COB2: Familiarize with the languages for semantic web and ontologies.

COB3: Know the use of ontology in semantic web.

COB4: Learn to use the appropriate tools for ontology.

COB5: Understand the real time applications of ontology and semantic web.

MODULE I INTRODUCTION 9

Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture.

MODULE II LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES 9

Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL- OWL.

MODULE III ONTOLOGY LEARNING FOR SEMANTIC WEB 12

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms - Evaluation.

MODULE IV ONTOLOGY MANAGEMENT AND TOOLS 10

Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. Volution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

MODULE V APPLICATIONS 5

Web Services – Semantic Web Services - Case Study for specific domain – Security issues – current trends.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering:with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web" Springer, March 2016.
2. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004
3. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer; 1 edition, 2002 John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley & Sons Ltd., 2003.
4. Dieter Fensel (Editor), Wolfgang Wahlster, Henry Lieberman, James Hendler, "Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential",The MIT Press, 2002.
5. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, 2003.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Outline the architectures of semantic web and ontology.

CO2: Utilize the languages used for ontology and semantic web.

CO3: Analyze the use of ontology in semantic web.

CO4: Use tools for ontology and semantic web.

CO5: Apply the semantic web and ontology in web services.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M				
CO2	H	M				
CO3	H	M				
CO4	M	H				
CO5	H	M				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and

productive employment and decent work for all.

Statement: The knowledge of the Ontology and Semantic Web leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITEY 115	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Learn the basic concepts of software project management and software estimation methods.

COB2: Know the software cost estimation methods.

COB3: Learn how to allocate resources for software projects.

COB4: Learn how to manage a project

COB5: Manage peoples

MODULE I PROJECT MANAGEMENT CONCEPT 9

Evolution of Software Economics – Improving Software Economics – Life-Cycle Phases – Manage People – Implement Process – Leverage Tools – Utilize Measurements.

MODULE II SOFTWARE ESTIMATION & COSTING 9

Form Vision - Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Organize Resources – Sketch Schedule – Write Plan.

MODULE III RISK MANAGEMENT 9

Risk Definition – Risk Categories – Risk Assessment (Identification / Analysis / Prioritization) – Risk Control (Planning / Resolution / Monitoring) – Failure Mode and Effects Analysis (FMEA)

MODULE IV SOFTWARE PROJECT MANAGEMENT 9

Monitor Project – Engineer a Great Product – Deliver System – Assess Project – Managing Global Software Projects.

MODULE V PEOPLE MANAGEMENT 9

PCMM – Team Management – Motivating Software Engineers Working in Virtual Teams Across Glob – Agile Project management

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Anna P. Murray, "The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond", JohnWiley& Sons, Inc., 2016.

2. Dragan Z and Milosevic, "Project Management ToolBox_ Tools and Techniques for the Practicing Project Manager", 2nd ed., John Wiley & Sons, Inc., 2016
3. GüntherRuhe, ClaesWohlin, “Software Project Management in a Changing World, Springer-Verlag, 2014
4. Bob Hughes,MikeCotterell,Rajib Mall, “Software Project Management “, 5th edition, Tata McGraw-Hill Education Pvt. 2011
5. Roger S. Pressman, “software engineering” 7th edition, Mc Graw Hill Education, 2014
6. Royce, W. “Software Project management: A Unified Framework”, Addison- Wesley, 1998.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Explain the software project management concepts

CO2: Estimate the cost and prepare project plan document.

CO3: Identify and analyze risks.

CO4: Express how to manage projects

CO5: Lead a team

CO5: Manage the people

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		M			
CO2		M			
CO3	M				
CO4				M	
CO5				M	L
CO6				M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: The proper learning of the Software Project management leads to monitor and control software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 116	DATA SCIENCE AND ANALYTICS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: Understand the terminologies and concepts of Data Science

COB2: Gather, store and process data for organizations

COB3: Learn the processes for extracting and useful patterns from large datasets.

COB4: Understand and describe the different stages in a data science project.

COB5: Learn the data manipulation and data visualization.

MODULE I INTRODUCTION TO DATA SCIENCE 8

Introduction- Data Science- Diverse applications of data science – Common data science terminologies – python for data science- Use of Jupiter Notebooks.

MODULE II DATA ANALYTICS LIFECYCLE 10

Data Analytics Lifecycle Overview- Key Roles for a Successful Analytics Project- Discovery- Data Preparation- Model Planning – Model Building – Communicate Results- Operationalize- Case Study: Global Innovation Network and Analysis (GINA).

MODULE III CLUSTERING AND ASSOCIATION 9

Clustering overview- K-means method- Determining number of clusters – Diagnostics – Association rules – apriori algorithm – Candidate rules - Application of association rules- Validation and testing.

MODULE IV REGRESSION AND CLASSIFICATION 9

Linear regression – Use-case - Model description – Logistic regression- use-case - model description –Bayes theorem - Naïve Bayes classifier - Smoothing – Diagnostics of classifier.

MODULE V DATA MANIPULATION AND VISUALIZATION 9

Introduction to NumPy – Data manipulation with Pandas-Data indexing - Selection –Handling missing data - Combining data sets - Visualization - Simple line plots - Scatter plots - Density and contour plots - Histograms.

L - 45; TOTAL HOURS - 45

TEXT BOOKS:

1. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, John Wiley & Sons Inc, 2015.
2. Jake VanderPlas ,"Python Data Science Handbook-Essential Tools for Working with Data", O'Reilly Media, 2016.

REFERENCES:

1. Carl Shan, William Chen, Henry Wang, and Max Song, "The Data Science Handbook: Advice and Insights from 25 Amazing Data Scientists", Data Science Bookshelf, 2015.
2. Viktor Mayer-Schönberger and Kenneth Cukier, "Big Data: A Revolution That Will Transform How We Live, Work, and Think", John Murray Publishers, 2017.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Discuss the different terminologies and various applications of data science.

CO2: Explain the overall life cycle of data analytics process with an example.

CO3: Identify the appropriate data analytical method for data extraction

CO4: Explain the various data science algorithms to build predictive models.

CO5: Use Python for data manipulation and visualization and build data science project.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1		M			
CO2		M			
CO3	M				
CO4				M	
CO5				M	L
CO6				M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and

productive employment and decent work for all.

Statement: The proper learning of the Software Project management leads to monitor and control software for the business requirements and engineering problems and this will support the students to get employment.

ITEY 117	GREEN COMPUTING TECHNOLOGY	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students have to

COB1: understand the terminologies and concepts of green computing

COB2: acquire knowledge to adopt green computing practices to minimize energy consumption

COB3: discuss the various green enterprise activities, functions and their role with IT

COB4: discuss the various laws, standards and protocols for regulating green IT.

COB5: analyze the various key sustainability and green IT trends with case studies.

MODULE I GREEN IT FUNDAMENTALS, ASSETS & MODELING 9

Green IT Fundamentals: Business, IT, Environment - Green IT Strategies: Drivers, Dimensions, Goals - Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management – Green Enterprise Architecture - Green Information Systems – Green Applications.

MODULE II GREEN IT FRAMEWORK & GREEN SOFTWARE 9

Data center virtualization – Implementing Green Data Center – Saving energy –Enabling transparency, Telecommuting, Teleconferencing and Teleporting – Going paperless - Materials recycling – Green Data center – Green Grid framework – Green Software: Energy-saving software techniques.

MODULE III GREEN ENTERPRISES AND ROLE OF IT 9

Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.

MODULE IV REGULATING THE GREEN IT: LAWS, STANDARDS AND PROTOCOLS 9

Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements

and Greenpeace.

MODULE V GREEN IT: AN OUTLOOK & CASE STUDY 9

Greening by IT: A seven-step approach to creating green IT strategy, Research and Development directions, Case Studies: Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

L – 45; TOTAL HOURS – 45

REFERENCES:

1. Alok Kumar Singh, Raj Kumar Patra," Green Computing and Its Applications", Computer Science, Technology and Applications, https://doi.org/10.52305/ENYH6923, December 16, 2021.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Telecommuting, Emereo Publishing. ISBN-13: 978-1-9215-2344-1,2014.
3. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Discuss Green Computing concepts, assets and business process management.

CO2: Outline Green data center framework and Green software methodologies.

CO3: Discuss information systems in Greening enterprises and their roles in IT.

CO4: Analyze the regulatory environment, Green building standards and Green datacenters.

CO5: Outline the green IT strategies and case studies.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				L
CO2	M			M	
CO3		H			
CO4					M
CO5	M			M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement :Green computing is to improved in a technical field that describes the way of designing, manufacturing, using, and disposing of computer equipment and other technology components in a way that reduces the scale of the harmful impact on the environment to some extent.

ITEY118	BLOCKCHAIN ARCHITECTURE AND USE CASES	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

The students have to

COB 1: Understand the problems solved by Block chain.

COB 2: Learn how technology can make institutions faster and less expensive.

COB 3: AnalyzetheBlock chain security for transactions and contracts.

COB 4: Gain knowledge about bitcoins and problems in bitcoins.

COB 5: Understand about cryptographic hash functions.

MODULE I INTRODUCTION TO BLOCKCHAIN 9

Introduction- Replacing institutions with technology – New technological paradigm Security and privacy – Cryptography – Block chain future – finance, Governance, crowdfunding, Insurance.

MODULE II PRINCIPLES OF BLOCKCHAIN 9

Working of Block chain – Distributed Ledgers- Creating a Block- Adding Transactions-Compiling the Ledger – Time stamp and Block ID – Linking Blocks together.

MODULE III CRYPTOGRAPHIC HASH FUNCTIONS 9

Working of block chain hashing- Cryptographic hash functions – High level overview of hashing in proof of work- Proof of stake – other consensus mechanisms.

MODULE IV MINING BITCOIN 9

Mining a Bitcoin block by hand- Bitcoin history – story of Satoshi – Bitcoin Scalability problem – wait times –restricted block size.

MODULE V BLOCKCHAIN CATEGORIES & TECHNOLOGIES 9

block chain categories- Challenges of block chain technology – Introduction to block chain programming – Potential of block chain – Governments and block chain - Bitcoin cash – Litecoin – Privacy coins – Dash – Hyper ledger – IOTA – Ripple.

L- 45; TOTAL HOURS – 45

REFERENCES:

1. Alan T.Norman, “block chain Technology Explained – The Ultimate Beginner’s Gide”,Create Space Independent Publishing Platform, 2017
2. Mark Atwood, “block chain Technology Explained”, CreateSpace Independent Publishing Platform, 2018
3. Antony Lewis. ‘The Basics of Bitcoins and Block chains: An introduction to Cryptocurrencies and the Technology that Powers Them”, two rivers distribution publishers, 2019.
4. Mark Gates, “block chain: Ultimate Guide to Understanding block chain, Bitcoin, Cryptocurrencies, Smart Contracts and the Future of Money”, Create Space Independent Publishing Platform, 2017.
5. Jeff Reed, “block chain: The Essential Guide to Understanding the block chain Revolution”, Create Space Independent Publishing Platform, 2016.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Discuss about applying block chain in various institutions.

CO2: Explain the significance of digital currencies like bitcoin.

CO3: Analyze the security and privacy issues of transactions & contracts.

CO4: Discuss about the application of block chain technology in real world applications.

CO5: Analyze the challenges and potential bottlenecks of block chain technology.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	H	L	L	-	-
CO2	H	L	L	-	-
CO3	L	H		-	-
CO4	L	H	L	-	-
CO5	L	H	L	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Understanding the concept of block chain Technology and its applications and analyzing the significance of it enable both the genders to get a quality education and promote their lifelong learning opportunities in the fast growing internet field.

ITEY 119 ANALYTICS OF THINGS L T P C

SDG: 8 3 0 0 3

COURSE OBJECTIVES:

Students have to

CO1: To understand the needs of AoT in Real Time.

CO2: To acquire knowledge about the IoT design methodology.

CO3: To study the Raspberry Pi and device integration.

CO4: To explore knowledge about real-time data analysis using various models.

CO5: To understand the IoT Tools and some real-time case studies.

MODULE I INTRODUCTION TO IOT AND AOT 9

Introduction to Analytic of Things- Why do we need AoT-Challenges faced by AOT- Introduction to IOT-Physical design of IOT- Logical design of IOT-IOT enabling Technologies - IOT Levels-Domain specific IOT- IOT and M2M-Difference between IOT and M2M-Software defined networking.

MODULE II INTERNET OF THINGS 9

IoT design methodology-purpose requirement specification - Process specification-Domain model specification- Information model specification-Service specification-IoT level specification-Function view specification-Operational view specification-Device and component integration-application development- Case study on IOT system for weather monitoring.

MODULE III LOGICAL DESIGN 9

Introduction to Python-Python Data types and structures–Functions-Modules-Packages-File Handling-Date/Time Operations- Classes- Python packages for IoT- IoT physical design- Raspberry Pi- Raspberry Pi board-Raspberry Pi interfaces- Programming Raspberry Pi with Python: Controlling LED with Raspberry Pi-Interfacing a LED with Raspberry Pi-Interfacing a Light Sensor with Raspberry Pi-Other IOT devices.

MODULE IV ANALYTICS OF THINGS 9

Data Analytics for IoT-Apache Hadoop: Map Reduce Programming Model-Hadoop Map Reduce Job Execution- Map Reduce Job Execution workflow-Hadoop cluster setup-Apache oozie: setting up Oozie- Oozie workflow for IoT data analysis - Apache Spark-Apache storm: Setting up a storm cluster-Using Apache storm for Real time Data Analysis-REST based approach.

MODULE V TOOLS AND CASE STUDIES 9

Introduction-Chef-Setting up Chef- Chef Case Studies-Puppet-Puppet case study-IoT code generator- Case studies for IOT design: Introduction-Home automation- Smart cities- Environment based IoT automations- Agriculture-Productive Applications.

L –45 ; TOTAL HOURS – 45

REFERENCES:

1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Orient Black swan Private Limited - New Delhi, 2015, 1st Edition. (ISBN: 978-8173719547).
2. Analytics of Things- https://analyticsindiamag.com/analytics-things-aot/.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Explore the IoT and AoT.

CO2: Understand design methodology involved in IoT.

CO3: Became familiar with Raspberry Pi.

CO4: Explore the methods involved in handling data collected by IoT devices.

CO5: Explore the IoT tools and real-time applications of IoT and AoT.

Board of Studies (BoS):
16th BoS of IT held on 18.08.2022

Academic Council:
19th Academic Council meeting held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5
CO1	M				
CO2	M	H	H		
CO3	H	H			M
CO4	H	H	M		
CO5	H	H	M		H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: Analytics of Things describe the analysis of the data generated by the Internet of Things devices. This leads to making the connected devices smart and to give the devices the ability to make intelligent decisions.

OPEN ELECTIVE COURSES

OEEY 701	ANALYTICAL TECHNIQUES	L	T	P	C
SDG: 6, 7		3	0	0	3

COURSE OBJECTIVES:

To make the students to understand the

COB1: basics in data analysis

COB2: basics and principles in volumetric and gravimetric analysis

COB3: types and principles of electro analytical methods

COB4: principles and analysis of spectroscopic techniques

COB5: the principle and methods in chromatography and thermal analysis

MODULE I DATA ANALYSIS 9

Precision and accuracy, Classification of errors, methods of minimization and elimination of errors Mean and standard deviation; absolute and relative errors; students t-test, F-test, linear regression for deriving calibration plots, covariance and correlation coefficient

Statistics for analytical experimentation: Probability, Regression analysis, Data analysis and signal enhancement.

MODULE II VOLUMETRIC METHODS OF ANALYSIS 9

Different methods of expressing concentration terms, Difference between titrimetic and volumetric analysis, Types and roles of indicators - Principle and reactions involved in neutralization, precipitation, complexometric and redox titrations, calculations involving stoichiometry – for all types of systems - Gravimetric analysis (volatilisation and precipitation methods)

MODULE III ELECTROANALYTICAL METHODS 9

Types of electrodes - Conductometric Titrations - Potentiometric titrations - pH-metry and ion-selective electrodes - Amperometric titrations - Coulometric Titrations, DM Electrode - polarography - electrogravimetry - voltammetry, cyclic voltammetry, impedance studies - Electrochemical sensors, ISFETs, CHEMFETs.

MODULE IV SPECTROPHOTOMETRIC TECHNIQUES 9

Quantitative applications of Colorimetric analysis – UV-Visible spectrophotometry – *Atomic absorption spectroscopy* (*AAS*) - atomic emission spectroscopy (AES), *Flame photometry*, ICP-AES - Fluorescence

spectroscopy, Stern Volmer Equation and quantum yield calculation.

MODULE V CHROMATOGRAPHIC TECHNIQUES AND THERMAL METHODS 9

Chromatography**:** Paper, TLC and column Chromatography – Detectors in Chromatography - GC, HPLC, (hyphenated techniques GC/MS, LC/MS) and GPC -– ion exchange chromatography – Electrochromatography**:** Capillary electrophoresis and gel electrophoresis

Thermal analytical techniques: TGA, DTA, DSC, DMA – Chemisorption Techniques – TPD, TPO, TPR, TPS.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. Skoog D.A., Holler F.J. and Nieman T.A., Principles of Instrumental Analysis, 5th Edition, Harcourt College Publication., Singapore, 1998.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

COURSE OUTCOMES:

The student will be able to

CO1: analyse the numerical data without error

CO2: perform the volumetric and gravimetric analysis of chemical compounds and interpret the result

CO3: perform the electro analytical titrations and analyse the result

CO4: identify the appropriate spectral technique and do the spectral analysis and interpret the data

CO5: perform the chromatographic techniques and separate the compounds

Board of Studies (BoS):
12th BoS of Chemistry held on 22.07.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M		M											
CO2	H	M		M											
CO3	H	M		M		H									
CO4	H	M		M	M	H									
CO5	H	M		M	M	H									

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 6: Clean Water & Sanitation
SDG 7: Affordable and Clean Energy

Statement: Through various analytical methods, innovative, cheap and affordable materials can be developed and can be employed in the area of clean water, sanitation and energy

OEEY 702 ARTIFICIAL INTELLIGENCE AND IOT L T P C

SDG: 8 3 0 0 3

COURSE OBJECTIVES:

COB1: To learn the working of intelligent agents.

COB2: To study the various search techniques and optimization of search.

COB3: To represent knowledge in first order logic**.**

COB4: To know the fundamentals of IoT.

COB5: To learn the IoT architecture and protocol stack.

MODULE I ARTIFICIAL INTELLIGENCE INTRODUCTION 9

Artificial Intelligence Foundations - Artificial Intelligence History - Agents and Environments - Structure of Agents - Problem-Solving Agents - Search Algorithms - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions.

MODULE II SEARCH OPTIMIZATIONS 9

Local Search and Optimization Problem - Continuous Spaces - Nondeterministic Actions - Partially Observable Environments - Online Search Agents and Unknown Environments - Constraint Satisfaction Problems – Backtracking Search – Adversarial Search and Games - Alpha Beta Search.

MODULE III KNOWLEDGE REPRESENTATION 9

Knowledge Based Agents – Propositional Logic – First Order Logic – Inference in First Order Logic – Forward Chaining – Backward Chaining.

MODULE IV IOT FUNDAMENTALS 9

Fundamentals of IoT – Characteristics of IoT – IoT architecture and Components – Logical Design of IoT – Communication Models – IoT Communication APIs.

MODULE V IOT ARCHITECTURE AND PROTOCOLS 9

Structure – Objectives – Three layer and Five Layer Architecture – Cloud and Fog based Architecture – IoT Network Protocol Stack - IoT Technology Stack – Case Study – Applications of AI in IoT.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, Fourth Edition, 2020. ISBN: 978-0134610993.
2. Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko,

Kamal Kant Hiran, Internet of Things (IoT): Principles, Paradigms and Applications of IoT, BPB Publications, First Edition, 2020, ISBN: ISBN: 978-9389423365.

REFERENCES:

1. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, Artificial Intelligence (AI): Recent Trends and Applications, CRC Press, 2021, ISBN: 978-0-367-43136-5.
2. Vlasios Tsiatsis, Stamatis Karnouskos, Jan, Internet of Things: Technologies and Applications for a New Age of Intelligence, 2nd Edition, Academic Press, 2019, ISBN: 978-0-12-814435-0

COURSE OUTCOMES: The student will be able to

- Identify the suitable search algorithms for solving problems.
- Employ AI adversarial game search techniques while evaluating the application of more real world problems.
- Use first order logic for wide variety of applications, from planning and diagnosis to knowledge representation and reasoning.
- Apply the technologies, standards, and protocols that are best suited for low-level sensor nodes.
- Determine the most appropriate IoT Devices and Sensors based on case Studies.

Board of Studies (BoS) :
21st BoS of CSE held on 27.02.2023

Academic Council:
20th AC held on 13.04.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2
CO1	H	M	H	L	M	-	L	-	-	L	-	M	H	M
CO2	H	H	H	L	M	-	L	-	-	L	-	H	M	H
CO3	H	H	H	L	L	-	-	-	-	L	-	L	M	H
CO4	H	M	H	L	L	-	-	-	-	-	-	M	M	H
CO5	H	H	H	L	L	-	-	-	M	-	M	M	H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Statement: The objective of AIoT is to improve human-machine interactions, IoT operations and data management and analytics.

OEEY 703	BIOMATERIALS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To enable the students understand importance of and properties of Biomaterials

COB2: To familiarize the students with different orthopaedic materials.

COB3: To understand different cardiovascular materials.

COB4: To help students study about materials in opthalmology

COB5: To make the students understand applications of various biomaterials

MODULE I BIOLOGICAL PERFORMANCE OF MATERIALS 9

Biocompatibility- Introduction to the biological environment – Material response: swelling and leaching, corrosion and dissolution, deformation and failure, friction and wear – Host response: the inflammatory process - coagulation and hemolysis- approaches to thrombo- resistant materials development.

MODULE II ORTHOPAEDIC MATERIALS 9

Bone composition and properties - temporary fixation devices - joint replacement – Biomaterials used in bone and joint replacement: metals and alloys – Stainless steel, cobalt based alloys, titanium based materials – Ceramics: carbon, alumina, zirconia, bioactive calcium phosphates, bioglass and glass ceramics – polymers: PMMA, UHMWPE/HDPE, PTFE – Bone cement – Composites.

MODULE III CARDIOVASCULAR MATERIALS 9

Blood clotting – Blood rheology – Blood vessels – The heart – Aorta and valves – Geometry of blood circulation – The lungs - Vascular implants: vascular graft, cardiac valve prostheses, cardiac pacemakers – Blood substitutes – Extracorporeal blood circulation devices.

probability-internal conversion- nuclear isomerism.

MODULE IV DENTAL MATERIALS 9

Teeth composition and mechanical properties – Impression materials – Bases, liners and varnishes for cavities – Fillings and restoration materials – Materials for oral and maxillofacial surgery – Dental cements and dental amalgams – Dental adhesives.

MODULE V MATERIALS IN OPTHALMOLOGY 9

Biomaterials in ophthalmology – Viscoelastic solutions, contact lenses,

intraocular lens materials – Tissue grafts – Skin grafts – Connective tissue grafts – Suture materials – Tissue adhesives – Drug delivery: methods and materials – Selection, performance and adhesion of polymeric encapsulants for implantable sensors- biomemtic materials-Technology from nature.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Sujata V. Bhat. Biomaterials, Narosa Publication House, New Delhi, 2002.
2. Jonathn Black. Biological Performance of Materials: Fundamentals of biocompatibility, Marcel Dekker Inc, New York, 1992.
3. D.F.Williams (editor). Materials Science and Technology: A comprehensive treatment, Volume 14. Medical and Dental Materials, VCH Publishers Inc, New York, 1992.
4. F.Silver and C.Doillon. Biocompatibility: Interactions of Biological and implantable materials. Volume I Polymers, VCH Publishers Inc, New York, 1989.
5. L.L.Hench and E.C.Ethridge. Biomaterials: An Interfacial Approach, Academic Press, 1982.
6. Joon Park, R. S. Lakes, Biomaterials. An Introduction, Springer, third edition, 2010. Springer

COURSE OUTCOMES:

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

CO1: importance and properties of biomaterial..

CO2: different classes of orthopaedic materials

CO3: different types of cardiovascular materials.

CO4: various types of materials used in ophthalmology.

CO5: applications of various biomaterials

Board of Studies (BoS) :	**Academic Council:**
BOS of Physics was held on 30.6.22	19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	M	L	L	M	M	M	L	L	L	M	M	M	M	M
CO2	H	M	M	L	L	M	L	L	L	L	L	M	M	M	M
CO3	H	M	M	L	L	L	L	L	L	L	L	M	M	M	M
CO4	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M
CO5	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement : The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

OEEY 704	BIOMEDICAL INSTRUMENTATION	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the human physiological systems.

COB2: To know the different aspects of biosignal acquisition.

COB3: To understand the basics in biopotential recorders.

COB4: To know the importance methods, instruments available for biomedical field.

COB5: To analyze the special biomedical instrumentation systems.

MODULE I HUMAN PHYSIOLOGICAL SYSTEMS 9

Cells and their structure – Nature of Cancer cells – Transport of ions through the cell membrane – Resting and action potentials – Bio-electric potentials – Nerve tissues and organs – Different systems of human body. Biopotential Electrodes and Transducers Design of Medical instruments – components of the biomedical instrument system – Electrodes – Transducers.

MODULE II BIOSIGNAL ACQUISITION 9

Physiological signal amplifiers – Isolation amplifiers – Medical preamplifier design – Bridge amplifiers – Line driving amplifier – Current amplifier – Chopper amplifier – Biosignal analysis – Signal recovery and data acquisition – Drift Compensation in operational amplifier – Pattern recognition – Physiological Assist Devices. Pacemakers – Pacemakers batteries – Artificial heart valves – Defibrillators – nerve and muscle stimulators Heart – Lung machine – Kidney machine.

MODULE III BIOPOTENTIAL RECORDERS 9

Characteristics of the recording system – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electroethinogrphy (ERG) and Electroculography (EOG) – Recorders with high accuracy – recorders for OFF line analysis.

MODULE IV OPERATION THEATRE EQUIPMENT 9

urgical diathermy- shortwave diathermy – Microwave diathermy – Ultrasonic disathermy – Therapeutic effect of heat – Range and area of irritation of different techniques – Ventilators – Anesthesia machine – Blood flowmeter – Cardiac Output measurements – Pulmonary function analyzers – Gas

analyzers – Blood gas analyzers – Oximeters – Elements of intensive care monitoring.

MODULE V SPECIALISED MEDICAL EQUIPMENTS 9

Blood Cell counter – Electron microscope – Radiation detectors – Photometers and colorimeters – digital thermometer – audiometers – X-rays tube – X-ray machine – image intensifiers – Angiography – Application of X-ray examination. Safety instrumentation: Radiation safety instrumentation – Physiological effects due to 50Hz current passage – Microshock and macroshock – electrical accident Hospitals – Devices to protect against electrical hazards – Hospitals architecture.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Arumugam M., Biomedical Instrumentation, Anurada Agencies Publishers, 1992.
2. Khandpur R.S., Handbook of Biomedical Instrumentation, Third Edition, Tata McGraw-Hill Education, 2014.
3. Shakti Chatterjee and Aubert Miller, Biomedical Instrumentation Systems, Cengage Learning Publisher, 2010.
4. Gromwell L., Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Second Edition, Prentice Hall, 1980.

COURSE OUTCOMES:

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

CO1: the human physiological systems.

CO2: the different aspects of biosignal acquisition.

CO3: different biopotential recorders such as EEG, ECG, EMG, EOG

CO4: biomedical instruments involved in advanced operation theatres

CO5: the application of biomaterials towards specialized medical equipment such as electron microscope and radiation detectors

Board of Studies (BoS) :	**Academic Council:**
BOS of Physics was held on 30.6.22	19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	M	L	L	M	M	M	L	L	L	M	M	M	M	M
CO2	H	M	M	L	L	M	L	L	L	L	L	M	M	M	M
CO3	H	M	M	L	L	L	L	L	L	L	L	M	M	M	M
CO4	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M
CO5	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement : The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

OEEY 705	BIOPHOTONICS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To know the role of light and its interaction in the cells and tissues.

COB2: To understand the different imaging techniques for the biological systems.

COB3: To know the concepts of spectroscopy in biological applications.

COB4: To understand the optical force spectroscopy.

COB5: To understand the role of Biophotonic materials in applications.

MODULE I INTERACTION OF LIGHT WITH BIOLOGICAL SYSTEMS **9**

Interaction of light with cells, tissues, nonlinear optical processes with intense laser beams, photo-induced effects in biological systems.

MODULE II IMAGING TECHNIQUES **9**

Imaging techniques: Light microscopy, wide-field, laser scanning - confocal, multiphoton, fluorescence lifetime imaging, FRET imaging - Frequency-Domain lifetime imaging. Cellular Imaging - Imaging of soft and hard tissues and other biological structures.

MODULE III SINGLE MOLECULE SPECTROSCOPY **9**

Single molecule spectroscopy: UV-VIS spectroscopy of biological systems, single molecule spectra and characteristics – IR and Raman spectroscopy and Surface Enhanced Raman Spectroscopy for single molecule applications.

MODULE IV OPTICAL FORCE SPECTROSCOPY **9**

Optical Force Spectroscopy: Generation optical forces – Optical trapping and manipulation of single molecules and cells in optical confinement - Laser trapping and dissection for biological systems - single molecule biophysics, DNA protein interactions.

MODULE V BIOSENSORS **9**

Biosensors, Principles- DNA based biosensors – Protein based biosensors– materials for biosensor applications- fabrication of biosensors.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Prasad. P.N., Introduction to Biophotonics, John Wiley & Sons, 2003
2. Michael P. Sheetz, Laser Tweezers in Cell Biology (Methods in Cell Biology), Vol.55, Academic Press Publishers, 1997.
3. Ranier .W, Nanoelectronics and Information Technology, Wiley Publishers, 2012.
4. Drexler. K.E., Nanosystems: Molecular Machinery, Manufacturing and Computation, Wiley Publishers, 1992.

COURSE OUTCOMES:

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

CO1: Make clear insights into the applications of light interaction with biological systems.

CO2: Compare different imaging techniques

CO3: Understand and analyse the various spectroscopic techniques used in biological system.

CO4: Effectively grasp the usage of the optical force spectroscopy.

CO5: Get clear ideas and communicate about the importance of use of spectroscopy in design of bio-photonic devices.

Board of Studies (BoS) : BOS of Physics was held on 30.6.22

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	M	L	L	M	M	M	L	L	L	M	M	M	M	M
CO2	H	M	M	L	L	M	L	L	L	L	L	M	M	M	M
CO3	H	M	M	L	L	L	L	L	L	L	L	M	M	M	M
CO4	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M
CO5	H	M	M	L	M	M	M	L	L	L	M	M	M	M	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement : The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

OEEY 706	DATA SCIENCE AND MACHINE LEARNING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

CO1: To understand the needs of machine learning in Real Time.

CO2: To acquire knowledge about the data science in machine learning.

CO3: To study the Monte Carlo Sampling and processing.

CO4: To explore knowledge about real-time data analysis using various models.

CO5: To understand the deep learning.

MODULE I INTRODUCTION 9

Introduction to Artificial Intelligence - Machine Learning – Types of Machine Learning - Data preprocessing - Noise Removal - Data Transformation - Normalization - Importing, Summarizingand Visualizing Data – Statistics-Visualizing Data-Plotting Qualitative Variables and Quantitative Variables- Data Visualization in a Bivariate Setting

MODULE II MACHINE LEARNING ALGORITHMS 9

Introduction to Supervised and Unsupervised Learning-Linear Regression - Single Variable – Multivariate –Logistic - Naive Bayes - Decision Tree - Neural Network - Single Layer Perceptron - Multilayer BPN- Training and Test Loss-Statistical Learning-Estimating Risk-Modeling Data-Multivariate Normal Models-Bayesian Learning

MODULE III SAMPLING AND UNSUPERVISED LEARNING 9

Unsupervised Learning Algorithm -Clustering - Monte Carlo Sampling-Resampling-Markov Chain Monte Carlo-Monte Carlo Estimation-Monte Carlo for Optimization-Simulated Annealing – Cross-Entropy Method-Splitting for Optimization -Noisy Optimization-Risk and Loss in Unsupervised Learning – Expectation-Maximization (EM) Algorithm-EM Algorithm for Mixture Models-K-Means – KNN - Hierarchical

MODULE IV REGRESSION ANALYSIS AND REGULARIZATION 9

Linear Regression-Analysis via Linear Models-Model Selection and Prediction – Cross-Validation and Predictive Residual Sum of Squares-In-Sample Risk and Akaike Information Criterion-Inference for Normal Linear Models -Nonlinear Regression Models-Modeling Regularization-Reproducing Kernel Hilbert Spaces- Smoothing Cubic Splines- Gaussian Process Regression - Graphical Models - Bayesian Networks

MODULE V ADVANCED LEARNING 9

Semi-supervisory Learning - Reinforcement Learning Algorithm – Feed-Forward Neural Networks -Back-Propagation – QLearning-Methods for Training- Steepest Descent- Levenberg–Marquardt Method - Limited-Memory BFGS Method- Adaptive Gradient Methods-Simple Polynomial Regression -Image Classification

L – 45 ; TOTAL HOURS – 45

REFERENCES:

3. Alex Smola, S.V.N. Vishwanathan, Introduction to Machine Learning, Cambridge University Press, 2008.
4. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Second Edition, Chapman & Hall/CRC, 2014.
5. Kroese, Dirk P., et al. Data science and machine learning: mathematical and statistical methods. Chapman and Hall/CRC, 2019.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: pre process the data

CO2: identify the suitable machine learning algorithm and apply the same to solve the given problem.

CO3: explain risk analysis and optimization algorithms.

CO4: apply the suitable regression method and regularization of data.

CO5: explore the applications of advanced learning.

Board of Studies (BoS): 17th BoS of IT held on 28.02.2023

Academic Council: 20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5
CO1	M	L			L
CO2	M	L		M	
CO3	L	L	L		L
CO4	M	L	L	H	
CO5	L	H	L		H

Note: L - Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work.

Statement: The Learning algorithms helps to design and develop solutions for solving real world application in any engineering domain.

OEEY 707	ELECTRIC VEHICLE AND BATTERY STORAGE TECHNOLOGY	L	T	P	C
SDG:8,9		3	0	0	3

COURSE OBJECTIVES:

COB 1: To study the concept of electric vehicles

COB2: To get familiarized with EV and PHEV Energy Storage Systems

COB3: To learn the basics of various electric drive trains

COB4: To study about sensors and electric vehicle control

COB5: To study about electric vehicle and its environmental impact.

MODULE I INTRODUCTION TO ELECTRIC VEHICLE (EV) 9

A Brief History -Technology, benefits and challenges in comparison with IC engine - EV classification and electrification levels - degree of hybridization - Concept of Hybrid Electric Vehicle (HEV) – Working Principle of an HEV drive train - concept of electric, hybrid electric and plug-in hybrid electric vehicles – HEV drive train topologies - plug-in HEV drive train topologies.

MODULE II EV AND PHEV ENERGY STORAGE SYSTEMS 8

Battery parameters - Types of Battery : Lithium – Nickel – Sodium – Zinc – Lead Acid - Coin cell - Rechargeable Battery sealing – Ideal model, Linear model, Thevenin model – Battery Cell Voltage Equalization – Onboard power electronics battery management – Equalizer chaining method. Electrical Modeling of Ultra capacitors, Flywheel Energy Storage Systems and Renewable Fuel Cell Power Sources.

MODULE III FUEL CELL AND HYBRID ELECTRIC VEHICLE DRIVE TRAIN 10

Component Stage Based Efficiency Analysis of Series and Parallel HEV Drive Trains - Varied Driving Patterns and Regenerative Braking Efficiency Analysis - Overall Electric Drive Train Efficiency Analysis - Fuel Cell HEV: Modeling and Control - Power Electronics Interface of Fuel Cell and Traction System - Concept of Fuel Cell Plug-in HEV (FC-PHEV).

MODULE IV SENSORS AND VEHICLE CONTROL 11

Introduction, Basic Sensor Arrangement, Types of Sensors, Oxygen Sensor, Cranking Sensor, Position Sensor, Engine Oil Pressure Sensor, Linear and Angle Sensor, Flow Sensor, Temperature and Humidity Sensor, Gas Sensor, Speed and Acceleration Sensor, Knock Sensor, Torque Sensor, Yaw Rate Sensors, Tire Pressure Sensor, Actuators.

Protocols: In vehicle Networking (IVN) - Local Interconnect Network(LIN) – Control Area Network (CAN) – Media Oriented System Transport (MOST) and FlexRay - Wireless Access in Vehicular Environment (WAVE).

MODULE V ENVIRONMENTAL IMPACT AND ENERGY MANAGEMENT 6

Vehicle pollution in context - alternative and sustainable energy used via the grid hybridization - V2G, G2V, V2B, V2H - energy consumption in braking and regeneration - brake system of EVs and HEVs.

L – 45; TOTAL HOURS:45

TEXT BOOKS:

1. Sheldon S. Williamson, “Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles”, Springer, 2013.
2. James Larminie and John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd, 2nd edition, 2015.
3. M. Ehsani, Y. Gao, Stefano Lango, K.M.Ebrahimi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 3rd Edition,2018.

REFERENCES:

1. Tariq Muneer and Irene Illescas García, “The automobile, In Electric Vehicles: Prospects and Challenges”, Elsevier, 2017.
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition, CRC Press, 2016.
3. Tom Denton, “Electric and Hybrid Vehicles” Routledge Publishers, 1st edition, March 2016.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: identify the opportunities and challenges of advances in electric vehicles

CO2 : model battery system for any EV

CO3: model and choose a suitable drive scheme suitable for developing an EV

CO4: compute the performance parameter of sensors, actuators and to apply suitable technique for automotive communication

CO5: choose proper energy consumption method to integrate with grid

Board of Studies (BoS) : 18th BoS of EEE held on 10.02.2023

Academic Council: 20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1	L	H	L	L	M	L	L	H	L	M	M	L	H	L
CO2	H	L	L	L	L	L	H	L	L	L	L	L	L	H
CO3	L	H	M	L	M	L	L	L	M	L	M	L	M	M
CO4	M	L	H	L	L	L	M	L	H	L	L	H	L	L
CO5	L	L	L	L	H	L	L	L	L	L	H	L	L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Decent work and economic growth

Statement: The learners of this course can get decent work and earn financial benefits and they can work in interdisciplinary areas to promote economic growth.

SDG No. 9 Industry, innovation and infrastructure

Statement:

The development of zero emission electric vehicles will meet out the desired needs such as new innovative systems for industry and establishing advanced infrastructure.

OEEY 708	GREEN BUILDING AND ENERGY	L	T	P	C
SDG: 11	MANAGEMENT	3	0	0	3

COURSE OBJECTIVES:

The objectives of the course are to impart knowledge on

COB1: the concept of green design

COB2: the basics of green design strategies

COB3: the elements of green building

COB4: the concept of green building materials

COB5: the concept of energy management.

MODULE I BASIC CONCEPTS 8

Green Design concepts and definitions - sustainability begins with climate - recent upsurge in the green building movement -incentives for building green - incentives and tax deductions-green building programs -defining sustainable communities-emerging directions- liability - spectacular landmarks

MODULE II DESIGN STRATEGIES 9

Conventional versus Green Delivery Systems- green design strategies- The Integrated Design Process (IDP) -the green-building project delivery process- the integrated multidisciplinary project team - design process for high-performance buildings -sustainable site selection-general considerations- site selection - development density and community connectivity –brown field redevelopment - alternative transportation -site development storm water design-heat-island effect - light-pollution reduction

MODULE III ELEMENTS OF GREEN BUILDING 9

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency- Commissioning process – fundamental commissioning –retro commissioning -enhanced commissioning

MODULE IV GREEN COMPOSITES FOR BUILDINGS 9

Concepts of Green Composites-low-emitting materials -adhesives, finishes, and sealants -paints and coatings- flooring systems- earthen building materials- building reuse -materials reuse- construction waste management-recycled materials regional materials- rapidly renewable materials- bamboo-cork - insulation- linoleum straw-bale construction-wheat board - use and selection of green office equipment

-certified wood- life-cycle assessment of building materials and products

MODULE V ENERGY MANAGEMENT 10

Energy Management – Definitions and significance – objectives – Characterising of energy usage – Energy Management program – Energy strategies and energy planning Energy Audit – Types and Procedure – Optimum performance of existing facilities – Energy management control systems- Low Energy Approaches to Water Management. Management of Solid Wastes.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Osman Attmann., “Green Architecture Advanced Technologies and Materials”, McGraw Hill, 2010.
2. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.
3. Moncef Krarti, “Energy Audit of Building Systems: an Engineering approach” CRC Press, LLC, Florida 2000.
4. “Alternative Building Materials and Technologies”. K.S.Jagadish, B.U. Venkataramareddy and K. S. Nanjundarao New Age International, 2007.

REFERENCES:

1. Doty S. and W. C. Turner, “Energy Management Hand book”, Fairmont Press, 2009.
2. LEED - Practices, Certification and Accreditation Handbook”. Sam Kubba, Butterworth-Heinemann, 2009.

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: describe the basics of green design concept.

CO2: explain the concepts of green design strategies.

CO3: illustrate the elements of green building.

CO4: summarize the different green building materials.

CO5: describe the concept of energy management.

Board of Studies (BoS) : Academic Council:

17th BOS of CE held on 10.08.2022 20th AC held on 13.04.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	L	-	-	L	H	-	-	-	-	-	L	-	M
CO2	-	-	L	-	-	L	H	-	-	-	-	L	L	-	M
CO3	-	-	L	-	-	L	H	-	-	-	-	-	L	-	M
CO4	-	-	M	-	-	L	H	-	-	-	-	L	L	-	M
CO5	-	-	L	-	-	M	H	-	-	-	-	-	L	-	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable

Statement : The understanding of basics of green concepts, materials, energy management and leads to the development of sustainable building

OEEY 709	INDUSTRY 4.0 AND APPLICATIONS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To describe the concepts, trends and the paradigm of Industry 4.0

COB2:To analyze the IoT technologies for practical IoT applications

COB3: To develop the ability to use Internet of Things related protocols and connectivity methods

COB4:. To elaborate the business issues in Industry 4.0.

COB5: To select the appropriate design concepts of Industrial IoT systems for various application

PREREQUISITES: Basic concepts in automation

MODULE I INTRODUCTION TO INDUSTRY 4.0 9

The Various Industrial Revolutions, Digitalization and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation

MODULE II ROAD TO INDUSTRY 4.0 & RELATED DISCIPLINES 9

Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics, Cyber physical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Support System for Industry 4.0, Cyber Security.

MODULE III DATA INFORMATION AND COLLABORATION 9

Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0

MODULE IV BUSINESS ISSUES IN INDUSTRY 4.0 9

Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

MODULE V INDUSTRY 4.0 APPLICATIONS 9

Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan, “Industry 4.0: Managing the Digital Transformation”, Springer, 2017.
2. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things" A press, 2017.
3. Deepak Gupta, Victor Hugo C. de Albuquerque, Ashish Khanna, Purnima Lala Mehta, "Smart Sensors for Industrial Internet of Things: Challenges, Solutions and Applications", Springer, 1st Edition, 2021.
4. Francis daCosta, “Rethinking the Internet of things: A Scalable Approach to Connecting Everything”, Apress, 2014.

REFERENCES:

1. Christoph Jan Bartodziej, "The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics", Springer, 2016.
2. Gary Smart, "Practical Python Programming for IoT: Build advanced IoT projects using a Raspberry Pi 4, MQTT, RESTful APIs, Web Sockets, and Python 3", Pckt Publishing, 2020

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: apply the basic concepts and principles of Industry 4.0

CO2:identify, formulate and solve engineering problems using Industrial IoT

CO3:describe basics of cloud computing with IoT capability

CO4:discuss the challenges of the industry through IoT techniques

CO5:develop a domain specific IoT system

Board of Studies (BoS) :
24th BOS of ECE held on 08.02.2023.

Academic Council:
20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	L	L	L	L	L	L	H	H	H
CO2	M	H	M	M	L	L	L	L	L	L	L	L	H	H	H
CO3	M	M	L	M	L	L	L	L	L	L	L	L	H	H	H
CO4	H	M	M	M	L	L	L	L	L	L	L	L	H	H	H
CO5	H	H	M	M	L	L	L	L	L	L	L	L	H	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation,

Statement: Able to apply the theoretical concepts for the various application in Industry 4.0

OEEY 710 NANOTECHNOLOGY AND CATALYSIS L T P C
SDG: 6,7,9,15 3 0 0 3

COURSE OBJECTIVES:

To make the student conversant with

COB1: basic knowledge on nanoscience and nanotechnology which includes the exotic properties of materials at nanoscale including various techniques for the processing of nanomaterials

COB2: various techniques available for the characterization of nanostructured materials

COB3: applications in selected fields and impacts of nanotechnology in ecosystem

COB4: Impart the basic concepts involved in catalytic processes.

COB5: Understand the importance of heterogeneous catalysis.

MODULE I INTRODUCTION AND PREPARATION OF NANOMATERIALS 9

Introduction to nanomaterials, Properties of nanomaterials, Nanostructures: Zero-, One-, Two- and Three-dimensional structures, Surface Plasmon Resonance, Change of bandgap; Methods of preparation of nanomaterials, top-down approach and bottom-up: Chemical precipitation and coprecipitation; Sol-gel synthesis; Ball milling synthesis; lithography, Plasma Laser deposition (PLD) techniques, Thermolysis routes (Solvothermal, Hydrothermal and pyrolysis), Microwave assisted synthesis; Sonochemical synthesis; Electrochemical synthesis.

MODULE II CHARACTERIZATION TECHNIQUES 9

Structural Characterization: X-ray diffraction, Scanning Electron Microscopy (SEM/HR-SEM/FE-SEM) with EDS, TEM (HR-TEM) and SAED analysis, Atomic force Microscopy (AFM). X-ray Photoelectron spectroscopy (XPS), Raman analysis. Introduction to advanced Scanning Probe Microscopy Techniques Scanning Tunnelling Mode (STM), Piezoelectric force microscopy (PFM). DLS and zeta potential analysis. BET surface area analysis, CHNSO micro analysis.

MODULE III APPLICATIONS AND ENVIRONMENTAL IMPACTS 9

Current applications - Short-term Applications - Long - term Applications – Energy filed - solar cells, military battle suits. Biomedical applications – Photodynamic therapy in targeted drugs - quantum dot technology in cancer

treatment, MRI applications. Nanosensors: pH, heat, humidity, gas, toxic chemicals sensors and sensors for aerospace and defence – biosensors – water remediation - Environmental Impacts: toxicological health effects, relevant parameters in nanoparticles toxicology, integrated concept of risk assessment of nanoparticles.

MODULE IV CONCEPTS OF CATALYSIS 9

Acid-base catalysis – catalysis by transition metal ions and their complexes – supported transition metal complexes as catalysts – catalysis by enzymes – phase transfer catalysis - photocatalysis – adsorption – chemisorption on metals, metal oxides and semiconductors - kinetics of unimolecular and bimolecular surface reactions - Contact time - WHSV - time on stream - Catalyst deactivation and regeneration, TOF, TON.

MODULE V HETEROGENEOUS CATALYSTS 9

Metals, metal oxides, mixed metal oxides, supported metals, spinels, perovskites, super acids, hydrotalcites, zeolites and zeotypes (small, medium, large), shape selective catalysts, mesoporous materials (SBA, MCM, KIT, AlPOs, MOFs, COFs) Hydrothermal synthesis, sol-gel process, impregnation method, ion-exchange method - Operations in catalyst manufacture - drying, calcination, spray drying, Reactors- fixed bed and flow reactors.

L – 45; TOTAL HOURS – 45

REFERENCES:

1. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill, New Delhi, 2007.
2. G. Cao, Nanostructures and Nanomaterials –Synthesis, Properties and Applications, Imperial College Press, London, 2004.
3. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials, Volume 1, Wiley –VCH Verlag GmbH & Co. KgaA, Weinheim, 2004.
4. G. A. Ozin, A. C. Aresnault, L. Cadematriri, Nanochemistry: A chemical approach to nanomaterials, RSC Publishing, 2008
5. J. Rajaram and J.C. Kuriacose, Kinetics and Mechanisms of Chemical Transformations, Macmillan Publishers India Limited, 2000.
6. B. Viswanathan, S. Sivasanker and A.V. Ramaswamy (Editors), Catalysis

COURSE OUTCOMES:

The students will be able to

CO1: differentiate the nanomaterials based on their dimensions and acquire knowledge of various synthetic methods

CO2: understand the components of instrumental techniques of and characterization techniques for structural and properties of nanomaterials

CO3: select the appropriate nanomaterials for specific applications in the interested arena

CO4: Find the fundamentals of catalysis

CO5: Evaluate significance of heterogeneous catalysts.

Board of Studies (BoS): 12th BoS of Chemistry held on 22.07.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L		M	H	H									
CO2	M			H	M	H									
CO3					H	M									
CO4															
CO5															

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 6: Clean Water and Sanitation

SDG 7: Affordable & Clean Energy

SDG 9 : Industry and Innovation

SDG 15 : Life on Land

Statement:

SDG 6, 7 & 9: Foundation to work in R&D of renewable energy and sensors sector and for teaching career.

SDG 15: R&D labs in API labs in the production novel materials for various applications

OEEY 711	PROJECT MANAGEMENT	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the concepts of organizational project management.

COB2: To acquire knowledge on leadership in project management.

COB3: To gain knowledge in stakeholder management and program management

COB4: To familiarize with the project scope and time management

COB5: To be conversant with project execution, monitoring and closing.

MODULE I INTRODUCTION – ORGANIZATIONAL PROJECT MANAGEMENT L:9

Introduction to Organizational Project Management- Organizational Project Management Framework- Project Linkages to Strategic Management - Relationships between Portfolio, Program, and Project Management - Organizational Issues and Project Management.

MODULE II PROJECT MANAGEMENT - LEADERSHIP L:9

Importance of Leadership in Project Management-Roles and Responsibilities of a Project Manager-Leadership vs. Management-Project Management Leader's Portfolio-Technical Management skills -Project Entrepreneurship skills- Project Leadership skills

MODULE III PROJECT STAKE HOLDER MANAGEMENT AND PROGRAM MANAGEMENT L:9

Project Stakeholder Management-Stakeholders Identification and Assessment - Stakeholders vs. Project Lifecycle - Stakeholders and Interested Parties- Program Management - Program Characteristics - Programs vs Projects - Programs vs Portfolios

MODULE IV PROJECT SCOPEAND TIME MANAGEMENT L:9

Project Scope: Planning, Defining, Verification and Change control -Project Activity sequencing -Precedence diagram method- Arrow diagram method – Project Activity Time Estimation -Tools for Activity Time Estimation -Schedule development – Resource levelling heuristics

MODULE V PROJECT EXECUTION,MONITORING AND CLOSING L:9

Execution phase overview-Delegating tasks -Assessing project status - Foreseeing future challenges - Managing progress and timeline adjustments Project execution guidelines - Monitoring phase overview - Key Performance Indicators -Evaluating progress-Assessing work quality -Setting quality assurance procedures -Monitoring risks -Closing phase overview -Obstacles in the closing phase -Evaluating project performance-Final reports and managing records -Project closing guidelines

L – 45; TOTAL HOURS – 45

TEXTBOOKS:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015

REFERENCES:

1. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009
3. A Guide to the Project Management Body of Knowledge (PMBOK® Guide)–Sixth Edition, Author& publisher - Project Management Institute 2017
4. Lean Project Management: Philip Small, Arkham Publishing Limited, March 2020

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1:Explain the concepts of organizational project management

CO2: Discuss the leadership in project management.

CO3: Elucidate the stakeholder management and program management

CO4: Explain project scope and time management

CO5: Describe project execution, monitoring and closing

Board of Studies (BoS) :
21st BOS of Mechanical Engg. held on 10.02.2023.

Academic Council:
20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L		L	M		H							M	L
CO2	L		M	L		L							L	H
CO3	M		M	H		L							H	M
CO4	L		L	L		M							L	M
CO5	L		M	L		L							H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The comprehensive understanding of Project management principles and techniques brings prosperity, create jobs, and build prosperous equitable societies across the country

OEEY 712	REAL TIME EMBEDDED SYSTEMS	L	T	P	C
SDG: 4,9		3	0	0	3

COURSE OBJECTIVES:

COB1: To define the fundamental concepts of real time systems

COB2: To analyze the various uniprocessor and multiprocessor scheduling mechanisms

COB3: To develop knowledge on programming languages and tools for real time systems.

COB4: To discuss the overview of real time data bases

COB5: To classify the fault tolerance and evaluation techniques in real time systems.

PREREQUISITES: Embedded Systems, Operating Systems

MODULE I INTRODUCTION : EMBEDDED SYSTEMS & REAL TIME SYSTEMS **9**

Introduction –Embedded system - characterizing real time system -Performance Measures for Real Time Systems – Estimating Program Run Times – Task Assignment and Scheduling.

MODULE II PROGRAMMING LANGUAGES AND TOOLS **9**

Desired language characteristics – ADA language - Data typing – Control structures – Facilitating Hierarchical Decomposition- Packages- Run time Error handling – Overloading and Generics – Multitasking – Timing Specifications – Programming Environments – Run time support.

MODULE III REAL TIME DATABASES **9**

Basic Definition, Real time Vs General Purpose Databases- Main Memory Databases- Transaction priorities-Transaction Aborts-Concurrency control issues-Disk Scheduling Algorithms-Two – phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

MODULE IV REAL TIME COMMUNICATION **9**

Communications media, Network Topologies, Protocols- contention based, Token based, Stop-and-Go multihop, Polled Bus, Hierarchical Round Robin Protocol, Deadline-Based Protocols, Fault Tolerant Routing.

MODULE V FAULT TOLERANT AND EVALUATION TECHNIQUES 9

Fault Tolerance Techniques – Fault Types – Fault Detection-Fault and Error containment- Redundancy- Reliability Evaluation Techniques – Software error models.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 2010.
2. Rajib Mall,”Real-time systems: theory and practice”, Pearson Education, 2007.

REFERENCES:

1. Xiaocong Fan, “Real-Time Embedded Systems: Design Principles and Engineering Practices”, Elsevier, 2015.
2. Albert M. K. Cheng, “Real-Time Systems: Scheduling, Analysis, and Verification“, Wiley publishers, 2003.
3. P. A. Laplante," Real-Time Systems Design & Analysis", Willey, 2011.
4. Qing Li, "Real Time Concepts for Embedded Systems", Elsevier, 2011.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: describe the characteristics of real time system.

CO2: apply scheduling algorithms based on the application.

CO3: discuss about the programming language characteristics and tools of real time systems.

CO4: choose the appropriate real time communication protocols.

CO5: analyze the fault tolerance and evaluation techniques in real time systems.

Board of Studies (BoS) : 24th BOS of ECE held on 08.02.2023.

Academic Council: 20th AC held on 13.04.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	H	H	H	H	H	M	M	M	M	M	M	H	H	H
CO2	H	H	H	H	H	H	M	M	M	M	M	M	H	H	H
CO3	H	H	H	H	H	H	M	M	M	M	M	M	H	H	H
CO4	H	H	H	H	H	H	M	M	M	M	M	M	H	H	H
CO5	H	H	H	H	H	H	M	M	M	M	M	M	H	H	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Statement: Understanding of the real time systems will bring practical knowledge on quality education.

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation
Statement: capable of promoting industrialization through the application of real-time system design principles.

OEEY 713	ROBOTIC TECHNOLOGY	L	T	P	C
SDG: 9		3	0	0	3

OBJECTIVES:

COB1: To study the basics of robotics technology.

COB2: To acquire knowledge about robot operating system.

COB3: To familiarize with robot assembly and aerial robots.

COB4: To learn about futuristic robots.

COB5: To know about the application of robots in various fields.

MODULE I INTRODUCTION L:6

Robot – Definition – Robot Anatomy – Co-ordinate Systems - Work envelope: Types and classification – Specifications – Pitch, Yaw, Roll, and Joint notations - Speed of motion - Pay load – Robot Parts and their functions – Need for robots.

MODULE II ROBOT OPERATING SYSTEM L:10

Master – Node – Topic – Messages – Subscriber – Publisher – Robot Operating System (ROS) packages – ROS file system – Services and actions – Custom publisher – Custom subscriber – ROS topic list and ROS topic information -ROS topic echo – ROS topic pub – Custom messages.

MODULE III ROBOT ASSEMBLY AND AERIAL ROBOTS L:12

Robotic assembly automation - Parts presentation methods - Assembly operations - Assembly system configurations - Design for robot assembly - Basics of aerial robots - Modelling and control of small Unmanned Aerial vehicles - Guidance and navigation of small range aerial robots.

MODULE IV FUTURE TECHNOLOGY L:9

Wheeled and legged Robot – Legged locomotion and balance – Arm movement, Gaze and auditory orientation control – Facial expression – Hands and manipulation – Sound and speech generation – Motion capture/Learning from demonstration.

MODULE V APPLICATIONS L:8

Implementation of Robots in Industries - Industrial application for material handling: machine loading and unloading, assembly, and inspection– Applications of robot in Arc welding, Spot welding, and Spray painting - Robots in Assembly operation, Cleaning and underwater applications –Applications of

Robots in Agriculture, Mining, Defense, Nuclear, Medical, and Space.

L – 45; TOTAL HOURS – 45

TEXTBOOKS:

1. Robert J. Schilling, “Fundamentals of Robotics Analysis and Control”, PHI Learning.,2009.
2. Richard D. Klafter, Thomas. A, ChriElewski, Michael Negin, “Robotics Engineering an Integrated Approach”, Phi Learning.,2009
3. YoonSeokPyo, HanCheol Cho, RyuWoon Jung, TaeHoon Lim, ROS Robot Programming.
4. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw Hill, 2001.

REFERENCES:

1. Bernard Hodges, “Industrial Robotics”, Second Edition, Jaico Publishing house, 1993.
2. Tsuneo Yohikwa, “Foundations of Robotics Analysis and Control”, MIT Press., 2003.
3. John J. Craig, “Introduction to Robotics Mechanics and Control”, Third Edition, Pearson,2008.
4. Craig.J. J, “Introduction to Robotics Mechanics and Control”, Addison-Wesley, 1999.Robotics Lab manual, 2007.

COURSEOUTCOMES:

After completion of the course, students should be able to

CO1: Explain the basics of robots.

CO2: Elucidate robot operating system.

CO3: Discuss about robot assembly and aerial robots.

CO4: Describe the future robot technology.

CO5: Explain the applications of robots.

Board of Studies (BoS) :
21st BOS of Mechanical Engg. held on 10.02.2023.

Academic Council:
20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		M			M					L	L	H	M
CO2	M		M			M					L	L	H	M
CO3	M		M			M					L	L	H	M
CO4	M		M			M					L	L	H	M
CO5	M		M			M					L	L	H	M

Note: L - Low Correlation M - Medium Correlation H - High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic knowledge of robot technology, its operating system, and future robot helps in developing robots for various applications.

OEEY 714 SOFT COMPUTING TECHNIQUES L T P C
SDG:8,9 3 0 0 3

COURSE OBJECTIVES:

COB 1: To enumerate the strengths and weakness of soft computing
COB2 To focus on the basics of neural networks
COB3: To learn the basics of fuzzy systems and hybrid Neurofuzzy systems
COB4: To emphasize the role of evolutionary computing algorithms
COB5: To learn the ANN, FIS and GA tool boxes for various soft computing applications.

MODULE I BASICS OF SOFT COMPUTING 8

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research.

MODULE II ARTIFICIAL NEURAL NETWORK 10

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications.

MODULE III FUZZY SYSTEMS 10

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications.

MODULE IV EVOLUTIONARY COMPUTING & ALGORITHMS 7

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Meta heuristic algorithms - Evolutionary strategies and applications.

MODULE V MATLAB TOOL BOX FOR SOFT COMPUTING 10

Artificial Neural Network (ANN) Toolbox - training and testing with different activation functions- controller design using ANN toolbox Fuzzy Inference System (FIS) Editor

and tool box- fuzzy controller design - Genetic Algorithm Toolbox - Application of ANN, FIS and GA tool box to various power system and control applications.

L – 45; TOTAL HOURS – 45

TEXT BOOK:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013

REFERENCES:

1. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
2. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009
3. Matlab Simulink Manual

COURSE OUTCOMES: At the end of the course, the student will be able to

CO1: enumerate the theoretical basis of soft computing

CO2 : explain the Neural network architecture and different learning rules

CO3: apply the fuzzy systems and hybrid Neurofuzzy systems

CO4: demonstrate the different evolutionary and metaheuristic algorithms

CO5: demonstrate the most appropriate soft computing technique for a given situation using MATLAB tool box.

Board of Studies (BoS) :
18th BoS of EEE held on 10.02.2023

Academic Council:
20th AC held on 13.04.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1	L	H	L	L	M	L	L	H	L	M	M	L	H	L
CO2	H	L	L	L	L	L	H	L	L	L	L	L	L	H
CO3	L	H	M	L	M	L	L	L	M	L	M	L	M	M
CO4	M	L	H	L	L	L	M	L	H	L	L	H	L	L
CO5	L	L	L	L	H	L	L	L	L	L	H	L	L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Decent work and economic growth

Statement: The learners of this course can get decent work and earn financial

benefits and they can work in interdisciplinary areas to promote economic growth.

SDG No. 9 Industry, innovation and infrastructure

Statement:

The development of soft computing techniques will meet out the desired needs such as new innovative systems for industry and establishing advanced infrastructure.

OEEY 715	STRUCTURAL INTERPRETATION OF	L	T	P	C
SDG: 4, 9	MATERIALS	3	0	0	3

COURSE OBJECTIVES:

To use the concepts (basic and advanced level) of analytical methods for structure elucidation of materials and the students will be trained for the

COB1: Interpretation of electronic spectral data of materials

COB2: Interpretation of magnetic spectral data of materials

COB3: Interpretation of structural and morphological data of materials

COB4: Interpretation of thermoanalytical data of materials

COB5: Interpretation of electrochemical and XPS data of materials

MODULE I ELECTRONIC DATA 9

UV-visible, fluorescence and phosphorescence: Characteristic absorption of simple chromophoric groups, conjugated/ aromatic/ ligand systems, metal complexes and materials. FT-IR and Raman: Characteristic group frequencies of organic, inorganic molecules and various materials (polymer, nano, semiconducting) Interpretation of organic and inorganic and hybrid materials using combination of the spectral data.

MODULE II MAGNETIC AND MASS DATA 9

Solid-state nuclear magnetic resonance spectroscopy: Compounds containing ^{1}H, ^{13}C, ^{19}F,^{27}Al, ^{29}Si, and ^{31}P nuclei. Electron spin resonance (ESR): Simulation of ESR spectra of paramagnetic species, spin dynamics in solid and liquid. Mass spectrometry: The production and analysis of positive ions, molecular ions, application of isotopic abundance measurements, fragmentation modes and rearrangement of ions. Interpretation of organic, inorganic compounds and materials using combination of the spectral data.

MODULE III STRUCTURAL AND MORPHOLOGICAL DATA 9

Fundamental theoretical framework for diffraction (XRD) and imaging methods (SEM, TEM and AFM) used in structural and compositional characterization of materials in solid, film state etc.

MODULE IV THERMOANALYTICAL DATA AND SURFACE AREA 9

Interpretation of Differential Thermal Analysis (DTA), Thermo-gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC) data of various materials including inorganic complex, organic polymeric materials, composite, nano-composites etc; Surface area analysis; isotherms, types, BET surface area, pore dimensions, pore volume, etc.

MODULE V ELECTROCHEMICAL AND XPS DATA 9

Cyclic voltammetry for oxidation and reduction potentials, TAFEL polarization and Impedance spectroscopy for corrosion inhibitor behavior, chronoamperometry for charge or discharge of battery. X-ray photoelectron spectroscopy: Study the chemical composition and oxidation state of elements at the surface and interface. Applications of XPS in various arenas.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. R. S. Drago, Physical Methods for Chemists, W. B. Saunders,1992.
2. R. M. Silverstein, C. G. Bassler and T. C. Morril, Spectrophotometric Identification of Organic Compounds, 5th edition, Wiley, 1991.
3. D. H. Williams and I. Fleming, Spectroscopic Methods in Organic Chemistry, 3rd edition, McGraw Hill, 1980.
4. W. Kemp, Organic Spectroscopy, ELBS, 1979.
5. W. L. Jolly, The synthesis and characterization of inorganic compounds, Prentice-Hall, 1970.
6. John Wertz, Electron Spin Resonance: Elementary Theory and Practical Applications, Springer Science & Business Media, 2012.
7. R. F. Speyer, Thermal Analysis of Materials, CRC Press, 1994.
8. P.J. Goodhew, J. Humphreys and R. Beanland, Electron Microscopy and Analysis, Taylor & Francis, 2001.
9. John F Watts, John Woistenhoime, An introduction to surface analysis by XPS and AES, John Wiley and Sons, 2nd edition, 2003.
10. James, B. Condon, Surface Area and Porosity Determinations by Physisorption Measurement and Theory, Elsevier, 1st edition, 2006.

COURSE OUTCOMES:

The students will be able to

CO1: Interpret electronic spectral data of materials

CO2: Interpret magnetic spectral data of materials

CO3: Interpret structural and morphological data of materials

CO4: Interpret thermo analytical data and porous nature of materials

CO5: Interpret electrochemical and XPS data of materials

Board of Studies (BoS):	**Academic Council:**
12th BoS of Chemistry held on 2207.2022	19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	H	M		H	M	H									
CO2	H	M		H	M	L									
CO3	H	L		H	M	M									
CO4	H	L		H	M	H									
CO5	H	L		H	M	L									

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Quality Education
SDG 9: Industry and Innovation

Statement:
SDG9: Foundation to work in R&D laboratory, chemical industry, independent researcher and for teaching career.
SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities.