HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2018-19)

B. Tech. Information Technology

DEPARTMENT OF INFORMATION TECHNOLOGY

SCHOOL OF COMPUTING SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE
VISION AND MISSION

MOTTO

"TO MAKE EVERY MAN A SUCCESS AND NO MAN A FAILURE."

VISION

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT

- Integrity, Innovation, Internationalization

DEPARTMENT OF INFORMATION TECHNOLOGY
VISION AND MISSION

VISION

To be a globally renowned academic department for quality education and research in the field of Information Technology with ethical values and social commitment.

MISSION

M1: To impart comprehensive technical education to produce highly competent IT professionals and entrepreneurs.

M2: To provide an academic environment for state of the art research with ethical standards.

M3: To conduct knowledge transfer programs to enhance the technical knowledge in the field of Information Technology.

B. Tech. Information Technology

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program is expected to enable the students to

PEO I Demonstrate comprehensive knowledge in IT solution development leading to excellence in professional career and/or higher education including research.

PEO II Provide solutions making use of the knowledge gained in Artificial Intelligence, Cloud Computing, Big Data, Cyber Security and Communication.

PEO III Adapt themselves to continuously changing technologies to develop innovative applications with ethical and social commitment.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

At the end of this program, graduates will be able to

PO1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

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

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

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

PO6 **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO)

At the end of this program, graduates will be able to

PSO1: Acquire an ability to use the algorithm's technique and tools for the development of software applications related to Information Technology.

PSO2: Design, develop and test software intensive systems for IT Industry to provide solutions to real world problems.

PSO3: Apply the knowledge in Machine learning and Artificial Intelligence to solve real time problems in Cyber Security and Big Data.

ACADEMIC REGULATIONS FOR

B. TECH. / B. TECH. (HONS.) DEGREE PROGRAMME

TABLE OF CONTENTS

I. PREAMBLE

As per the recommendations of UGC, the Hindustan Institute of Technology and Science (HITS) has introduced Choice Based Credit System (CBCS) from the academic year 2015-16. Choice Based Credit System (CBCS) is a proven, flexible mode of learning in higher education which facilitates a student to have guided freedom in selecting his/her own choices of courses in the curriculum for completing a degree program. This revision of regulations, curriculum and syllabi has been carried out further to make it more flexible and adaptive to the technology advancements happening in the world. CBCS offers a flexible system of learning.

The system permits a student to

(i) Learn at their own pace through flexible registration process

(ii) Choose electives from a wide range of courses offered within and outside their departments

(iii) Undergo additional courses and acquire more than required number of credits to obtain B. Tech (Hons)

(iv) Undergo additional courses in their special areas of interest and earn additional credits to obtain B. Tech with Minor Specialization

(v) Adopt an interdisciplinary approach in learning

(vi) Avail transfer of Credits

(vii) Gain Non – CGPA credits to enhance skill/employability by taking up additional project work, entrepreneurship, co-curricular and vocational training.

(viii) Make the best use of the expertise of available faculty.

(ix) Learn and earn credits through MOOC and Project Based Learning

(x) Enhance their Knowledge, Skill and Attitude through participation in innovative Curriculum Design, Delivery and Assessments.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Project Based Learning and Industrial Training so as to enable the students become eligible and fully equipped for employment in industries choose higher studies or entrepreneurship.

II. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

1. “Programme” means Degree Programme like B.Tech. Degree Programme.
2. “Discipline” means specialization or branch of B.Tech. Degree Programme, (e.g. Civil Engineering).
3. “Course” means a theory or practical subject that is normally studied in a semester, (e.g. Mathematics, Physics, etc.).

4. “Vice – Chancellor of HITS” means the Head of the Institution.
5. “Registrar” is the Head of all Academic and General Administration of the Institute.
6. “Dean Academics” means the authority of the University who is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
7. “Controller of Examinations” means the authority of the University who is responsible for all activities related to the University Examinations, publication of results, award of grade sheets and degrees.
8. “Dean – Student Affairs” is responsible for all student related activities including student discipline, extra and co – curricular activities, attendance and meetings with class representatives, Student Council and parent – teacher meet.
9. “HoD” means the Head of the Department concerned.
10. “Institute” means Hindustan Institute of Technology and Science (HITS), Chennai.
11. “TCH” means Total Contact Hours – refers to the teaching – learning periods.
12. “DEC” means Department Exam Committee.
13. “BoS” means Board of Studies.
14. “BoM” means Board of Management.
15. “ACM” means Academic Council meeting the highest authoritative body for approval for all Academic Policies.
16. “Class Teacher” is a faculty of the class who takes care of the attendance, academic performance and the general conduct of the students of that class.
17. “CIA” is Continuous Internal Assessment which is assessed for every student for every course during the semester.
18. “ESE” is End Semester Examination conducted by the Institute at the End of the Semester for all the courses of that semester.
19. “AICTE” means All India Council for Technical Education.
20. “UGC” means University Grants Commission.
21. “MHRD” means Ministry of Human Resource Development, Govt. of India.

ACADEMIC REGULATIONS FOR B. Tech. / B.Tech. (Hons.)
Under Choice Based Credit System (CBCS)
(Effective from Academic year 2018 - 19)

1.0 Vision, Mission and Objectives

The Vision of the Institute is "To make every man a success and no man a failure".

1.1 The Mission of the institute is

- To create an ecosystem that promotes learning and world class research.
- To nurture creativity and innovation.
- To instil highest ethical standards and values.
- To pursue activities for the development of the Society.
- To develop national and international collaborations with institutes and industries of eminence.
- To enable graduates to become future leaders and innovators.

Value Statement

Integrity, Innovation, Internationalization

1.2 Further, the Institute always strives

- To train our graduates with the latest and the best in the rapidly changing fields of Architecture, Engineering, Technology, Management studies, Science and Humanities and Liberal Arts.
- To develop graduates, with a global outlook, possessing Knowledge, Skills and Attitude and capable of taking up challenging responsibilities in the respective fields.
- To mould our graduates as citizens with moral, ethical and social values so as to fulfil their obligations to the nation and the society.
- To promote research in the field of Architecture, Engineering, Technology, Management studies, Science and Humanities and Liberal Arts and Allied disciplines.

1.3 Aims and Objectives of the Institute are focused on

- Providing state of the art education in Engineering, Technology, Applied Sciences and Management studies.
- Keeping pace with the ever – changing technological scenario and help the graduates to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and the nation.
- To inculcate a flair for Research, Development and Entrepreneurship.

2.0 Admission

The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, based on the guidelines issued by the UGC/ Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each of the B. Tech. degree programme will be decided by the Board of Management of the Institute as per the directives of AICTE/ UGC / MHRD, Government of India, taking into account, the market demands. Seats are also made available up to 20% of the sanctioned intake for Non – Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the Institute.

2.1. Eligibility for Admission

(i) Regular Entry

Passed 10 + 2 examination with Physics and Mathematics as compulsory subjects along with one of the other subjects as Chemistry/ Biotechnology/ Biology/ Technical Vocational course.

The candidates should have obtained the minimum marks as per AICTE norms.

(ii) Lateral Entry

The candidates possessing a Diploma in Engineering/Technology in the relevant discipline of specialization with minimum 50% marks awarded by the State Boards of Technical Education, India or any other competent authority as accepted by the Board of Management of the Institute as equivalent thereto are eligible for admission to the 3rd Semester of the B. Tech degree programme.

2.2 The candidate has to fulfil all the prescribed admission requirements / norms of the Institute.

2.3. In all matters relating to admission to the B. Tech degree programme, the decision of the Board of Management of the Institute shall be final.

2.4. At any time after admission, if found that a candidate has not fulfilled one or many of the requirements stipulated by the Institute, or submitted forged certificates, the Institute has the right to revoke the admission and forfeit the fee paid. In addition, legal action may be taken against the candidate as decided by the Board of Management.

3.0 Student Discipline

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the Institute.

3.1 Any act of indiscipline of a student reported to the Dean (Student affairs) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Student Affairs) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

3.2 Ragging in any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the Institute, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student of the Institute, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

4.0 Structure of the B. Tech Degree Programme

4.1 All B. Tech. degree Programmes will have the curriculum and syllabi (for 4 years) as approved by the respective Board of Studies and Academic Council of the Institute.

4.2 Credits are the weightages, assigned to the courses based on the following general pattern:

One Lecture / Tutorial period per week	--- 1 credit
Up to Three periods of Practical per week	--- 1 credit
4 periods of Practical per week	--- 2 credits

4.3 The curriculum for B. Tech. programme is designed to have a minimum of **165 credits + 4 Non – CGPA credits** that are distributed across eight semesters of study for the award of degree.

Choice Based Credit System (CBCS) was introduced from the Academic year 2015-16 in the curriculum to provide the students, a balanced approach to their educational endeavour.

Under CBCS, the degree programme will consist of the following categories of courses:

i) **General Core foundation** (**CF**) courses comprising of

- Humanities courses;
- Basic Sciences (BS)including Physics, Chemistry and Mathematics;
- Engineering Sciences (ES), including Basic Engineering courses such as Material Science, Basic Workshop, Engineering Drawing, Engineering Graphics, Digital systems, etc.

ii) **Compulsory Courses (CC) consist of the following.**

a. **Professional Core (PC)** courses: These courses expose the students to the foundation of Engineering topics related to the chosen programme of study comprising of theory and Practical/ field work/ Design project/ Project.

b. **Departmental Elective** (**DE**): These courses enable the students to take up a group of courses of their interest in the area of specialization offered by the parent Department / School.

iii) **Non –Departmental Electives (NE):** These courses are offered by Engineering and Non-Engineering departments (across the disciplines) other than their parent Department. Two groups of Electives are available under NE namely, Engineering Electives, offered by the Engineering Departments and Open Electives, offered by the Non – Engineering departments.

iv) **Indexed Journal / Conference Publications:** If a student publishes a research paper as main author in indexed Journal / Conference, the same can be considered as equivalent to two – credit course under NE.

v) **Non-CGPA courses:** These courses are offered in certain semesters are compulsory, but are not used for calculation of GPA and CGPA. However, the credits will be mentioned in the grade sheet.

4.4 Non – CGPA courses

The student shall select any two courses /activity listed in **Table 1** during the course of study. The student has to make his / her own efforts for earning the credits. The grades given will be Pass / Fail (P/F). The respective class teachers have to encourage, monitor and record the relevant activities of the students, based on the rules issued from time to time by the Institute and submit the End semester report to the Head of the Department.

Table 1. Non – CGPA Courses

No.	Course / Activity	Credits
1.	Start ups	2
2.	Industrial Training	2
3.	Technical conference, seminar, competitions, Professional Societies	2
4.	Management courses	2
5.	Technical Certification Course	2
6.	Sports	2
7.	NCC	2
8.	NSS	2
9.	YRC	2
10.	Art and Cultural activities	2
11.	English Proficiency Certification	2
12.	Aptitude Proficiency Certification	2
13.	Foreign Languages Level II and above	2
14.	Publication in Conferences / Seminar	2

4.5 A student must earn compulsorily, the credits mentioned under each category shown in **Table 2** and also a minimum total of **169 credits - 165 credits (CGPA) + 4 credits (Non CGPA)** for the award of B. Tech. degree. For Lateral entry students, the 41 credits required for first and second semester of B. Tech shall be deemed to have been earned based on their curriculum in the diploma course. They have to earn a minimum of **128 credits (124 credits + 4 Non CGPA credits)** for the award of B. Tech. degree.

4.6 Students are eligible for award of **B.Tech.(Hons)** upon successful completion of **181 credits (165 regular credits + 12 Additional Credits+ 4 Non CGPA credits)** maintaining a CGPA of 8.0 during their period of study (4 years) and no history of arrears as detailed in clause 7.0.

4.7 Students are eligible for the award of **B.Tech. with Minor specialisation** upon successful completion of 12 additional credits totalling **181 credits (165 regular credits + 12 Additional Credits+ 4 Non – CGPA credits)** as detailed in clause 8.0

Table 2. Distribution of Credits

No.	Category	Credits	Percentage
1	Basic Sciences (BS)	32	20
2	Humanities Courses (HS)	7	4
3	Professional Core (PC)	88	53
4	Department Elective (DE)	15	9
5	Non – Department Electives (NE)	10	6
6	Design Project	3	2
7	Internship	1	0.5
8	Project	8	5
9	Comprehension	1	0.5
	Total Credits	**165**	**100**
NON – CGPA			
10	Professional Development	4	---

4.8 The medium of instruction is English for all courses, examinations, seminar presentations and project reports.

5.0 Faculty Advisor

To help the students in planning their selection of courses and programme of study and for getting general advice on the academic programme, the concerned department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor. Such Faculty Advisor will continue to mentor the students assigned to him/her for the entire duration of the programme.

5.1 Class Committee

5.2 Every section / batch of the B. Tech. Degree programme will have a Class Committee consisting of Faculty and students.

5.3 The constitution of the Class Committee will be as follows:

a. One Professor not associated with teaching the particular class shall be nominated by the Head of the Department to act as the Chairman of the Class Committee as approved by the Dean Academics.
b. Course coordinator of each of the lecture – based courses (for common courses).
c. Class teacher of the class.

d. All Faculty handling the courses for that class in the semester.
e. Workshop Superintendent (for first two semesters); as applicable.
f. Four students from the respective class nominated by Head of the Department
g. Faculty Advisors of the respective class.

5.4 Course committee

A course committee shall be constituted by the HOD for all the common courses, with the faculty who are teaching the courses and with a Professor of the core department as the Chairman. The Course committee shall meet periodically to ensure the quality of progression of the course in the semester.

5.5 The basic responsibilities of the Class Committee and Course committee are

a. To review periodically the progress of the students.
b. To discuss issues concerning curriculum and syllabi and the conduct of the classes.
c. To inform the students about the method of assessment as recommended by the Department Exam Committee ("DEC") at the beginning of the semester. Each class committee / course committee will communicate its recommendations and the minutes of the meetings to the Head of the Department, Dean (Academics) and the Dean (Student Affairs).
d. To conduct meetings at least thrice in a semester as per the Academic Plan issued by the Dean – Academics.
e. To review the academic performance of the students including attendance, internal assessment and other issues like discipline, maintenance etc.

6.0 Registration for courses in a Semester

A student will be eligible for registration of courses only if he/she satisfies the regulation clause 12.0 (progression), and clause 13.0 (maximum duration) and has cleared all dues to the Institute, Hostel and Library up to the end of the previous semester provided that student is not debarred from enrolment on disciplinary grounds.

6.1 The institute follows a flexible Choice Based Credit System and Slot based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their time table. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements of minimum and maximum.

Except for the first year courses, registration for a semester will be done during a specified week before the start of the semester as per the Academic Schedule.

Late registration /enrolment will be permitted by the Dean – Academics for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

6.2 The student shall make the choice of course in consultation with the Faculty Advisor and as stipulated from time to time.

6.3 Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Non - Departmental Electives courses offered by certain specific Departments and for higher level Foreign Languages, as decided from time to time.

7.0 B. Tech, (Honours) Programme

A new academic programme B.Tech. (Hons.) is introduced in order to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area. The features of the new programme, include:

a. B.Tech. students in regular stream can opt for B.Tech. (Hons.), provided they have a CGPA of 8.0 up to the end of fourth semester without any history of arrears.
b. The students opting for this program have to take four additional courses of their specialization of a minimum of 3 credits each from 5th to 8th semesters with not more than 2 additional courses in a semester.
c. The list of such additional courses offered by the various Departments of the respective school will be announced in the beginning of the academic year to facilitate the registration process.
d. The student can also opt for post graduate level courses
e. The faculty advisor will suggest the additional courses to be taken by the students based on their choice and level of their academic competence.
f. Students who have obtained “E” or “U” or “RC” / “RA” grade or “DE” category (vide clause 16.0 – Grading) in any course, including the additional credit courses, are not eligible for B.Tech. (Hons) degree.
g. The students have to pay the requisite fee for the additional courses.

8.0 B. Tech with Minor specialization:

Students, who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering / Technology/ Arts/ Fashion/ Humanities/ Management/ Basic Sciences, may opt for additional courses in minor specialisation groups offered by a

department other than their parent department. Such students shall select the stream of courses offered with pre – requisites by the respective departments and earn a Minor Specialization.

a. The number of credits to be earned for Minor specialization is 12 credits.

b. The students are permitted to register for their minor specialization courses from the V semester onwards subject to a maximum of two additional courses per semester.

c. The list of such additional courses offered by the various departments and the schedule will be announced in the beginning of the academic year to facilitate the registration process.

d. The students have to pay the requisite fee for the additional courses.

9.0 Attendance

The faculty handling a course must finalise the attendance, 3 calendar days before the last instructional day of the course and submit to the HoD through the class teacher.

a. A student with less than 75% attendance (Total Contact Hours - "TCH") in any course, will **not** be permitted to appear for the end-semester examination in that particular course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail **Academic Leave** up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. A student with an attendance ("TCH" – Total Contact Hours) between 40% and 75% in any course will fall under the category "RC", which means Repeat the Course during the Summer / Winter break. Students under "RC" category will **not** be permitted to attend the Regular End Semester Examinations for that course. During the Summer / Winter break, the regular courses of the respective semester will be offered as Summer/Winter Courses, to enable the students to get required attendance and internal assessment marks to appear in the Repeat examination.

d. Students under "RC" category in any course shall attend, the immediately following Summer / Winter course as detailed in clause 11.1. The detailed schedule of the Summer / Winter courses offered in every semester will be announced during the end of that semester. The student who have obtained "RC" has to select their appropriate slots and courses, optimally to attend the courses.

e. The student, whose attendance falls below 40% for a course in any semester, will be categorized as "RA", meaning detained in the particular course for want of

attendance and they will not be permitted to write the End semester exam for that course. The procedure for repeating the course categorized as "RA" is mentioned in Clause 11.2.

9.1 Additional condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization.

For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective faculty coordinator / Director of sports from the designated authority, before deputing the students.

9.2 For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Student Affairs) is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put up recommendations to the Vice – Chancellor. Such condonation is permitted **only twice** for a student in the entire duration of the programme.

The Vice-Chancellor, based on the recommendation of the attendance sub - committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

10.0 Assessment Procedure

Every course shall have two components of assessment namely,

a. Continuous Internal Assessment "CIA": This assessment will be carried out throughout the semester as per the Academic Schedule.
b. End Semester Examination "ESE": This assessment will be carried out at the end of the Semester as per the Academic Schedule.

The weightages for the various categories of the courses for CIA and ESE is given in Table 3.

Table 3 Weightage of the CIA and ESE for various categories of the courses

No.	Category of Courses	CIA weightage	CIA Minimum	ESE	ESE Minimum	Passing minimum (CIA + ESE)
1	Theory Course	50%	40%	50%	50%	45%
2	Practical Course	80%	50%	20%	50%	50%
3	Theory Course with Practical Components	60%	40%	40%	50%	45%
4	Department Elective (DE)/ Non – Department Elective (NE)	50%	40%	50%	50%	45%
5	Design Project	100%	50%	---	---	50%
6	Comprehension	100%	50%	---	---	50%
7	Internship	100%	50%	---	---	50%
8	Project and Viva Voce	50%	50%	50%	50%	50%

10.1 Theory Course / DE / NE Assessment weightages

The general guidelines for the assessment of Theory Courses, Department Electives "DE" and Non – Department Electives "NE" shall be done on a continuous basis is given in Table 4.

Table 4(a): Weightage for Assessment

No.		Assessment Theory, DE, NE courses	Weightage Theory, DE, NE courses	Duration
1.	CIA	First Periodical Assessment	5%	1 period
2.		Second Periodical Assessment	10%	1 Period
3.		Third Periodical Assessment	10%	1Period
4.		Seminar/Assignments/Project	15%	--
5.		Surprise Test / Quiz etc.,	10%	--
6.	ESE	End Semester Exam	50%	2 to 3 hours

10.2 Practical Course: For practical courses, the assessment will be done by the course teachers as below:

Weekly assignment/Observation / lab records and viva as approved by the Department Exam Committee "DEC"

a. Continuous Internal Assessment -- 80%
b. End Semester Examination -- 20%

10.3 Theory courses with practical Component: For theory courses with practical component the assessment will be calculated as follows as approved by the "DEC".

a. Continuous Internal Assessment -- 60%
b. End Semester Exam -- 40%

Table 4(b): Weightage for Assessment

No.		Assessment Theory, DE, NE courses	Weightage Theory, DE, NE courses	Duration
1.	CIA	First Periodical Assessment	10%	1 period
2.		Second Periodical Assessment	10%	1 Period
3.		Third Periodical Assessment	10%	1Period
4.		Practical Assessment	30%	----
5.	ESE	End Semester Exam	40%	2 to 3 hours

10.4 Design Project – Assessment

The general guidelines for assessment of Design Project is given in Table 5.

Table 5: Assessment pattern for Design Project

No.	Review / Examination scheme	Broad Guidelines	Weightage
1.	First Review	Concept	20%
2.	Second Review	Design	30%
3.	Third Review	Experiment/Analysis	20%
4.	Project report and Viva – Voce	Results and Conclusion	30%

10.5 Comprehension – Assessment

The general guidelines for assessment of Comprehension is given in Table 6.

Table 6: Assessment pattern for Comprehension

No.	Review / Examination scheme	Broad Guidelines	Weightage
1.	First Periodical Assessment – MCQ	Basic Sciences	20%
2.	Second Periodical Assessment – MCQ	Core Engineering	50%
3.	Third Periodical Assessment – Presentation	Emerging Areas	30%

10.6 Internship

A student has to compulsorily attend Summer / Winter internship during 3rd year for a minimum period of one month.

In lieu of Summer / Winter internship, the student is permitted to register for undertaking case study / project work under an engineering faculty of the Institute and carry out the project for minimum period of one month.

In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HoD. The evaluation will be done through presentation and viva. The course will have a weightage of one credit or as defined in the respective curriculum.

10.7 For final year Project / Dissertation / Design Project/ Internship, the assessment will be done on a continuous basis as given in Table 7

Table 7: Assessment of Project work

No.	Review / Examination scheme	Weightage
1.	First Review	10%
2.	Second Review	20%
3.	Third Review	20%
4.	Project report and Viva – Voce	50%

For the final year project and Viva – Voce end semester examination, the student shall submit a Project Report in the prescribed format issued by the Institute. The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end – semester assessment will be based on the project report and a viva on the project conducted by a Committee constituted by the Registrar / Controller of examination. This may include an external expert.

10.8 For Non – CGPA courses, the assessment will be graded “Satisfactory/Not Satisfactory” and grades as Pass/Fail will be awarded.

10.9 Flexibility in Assessment

The respective Departments under the approval of the Department Exam Committee (DEC) may decide the mode of assessment, based on the course requirements.

10.10 A student securing **less than the minimum** specified internal assessment marks in any course (clause 10.0, Table 3), will **not be permitted** to appear for the end-semester examination in that particular course and will be graded under **"RC"** category for that course. This will be denoted in the grade sheet as "RC", till the course is successfully completed in the subsequent semester(s).

11.0 Procedures for Course Repetition / Repeat Examinations

11.1 Summer / Winter Course: - for "RC" Category

a. Students under RC category i.e.
   i. Attendance between 40% and 75% in any course(s) OR
   ii. CIA marks less than the prescribed minimum as specified in 10.0 Table 3 in any course(s) OR
   iii. Falls under both 1 and 2 above

   are eligible for registering for the **Summer / Winter Course** which will be conducted during the Summer / Winter break, to improve their Attendance and/or CIA marks in the courses, by paying the **prescribed registration fee fixed from time to time.**.

b. The Odd semester regular courses will be offered only in the Winter and the even semester regular courses will be offered only in the Summer.

c. **RC** students shall register by payment of prescribed fee and attend the classes during the summer / winter break and take assessments to earn minimum internal marks (clause 10.0, Table 3) and/or required attendance, to become eligible for writing the Repeat Examinations (Clause 11.3).

d. The revised CIA marks shall not exceed 60% of the total internal weightage for any repeat course.

e. Re- Registration for 'RC' category

The students under "RC" category who **fail to improve** their attendance and/or CIA marks and **not** become eligible to write the Repeat Examination through the immediate summer/winter course are permitted to **re – register** for the Summer / Winter course again under "RC" category whenever it is offered in the subsequent semester(s) during their period of study by **paying 50% of the prescribed registration fee** as mentioned in Clause 11.1 (a). It is the responsibility of the student to fix the appropriate slots in the Summer / Winter course time table. The student will not be able to register if he/she is unable to fix the slots in the time table. The course will remain in the "RC" category until he / she successfully completes that course.

11.2 Course – Repetition - "RA" Category

a. Students who secure attendance less than **40%** in any course(s) in a semester will be categorized under "RA" - meaning **Repeat the course(s)** for want of minimum attendance. The CIA marks obtained by the students placed under RA category will become null and void.

b. "RA" category students shall re-register for the same course once again whenever it is offered in the subsequent regular semesters and has to secure required minimum attendance and minimum internal assessment marks to become eligible to appear in the end semester examination for that course, by paying the requisite fee.

c. It is the responsibility of the student to schedule their time table to include the "RA" courses without affecting the attendance of the regular courses of the current semester.

d. Normally, a student will be permitted to register for not more than 3 "RA" courses in a semester. However, the students who wish to register for more than 3 "RA" courses are permitted to register only if the student finds suitable slots for doing the course within the framework of the time table for the regular semester. Request for registrations of additional RA courses over and above 3 in a semester shall be got approved by the respective HoDs.

e. The student has the option to drop their regular courses proportionally in their regular semester during the course registration process without affecting the minimum credit requirement specified. Such dropped courses will be categorized as "RA". However, the student has to complete the dropped courses in the subsequent semesters.

f. It is the responsibility of the student to fix the slots for "RA" courses within the framework of the time table and slot availability without affecting his/her regular courses.

g. Detention

A student who secure RC or RA or both in all the theory courses prescribed in a semester shall repeat the semester by registering for the semester in the next academic year. However, he/she is permitted to appear for arrear examination as per eligibility.

11.3 Repeat Examinations

a. Normally, the results of the End Semester Examinations for Regular Theory courses are announced within a period of 10 days after the last regular examination.

b. During the even semester, the Repeat Examinations will be conducted for even semester courses and during the Odd semester the Repeat Examinations will be conducted for Odd semester courses.

c. The schedule for the Repeat Examinations will be notified through the Academic Calendar which will be published at the beginning of every academic year.
d. The students under "RC" category, who have secured the requisite attendance and internal assessment marks as applicable, by successfully completing the Summer / Winter course, are eligible to register for the Repeat Examinations.
e. The students who fail to secure a pass or being absent for genuine reasons in their End Semester Examination for the regular courses are permitted to appear for the Repeat Exams by paying the prescribed fee.
f. For the **Supplementary examinations (refer: Clause 15.2)**, the students with "U" grade in any course (refer clause 10.0 Table 3 and Clause 16.1) shall register by paying requisite fee and appear in the Repeat Examinations.
g. The students who wish to apply for the revaluation of their answer scripts (Regular/ Supplementary / Repeat Examinations) should apply immediately after the announcement of results.

12.0 Progression to higher semester

12.1 B.Tech.– Regular: Student has to satisfy the following conditions as laid down in Table 8 for progression from one academic year to next.

Table 8. Minimum Eligibility for progression B.Tech.- Regular

To enroll for semester	Minimum no. of credits to be earned for progression
3	NIL
5	15 credits* in Theory courses in 1st, 2nd and 3rd Semesters
7	30 credits* in Theory courses up to 5th Semester

** Credit calculation is applicable for Theory / Theory integrated lab only*

If a student fails to satisfy the above clause 12.1 in an academic year, the student has to take a break in study until they become eligible for progression

12.2 B.Tech.- Lateral Entry

Student has to satisfy the following conditions as laid down in Table 9 for progression from one academic year to next.

Table 9. Minimum Eligibility for progression B.Tech.- Lateral Entry

To enroll for semester	Minimum no. of credits to be earned
5	NIL
7	15 credits* in Theory courses in 3rd, 4th and 5th Semesters

**Credit calculation is applicable for Theory / Theory integrated lab only*

If a student fails to satisfy the above clause 12.2 in an academic year, the student has to take a break in study until they become eligible for progression

12.3 If a student is in **RC** category (due to lack of minimum CIA marks **as specified in clause no. 10. Table 3**) or **RA** category (due to lack of minimum attendance as specified in clause 9.0 e) **in all theory courses prescribed in a semester**, he/she will be detained and will not be allowed to proceed to the next semester. He/she has to re-register for all the courses in the following academic year only.

13.0 Maximum Duration of the Programme

A student may complete the programme at a slower pace than the regular pace, but in any case in **not more than 6 years for B. Tech**, **and not more than 5 years for lateral entry students excluding the semesters withdrawn as per clause 14.0.**

A student completing the B.Tech. programme during the extended period will not be eligible for Institute ranking.

14.0 Temporary Withdrawal from the Programme

a. A student is permitted to take a break, up to a maximum of 2 semesters, during the entire programme to clear the backlog of arrears.
b. A student may be permitted by the Vice- Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, Start – up venture or other valid reasons as recommended by a committee consisting of Head of Department, Dean (Academic) and Dean (Student Affairs).

15.0 Declaration of results

15.1 A student shall secure the minimum marks as prescribed in Clause 10.1(Table 3) in all categories of courses in all the semesters to secure a pass in that course.

15.2 **Supplementary Examinations:** If a candidate fails to secure a pass in a course and gets a "U" grade as per clause 16.1 he/she shall register and pay the requisite fee for re-appearing in the End Semester Examination during the following semester(s). Such examinations are called Supplementary Examinations and will be conducted along with the Regular /Repeat Examinations. The Supplementary Exams for the Odd semester courses will be conducted during the odd semester and supplementary exams for the even semester courses will be conducted during the even semester only. The student need not attend any contact course. The Internal Assessment marks secured by the candidate will be retained for all such attempts.

15.3 A candidate can apply for the revaluation of his/her end semester examination answer script in a theory course, after the declaration of the results, on payment of a prescribed fee.

15.4 If a candidate fails to secure a pass in Practical/Theory with Practical component / Design Project / Internship / Comprehension courses, due to not satisfying the minimum passing requirement ("U" grade) – as per clause 16.1 he/she shall register for the courses by paying the prescribed fee in the subsequent semester when offered by the departments.

15.5 Revaluation is **not** permitted for Practical/Theory with Practical component/Design Project / Internship / Comprehension courses. However, only for genuine grievances as decided by the Exam Grievance Committee a student may be permitted to apply for revaluation.

15.6 After 5 years, i.e., completion of one year (2 semesters) from the normal duration of the programme, the internal assessment marks obtained by the candidate will not be considered in calculating the passing requirement. A candidate who secures 50% in the end semester examination will be declared to have passed the course and earned the specified credits for the course irrespective of the score in internal assessment marks earned in that course.

15.7 Candidate who earns required credits for the award of degree after 5 years for B.Tech. programme (on expiry of extended period of 2 semesters over and above normal duration of course) he/she will be awarded only *second class* irrespective of his/her CGPA. However, the period approved under temporary withdrawal, if any, from the programme (13.0) will be excluded from the maximum duration as mentioned above.

15.8 **Semester Abroad Programme:** Students who are allowed to undergo internship or Training in Industries in India or abroad during their course work or attend any National / International Institute under semester abroad programme (SAP) up to a maximum of 2 semesters will be granted credit transfer for the Course Work/project work done by them in the Industry /Foreign Institute as per the recommendations of the credit transfer committee. The leave period of the students for International internships / Semester Abroad programme etc., will be accounted for attendance.

16.0 Grading

16.1 A grading system as shown in Table 10 will be followed.

Table 10: Grading system

Range of Marks	Letter Grade	Grade Points	Remarks
90 – 100	S	10	Outstanding
80-89	A	09	Excellent
70-79	B	08	Very Good
60-69	C	07	Good
50-59	D	06	Average
45 – 49	E	05	Pass
<45	U	00	To Reappear for end-semester examination
--	RC	00	**Repeat Course (Summer / Winter) due to** Attendance deficiency (between 40% and 75%) and/or I. Lack of minimum CIA marks as specified in clause 10.0 Table 3
--	RA	00	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course
	--	00	**DETAINED** "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

16.2 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points P_i earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

16.3 The Grade card will not include the computation of GPA and CGPA for courses with letter grade **RA, RC** and **U** until those grades are converted to the regular grades.

16.4 A course successfully completed cannot be repeated.

17.0 Grade Sheet

17.1 Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 10.

17.2 A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than **U, RC, RA** in that course.

17.3 After results are declared, grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.
h. Credits earned under Non CGPA courses.
i. Additional credits earned for B. Tech (Hons.) and B. Tech with Minor specialization.

18.0 Class/Division

18.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0: First **Class with distinction**

6.5 ≤ CGPA <8.0: **First Class**

5.0 ≤ CGPA <6.5: **Second Class.**

18.2 (i) Further, the award of **'First class with distinction'** is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from II semester, within the minimum duration of the programme.

(ii) The award of **'First Class'** is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses **within 5 years for B. Tech programmes**

(iii) The period of authorized break of the programme (vide clause 14.0) will not be counted for the purpose of the above classification.

(iv) To be eligible for award of **B. Tech (Hons.)** the student must have earned additional 12 credits in the relevant Engineering courses offered by the Departments of the respective Schools, thereby a total of **181 credits (165 regular credits + 12 additional credits + 4 Non CGPA credits) and should have 8.0 CGPA without any history of arrears and should not have secured E, RC, RA, U, in any course during the entire programme.**

(v) To be eligible for award of **B. Tech with Minor Specialization**, the student must have earned additional 12 credits in the relevant courses offered by other than the parent department and has successfully earned **181 credits (165 regular credits + 12 Additional credits + 4 Non CGPA Credits)**

19.0 Transfer of credits

19.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

19.2 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under lateral entry based on the recommendation of the credit transfer committee on a case to case basis.

19.3 Admission norms for working Professional:

Separate admission guidelines are available for working / experienced professionals for candidates with the industrial / research experience who desire to upgrade their qualification as per recommendation of Credit Transfer Committee.

20.0 Eligibility for Award of the B.Tech. /B. Tech (Hons)/ B. Tech with Minor Specialization Degree

20.1 A student shall be declared to be eligible for award of B. Tech. /B. Tech (Hons) / B. Tech degree with Minor specialization if he/she has satisfied the clauses 4.6 /7.0 / 8.0 respectively within the stipulated time (clause 13, 14).

a. Earned the specified credits in all the categories of courses (vide clause 4.6) as specified in the curriculum corresponding to the discipline of his/ her study ;
b. No dues to the Institute, Hostels, Libraries etc.; and
c. No disciplinary action is pending against him / her.

The award of the degree shall be recommended by the Academic Council and approved by the Board of Management of the Institute.

21.0 Change of Discipline

21.1 If the number of students in any discipline of B.Tech. programme as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said disciplines can be filled by transferring students from other disciplines subject to eligibility. All such transfers will be allowed on the basis of merit of the students. The decision of the Vice-Chancellor shall be final while considering such requests.

21.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of discipline subject to the availability of vacancies and as per norms.

22.0 Power to modify

Notwithstanding all that has been stated above, the Academic Council is vested with powers to modify any or all of the above regulations from time to time, if required, subject to the approval by the Board of Management.

B.TECH – INFORMATION TECHNOLOGY									
(165 CREDIT STRUCTURE)									
SEMESTER - I									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MEA4101/ ELA4101	Engineering Graphics and Computer Aided Design / Professional English and Soft Skills	1	1	2	3	1	4
2	BS	MAA4101	Matrices and Calculus	3	0	2	4	1	5
3	BS	PHA4102/ CYA4101	Engineering Physics / Engineering Materials	3	0	0	3	1	3
4	PC	CSA4101	Problem Solving Using C*	2	0	2	3	1	4
5	PC	EEB4101/ ITB4101	Introduction to Digital Systems / Engineering and Design	3	0	0	3	1	3
6	BS	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
7	BS	PHA4131/ CYA4131	Engineering Physics Lab/ Materials Chemistry Lab	0	0	2	1	0	2
Total				**12**	**1**	**10**	**17.5**	**7**	**23**
***Project Based Learning**									
SEMESTER - II									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4117	Analytical Mathematics	3	0	2	4	0	5
2	BS	PHA4102/ CYA4101	Engineering Physics / Engineering Materials	3	0	0	3	1	3
3	BS	ELA4101/ MEA4101	Professional English and soft skills / Engineering Graphics and Computer Aided Design	1	1	2	3	1	4
4	PC	GEA4102	Sustainable Engineering Systems	2	0	0	2	1	2
5	PC	EEB4101/ ITB4101	Introduction to Digital Systems / Engineering and Design	3	0	0	3	1	4
6	PC	ITB4117	Object Oriented Programming in Java	3	0	0	3	1	3
7	PC	ITB4118	Data Structures and Algorithms	3	1	0	4	0	4
8	PC	ITB4141	Data Structures Lab using Object Oriented Programming	0	0	3	1	0	3
9	BS	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
10	BS	PHA4131 / CYA4131	Engineering Physics / Materials Chemistry Lab	0	0	2	1	0	2
Total				**17**	**2**	**11**	**23.5**	**5**	**30**

SEMESTER - III									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4201	Partial Differential Equations and Transforms	3	1	0	4	0	4
2	PC	ITB4201	Database Technologies	3	0	0	3	2	3
3	PC	ITB4202	Advanced Java Programming	3	1	0	4	2	4
4	BS	GEA4216	Professional Ethics and Life Skills	2	0	0	2	1	2
5	DE		Department Elective-I	3	0	0	3	0	3
6	NE		Non Department Elective–I	2	0	0	2	0	2
7	PC	ITB4231	Advanced Java Programming Lab	0	0	3	1	0	3
8	PC	ITB4232	Database Technologies Lab	0	0	3	1	0	3
9	PC	ITB4233	Design Project – I	0	0	2	1	1	2
Total				**16**	**2**	**8**	**21**	**6**	**26**

SEMESTER - IV									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4216	Probability and Statistics	3	1	0	4	0	4
2	PC	ITB4216	Data communications and networking	3	1	0	4	1	4
3	PC	ITB4217	Operating Systems	3	1	0	4	1	4
4	PC	ITB4218	Web and Mobile Programming	3	1	0	4	1	4
5	DE		Department Elective-II	3	0	0	3	0	3
6	NE		Non Department Elective–II	2	0	0	2	0	2
7	PC	ITB4241	Web and Mobile Programming Lab	0	0	3	1	0	3
8	PC	ITB4242	System Programming Lab	0	0	3	1	0	3
9	PC	ITB4243	Design Project – II	0	0	2	1	1	2
Total				**17**	**4**	**8**	**24**	**4**	**29**

SEMESTER - V									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4301	Optimization Techniques	3	1	0	4	0	4
2	PC	ITB4301	Artificial Intelligence	3	1	0	4	2	4
3	PC	ITB4302	Software Design and Modeling	3	1	0	4	1	4
4	PC	ITB4303	Embedded System Programming	3	1	0	4	1	4
5	DE		Department Elective-III	3	0	0	3	0	3
6	NE		Non Department Elective–III	2	0	0	2	0	2
7	PC	ITB4331	Embedded System Programming Lab	0	0	3	1	0	3
8	PC	ITB4332	Software Design and Modeling Lab	0	0	3	1	0	3
9	PC	ITB4333	Design Project – III	0	0	2	1	1	2
Total				**17**	**4**	**8**	**24**	**5**	**29**

SEMESTER - VI									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	ITB4316	Object Oriented Analysis and Design	3	1	0	4	3	4
2	PC	ITB4317	Networks and Information Security	3	1	0	4	3	4
3	PC	ITB4318	Machine Learning	3	1	0	4	2	4
4	BS	GEA4304	Business Economics	2	0	0	2	1	2
5	DE		Department Elective–IV	3	0	0	3	0	3
6	NE		Non Department Elective-IV	2	0	0	2	0	2
7	PC	ITB4341	Machine Learning Lab	0	0	3	1	0	3
8	PC	ITB4342	Networks and Information Security Lab	0	0	3	1	0	3
9	PC	ITB4343	Design Project – IV	0	0	2	1	1	2
Total				**16**	**3**	**8**	**22**	**10**	**27**

SEMESTER - VII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	ITB4401	Software Project Planning and Management	3	0	2	4	1	5
2	PC	ITB4402	Cyber Physical Systems	3	1	0	4	1	4
3	PC	ITB4403	Data Analytics	3	1	0	4	1	4
4	PC	ITB4404	Internet of Things	3	0	2	4	1	5
5	DE		Department Elective-V	3	0	0	3	0	3
6	NE		Non Department Elective–V	2	0	0	2	0	2
7	PC	ITB4431	Data Analytics Lab	0	0	3	1	0	3
8	PC	ITB4432	Design Project -V / Internship	0	0	2	1	1	2
9	PC	ITB4433	Comprehension	1	0	0	1	1	1
Total				**18**	**2**	**9**	**24**	**6**	**29**

SEMESTER - VIII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	ITB4441	Project & Viva – voce	0	0	24	8	0	24
Total				**0**	**0**	**24**	**8**	**0**	**0**
Total							**165**		

LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
3	DE	ITC4251	Information Theory and Coding	3	0	0	3	0	3
3	DE	ITC4252	Distributed System	3	0	0	3	0	3
3	DE	ITC4253	IT Infra Structure Management[1]	3	0	0	3	0	3
3	DE	ITC4254	IT Security Engineering[1]	3	0	0	3	0	3
3	DE	ITC4255	Python Programming	3	0	0	3	0	3
3	DE	ITC4256	Soft Computing	3	0	0	3	0	3
3	DE	ITC4257	E-Learning Techniques	3	0	0	3	0	3
4	DE	ITC4266	Principles of Mobile Computing	3	0	0	3	0	3
4	DE	ITC4267	Virtualization and Cloud Computing	3	0	0	3	0	3
4	DE	ITC4268	Cyber Crime Investigation and Digital Forensics[1]	3	0	0	3	0	3
4	DE	ITC4269	IT Security Operations[1]	3	0	0	3	0	3
4	DE	ITC4270	Decision Modeling	3	0	0	3	0	3
4	DE	ITC4271	Business Intelligence and its Applications	3	0	0	3	0	3
4	DE	ITC4272	Advanced Computer Algorithms	3	0	0	3	0	3
5	DE	ITC4351	Advanced Networks	3	0	0	3	0	3
5	DE	ITC4352	Digital Signal Processing	3	0	0	3	0	3
5	DE	ITC4353	Ethical Hacking and Cyber Security[1]	3	0	0	3	0	3
5	DE	ITC4354	Identity and Access Management[1]	3	0	0	3	0	3
5	DE	ITC4355	Natural Language Processing	3	0	0	3	0	3
5	DE	ITC4356	Predictive Analytics	3	0	0	3	0	3
5	DE	ITC4357	Building Enterprise Application	3	0	0	3	0	3
5	DE	ITC4358	UI Technologies	3	0	0	3	0	3
6	DE	ITC4366	Network Programming	3	0	0	3	0	3
6	DE	ITC4367	Web Application Security[1]	3	0	0	3	0	3
6	DE	ITC4368	IT Security Assessment and Testing[1]	3	0	0	3	0	3
6	DE	ITC4369	Deep Learning	3	0	0	3	0	3
6	DE	ITC4370	Data Visualization	3	0	0	3	0	3
6	DE	ITC4371	Web Services and Service Oriented Architecture	3	0	0	3	0	3
6	DE	ITC4372	Software Agents	3	0	0	3	0	3
7	DE	ITC4451	Digital Image Processing	3	0	0	3	0	3
7	DE	ITC4452	Mobile Programming	3	0	0	3	0	3
7	DE	ITC4453	Mobile Security[1]	3	0	0	3	0	3
7	DE	ITC4454	Applied Cryptography[1]	3	0	0	3	0	3
7	DE	ITC4455	Real Time Analytics	3	0	0	3	0	3
7	DE	ITC4456	Software Testing Technologies	3	0	0	3	0	3
7	DE	ITC4457	Agile Software Development	3	0	0	3	0	3

[1] **Cyber Security Specialized Electives**

[1] A student should earn 15 credits from Cyber Security specialized DE to get Specialization in B.Tech. Information Technology Cyber Security

LIST OF NON DEPARTMENTAL ELECTIVES OFFERED BY INFORMATIO TECHNOLOGY DEPARTMENT WITH GROUPING - SEMESTER WISE									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
3	NE	ITD4281	Digital Design and Practices	2	0	0	2	0	2
3	NE	ITD4282	Cyber Security for Beginners	2	0	0	2	0	2
3	NE	ITD4283	Programming for Analytics	2	0	0	2	0	2
3	NE	ITD4284	Essentials of Information Technology	2	0	0	2	0	2
4	NE	ITD4291	Mobile Communication Networks	2	0	0	2	0	2
4	NE	ITD4292	Cyber Crime Investigation and Digital Laws	2	0	0	2	0	2
4	NE	ITD4293	Bigdata Analytics	2	0	0	2	0	2
4	NE	ITD4294	Green Computing	2	0	0	2	0	2
5	NE	ITD4381	Edge Computing	2	0	0	2	0	2
5	NE	ITD4382	Ethical Hacking Techniques	2	0	0	2	0	2
5	NE	ITD4383	Marketing Analytics	2	0	0	2	0	2
5	NE	ITD4384	Open Source Programming	2	0	0	2	0	2
6	NE	ITD4391	Autonomous System	2	0	0	2	0	2
6	NE	ITD4392	Cloud Security	2	0	0	2	0	2
6	NE	ITD4393	Optimization Methods for Analytics	2	0	0	2	0	2
6	NE	ITD4394	Mobile Application Development	2	0	0	2	0	2
7	NE	ITD4481	Insight into Cloud Computing	2	0	0	2	0	2
7	NE	ITD4482	Cyber Security Techniques and Tools	2	0	0	2	0	2
7	NE	ITD4483	Machine Learning Techniques	2	0	0	2	0	2
7	NE	ITD4484	C# and .Net Frame Work	2	0	0	2	0	2

SEMESTER – I

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	MEA4101	COURSE CATEGORY	BS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.	1,4,6
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids	1,4,6
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models	1,4,6
4	Apply the 3D model commands to generate and solid object	1,4,6
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.	1,4,6
6	Student can able to develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.	1,4,6

Prerequisites : Nil

MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES (12)

Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Suggested Reading: Solid modeling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING (15)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Suggested Reading: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15)

Principles of isometric projection and solid modelling. Isometric drawing – Iso Planes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modelling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

***Suggested Reading**: Surface modeling and solid modeling commands*

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING (15)
Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software. 2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer. ***Suggested Reading***: *CAD commands for modeling and views generation*
MODULE 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING (15)
Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice. **Suggested Reading**: *CAD commands for modeling and views generation*

TEXT BOOKS	
1	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016
REFERENCE BOOKS	
1	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2	Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
3	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2012
4	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
6	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2016.
E BOOKS	
1	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html
MOOC	
1	http://nptel.ac.in/courses/112103019/
2	http://nptel.ac.in/courses/105104148/

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
COURSE CODE	ELA4101	COURSE CATEGORY	BS	L-T-P-S	1-1-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL – 6				

CO	COURSE OUTCOMES	PO
1.	Understanding the importance of professional communication and applying the knowledge.	3
2.	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations; enhance pronunciation skills based on the knowledge of phonetics.	3
3.	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems	3
4.	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments	3
5.	Imbibing soft skills to excel in interpersonal skills essential for workplace	3

Prerequisites : Plus Two English-Intermediate Level

MODULE 1 : THE ELEMENTS OF COMMUNICATION (9)

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business Communication-Professional Communication-barriers to communication –strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short Conversations-Situational communication-dialogue writing -Language Functions-analyse the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

Rogerson, Trish Stott & Derek Utley.2011

Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)

Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2 : AURAL –ORAL COMMUNICATION IN ENGLISH (9)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)-neutral accent- sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS , Professional Speaking Skills by Aruna Koneru, Oxford Press, Face to face series Cambridge University Press, Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela

MODULE 3 : GRAMMAR AND DEVELOPMENT OF READING SKILLS (9)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles-comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on students area of specialization answering questions- reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins IELTS, Cambridge books Practical English Usage by Michael Swan , Cambridge University Press

MODULE 4 : EFFECTIVE WRITING AND BUSINESS COMMUNICATION (9)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data(bar chart, pie chart, line graphs)

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS,IELTS Academic Writing 1,New Insights into IELTS, CUP

MODULE 5 : SOFT SKILLS (9)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management- Lateral Thinking (De Bono's Six Thinking Hats) and Problem Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.

Soft Skills for Everyone by Jeff Butterfield, Cengage Learning Education and personality development, K. Manoharan English for Life and the Workplace through the LSRW&T skills

Lateral Thinking skills by Edward De Bono

TEXT BOOKS	
1.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press. 2009
REFERENCE BOOKS	
1.	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.
2.	Embark, English for Undergraduates by Steve Hart et al, Cambridge University Press,2016, Edition
3.	Skills for the TOEFL IBT Test, Collins, 2012 edition
4.	Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition
5.	English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition
6.	Professional Speaking Skills by Aruna Koneru, Oxford Publications.
7.	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
8.	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002
9.	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
10.	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation, 2015
11.	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.
E BOOKS	
1.	https://www.britishcouncil.in/english/courses-business
2.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3.	http://www.bbc.co.uk/learningenglish/english/
4.	http://www.antimoon.com/how/pronunc-soundsipa.htm
5.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6.	Oneshopenglish.com
7.	Breakingnews.com
MOOC	
1	https://www.mooc-list.com/tags/english
2	https://www.mooc-list.com/course/adventures-writing-stanford-online
3	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	MATRICES AND CALCULUS (Common for all Departments)			CREDITS	4
COURSE CODE	MAA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL- 4				

CO	COURSE OUTCOMES	PO
1.	Able to study the concepts of matrices and apply them in related engineering problems.	1,3,4,6
2.	Capable to use the features of Differential Calculus in optimization problems.	1,3,4,6
3.	Able to extend the concepts of integral calculus in finding area and volume.	1,3,4,6
4.	Skilled to solve ordinary differential equations in engineering problems.	1,3,4,6

Prerequisites : Nil

MODULE 1: MATRICES (13L+2P)

Characteristic equation – Eigenvalues and Eigenvectors – Properties – Cayley Hamilton theorem (Statement only) – Verification and inverse of the matrix using Cayley Hamilton theorem- Diagonalization of matrices using similarity transformation. Suggested Reading: Basics of Matrices

Lab 1: Eigenvalues and Eigenvectors, Verification and inverse using Cayley Hamilton theorem- Diagonalization

MODULE 2: DIFFERENTIAL CALCULUS (13L+2P)

Methods of differentiation of functions – Product and Quotient rules – Inverse trigonometric functions – Implicit function – parametric form. Partial differentiation – Total differentiation- Taylor's series – Maxima and minima of functions of two variables

Suggested Reading: Basics of Differentiation

Lab 2: Taylor's series – Maxima and minima of functions of two variables

MODULE 3: INTEGRAL CALCULUS (13L+2P)

Integration – Methods of integration – Substitution method – Integration by parts – Integration using partial fraction – Bernoulli's formula. Applications of Integral Calculus: Area, Surface and Volume.

Suggested Reading: Basics of Integrations

Lab 3: Applications of Integral Calculus: Area, Surface area and Volume.

MODULE 4: ORDINARY DIFFERENTIAL EQUATIONS (13L+2P)

Second order differential equations with constant coefficients – Particular integrals – e^{ax}, $Sinax, Cosax, x^m$, e^{ax} Cos bx, e^{ax} Sin bx. Solutions of homogeneous differential equations with variable coefficients – Variation of parameters.

Suggested Reading: Basics of Differential Equations.

Lab 4: Solution of Second order differential equations.

LAB/MINI PROJECT/FIELD WORK

Theory with practical classes.

TEXT BOOKS

1 Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014

2	Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3	Chandrasekaran A, “A Text book of Engineering Mathematics I”, Dhanam Publications, Chennai, 2010
REFERENCE BOOKS	
1	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
2	Weir, M.D and Joel Hass, Thomas’ Calculus, 12th Edition, Pearson India, 2016.
3	Advanced Engineering Mathematics With Matlab, Third Edition, 2011 by CRC Press.
E BOOKS	
1	http://nptel.ac.in/courses/111105035/
2	https://www.edx.org/.../introduction-engineering-mathematics-utarlingtonx-engr3
MOOC	
1.	https://www.mooc-list.com/tags/engineering-mathematics

COURSE TITLE	**ENGINEERING PHYSICS (AERO, MECH, AUTO, CHEMICAL, BIOTECH, CIVIL)**			**CREDITS**	**3**
COURSE CODE	**PHA4102**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-0-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1.	Solve basic problems in mechanics and also understand the properties of matter.	1,2,4,6
2.	Have a knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2,4,6
3.	Knowledge on fundamental concepts of Quantum physics	1,2,4,6
4.	Fundamental knowledge on semiconductors and discrete devices.	1,2,4,6
5.	Understand the concept, working and application of lasers and fiber optics.	1,2,4,6

Prerequisites: Knowledge in fundamentals of physics at higher secondary level.

MODULE 1 : PROPERTIES OF MATTER AND HEAT (9L)

Elasticity - types of moduli of elasticity - Young’s modulus - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young’s modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivities of good and bad conductors – Forbe’s method – theory and experiment – Lee’s disc method for bad conductor

MODULE 2 : ACOUSTICS AND ULTRASONICS (9L)
Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.
MODULE 3 : QUANTUM PHYSICS (9L)
Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)
MODULE 4 : CRYSTAL PHYSICS AND MAGNETISM (9L)
Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures. Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.
MODULE 5 : PHOTONICS AND FIBRE OPTICS (9L)
Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.
LAB / MINI PROJECT / FIELD WORK
NA

TEXT BOOKS	
1.	P.Mani, "Engineering Physics", Vol-I & II, Dhanam Publications, Chennai, 2011.
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi, 2010.
REFERENCE BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications, 2007.
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi, 2003.
E BOOKS	
1	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2	http://iopscience.iop.org/book/978-1-6817-4585-5
3	https://www.springer.com/in/book/9783319206295
MOOC	
1	http://nptel.ac.in/courses/115106061/
2	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
COURSE CODE	CYA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Student will be able to - Suggest suitable metals for alloying.	1,2,4,6
2.	Identify the materials apt for engineering applications.	1,2,4,6
3	Select high temperature materials for engineering applications.	1,2,4,6
4.	Map the properties of nanomaterials with their applications.	1,2,4,6
5.	Suggest suitable materials for electronic applications.	1,2,4,6

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 : CRYSTAL STRUCTURE AND PHASE RULE (9L)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2: POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES. (9L)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites – Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3 : NANOMATERIALS AND MOLECULAR SIEVES (9L)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4 : MATERIALS FOR ELECTRONIC APPLICATONS (9L)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5 : LUBRICANTS, ADHESIVES AND EXPLOSIVES	(9L)
Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.	
LAB / MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi, 2012
2	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3	Composite materials, K.K. Chawala, 3rd ed., Springer-Verlag, New York, 2012.
4	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, , Wiley-VCH Verlag GmbH Co. KGaA, Weinheim, 2003.
5	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, , Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK, 2001.
E BOOKS	
1	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `
MOOC	
1	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	PROBLEM SOLVING USING C			CREDITS	3
COURSE CODE	CSA4101	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Describe the basics of digital computer and programming languages.	1,2,8,12
2	Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem.	1,2,3,5,12
3	Design and Implement C program using Control Statements and Functions.	1,2,3,5,9,10,12
4	Design and Implement C program using Pointers and File operations.	1,2,3,12
5	Identify the need for embedded C in real-time applications.	1,2,6,12

Prerequisites: Nil

MODULE 1 – PROGRAMMING LANGUAGES AND PROBLEM SOLVING TECHNIQUES (6L+6P)

Introduction – Fundamentals of digital computers - Programming languages -Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code.

Practical Component:

Drawing Flowcharts using E- Chart & Writing pseudo code for the following problems

(i) Greatest of three numbers

(ii) Sum of N numbers

(iii) Computation of nCr

MODULE 2: FUNDAMENTALS OF C (6L+6P)

Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements.

Practical Component:

(i) Program to illustrate arithmetic and logical operators

(ii) Program to read and print data of different types

(iii) Program to calculate area and volume of various geometrical shapes

(iv) Program to compute biggest of three numbers

(v) Program to print multiplication table

(vi) Program to convert days to years, months and days

(vii) Program to find sum of the digits of an integer.

MODULE 3: FUNCTIONS, ARRAYS AND STRINGS (6L+6P)

Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.

Practical Component:

(i) Program to compute Factorial, Fibonacci series and sum of n numbers using recursion

(ii) Program to compute sum and average of N Numbers stored in an array

(iii) Program to sort the given n numbers stored in an array

(iv) Program to search for the given element in an array (v) Program to do word count (vi) Program to insert a substring in a string (vii) Program to concatenate and compare two strings (viii) Program using pre-processor statements	
MODULE 4: POINTERS, STRUCTURES AND UNION	**(6L+6P)**
Pointers – Dynamic Memory allocation – Structure and Union – Files. **Practical Component:** (i) Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation (ii) Program to read and print records of a student/payroll database using structures (iii) Program to simulate file copy (iv) Program to illustrate sequential access file (v) Program to illustrate random access file	
MODULE 5: INTRODUCTION TO EMBEDDED C	**(6L+6P)**
Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler. **Practical component:** Simple programs using embedded C	
LAB / MINI PROJECT / FIELD WORK	
NA	
TEXT BOOKS	
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.
REFERENCE BOOKS	
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.
2.	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.
3.	S.Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.
E BOOKS	
1.	https://en.wikibooks.org/wiki/C_Programming
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc18-cs10/preview
2.	http://nptel.ac.in/courses/106105085/2
3.	https://www.udemy.com/c-programming-for-beginners/
4.	https://www.coursera.org/specializations/c-programming

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To understand basic operation in digital systems and instruments.	1,2,4,6
2	To gain knowledge on basic functioning of sensors and display units.	1,2,4,6
3	To familiarize the concepts of signal processing and converting elements.	1,2,4,6
4	To acquire the knowledge of microcontrollers and applications	1,2,4,6
5	To attain the basic concepts of consumer electronics and communication devices.	1,2,4,6

Prerequisites : Physics and Mathematics

MODULE 1 : INTRODUCTION TO DIGITAL SYSTEMS (9L)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).

Suggested Reading: Basics of number systems.

MODULE 2 : SENSORS AND DISPLAYS (9L)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

MODULE 3 : SIGNAL CONDITIONING CIRCUITS (9L)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

MODULE 4 : INTRODUCTION TO MICRO CONTROLLERS (9L)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

MODULE 5 : CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM (9L)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

LAB / MINI PROJECT/FIELD WORK

Field trip to consumer electronics industry.

TEXT BOOKS	
1	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2	Op-amps and Linear Integrated Circuits,Ramakant A. Gayakwad,4th edition,Prentice Hall, 2015.
3	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4	The 8051 Microcontroller And Embedded Systems Using Assembly And C, SepehrNaimi, SarmadNaimi, Muhammad Ali Mazidi, Second edition, 2017.
5	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
2.	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
3.	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
4.	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
5.	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2	https://electronics.howstuffworks.com/home-audio-video-channel.htm
MOOC	
1	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
3	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors %20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
4	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
5	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro /ui/Course_home2_5.html

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	ITB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0-0-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Students will be able to appreciate the different elements involved in good designs and to apply them in practice when called for.	1-12
2	Students will be aware of the product oriented and user oriented aspects that make the design a success.	1-12
3	Students will be able to think of innovative designs incorporating different segments of knowledge gained in the course	1-12
4	Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.	1-12
5	Students learn economic and environmental Issues, trade aspects and IPR	1-12

Prerequisites : Nil

MODULE 1-INTRODUCTION TO INFORMATION TECHNOLOGY DESIGN (7+2 PERIODS)

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions

MODULE 2-PROCESSES IN DESIGN THINKING (7+2 PERIODS)

Design process- Different stages in design and their significance; Defining the design space; Analbgies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed Architectures; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any architecture

MODULE 3 – PROTOTYPE IN IT DESIGN (4+5 PERIODS)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis. Engineering the design - From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; development; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in any IT

specialization.
MODULE 4- QUALITY ASPECTS IN IT DESIGN (4+5 PERIODS)
Design for "X"; covering quality, reliability, safety, Development, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. **Project: Example:** List out the design methods for IoT based structure
MODULE 5 – USER CENTRED DESIGNS IN INFORMATION TECHNOLOGY (4+5 PERIODS)
Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Smart phone using Android. Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Tradition and design; Study the evolution of Software Designs; Role of colours in design. Design as a marketing tool; Intellectual Property rights - Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it. **Project:** Examine the possibility of value addition for an existing product.

REFERENCE BOOKS	
1	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919
2	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	ENGINEERING IMMERSION LAB			CREDIT	0.5
COURSE CODE	GEA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-2
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Upon successful completion of this course the student should be able to Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations.	1,2,4,6
2	Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.	1,2,4,6
3	Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.	1,2,4,6

SLOT X - LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING WORKSHOP

1. Welding: Arc welding: Butt joints
2. Lap joints.
3. Machining: Facing
4. Turning

II. AUTOMOBILE ENGINEERING

1. Dismantling and Studying of two stroke gasoline engine.
2. Assembling of two stroke gasoline engine.
3. Dismantling and Studying of four stroke gasoline engine
4. Assembling of four stroke gasoline engine.

III. AERONAUTICAL ENGINEERING

1. Study of Flow Pattern around Various Objects.
2. Force measurement on Aircraft Model
3. Determination of Young's Modulus for Aluminum Cantilever Beam
4. Binary Addition & Subtraction using Microprocessor

IV. CIVIL ENGINEERING

1. Plumbing- Basic Pipe Connection using valves, couplings and elbows.
2. Carpentry – Sowing, Planning and making common Joints.
3. Bar Bending
4. Construction of a 50 cm height brick wall without mortar using English Bond.

SLOT Y - LIST OF EXPERIMENTS

V.ELECTRICAL ENGINEERING

1. Study of tools and accessories.
2. Study of cables.
3. Staircase wiring, Tube light and Fan connection.
4. Measurement of energy using single phase energy meter.

VI. ELECTRONICS ENGINEERING

1. Study of Active and Passive Components.
2. Study of Logic Circuits.
3. Making simple circuit using Electronic Components.
4. Measuring of parameters for signal using CRO.

VII. COMPUTER SCIENCE

1. Troubleshooting different parts of the computer peripherals, Monitor, Keyboard & CPU.
2. Installation of various operating systems, their capabilities, Windows, Unix, Linux.
3. Installation of commonly used software like MS Office
4. Assembling digital computer.

VIII. MECHATRONICS ENGINEERING

1. Study of Key Elements of Mechatronics Systems
2. Sensors – Load Cell, Thermocouple
3. Actuators – Linear & Rotary Actuators
4. Interfacing & Measurements – Virtual Instrumentation

REFERENCE

1	Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2015.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid, CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
4	Robert Quesada, Jeyapoovan T., Computer Numerical Control Machining and Turning Centers, Pearson Education, New Delhi, 2006

METHOD OF ALLOCATION FOR ENGINEERING IMMERSION LAB

SLOT X : MECH, AERO, AUTO, CIVIL EXPERIMENTS

SLOT Y : EEE, ELECTRONICS, CSE, MECHATRONICS EXPERIMENTS

- EVERY CLASS OF
  - GROUP A (AERO, AUTO, MECH, MCT, CHEM, BIO, CIVIL
  - GROUP B (CSE, IT, ECE, EEE, AEROSPACE)

GETS DIVIDED INTO 4 SUB - GROUPS NAMELY a, b, c, d -- EACH CONSISTING OF 15 TO 20 STUDENTS MAX.

- FOR EXAMPLE: **GROUP A STUDENTS WILL OCCUPY SLOT X**
  - WEEK 1 : SLOT X ---
    - ✓ a – MECH; b – AUTO; c – AERO ; d – CIVIL
  - WEEK 2 : SLOT X ---
    - ✓ b – MECH; c – AUTO; d – AERO ; a – CIVIL
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)
- **GROUP B STUDENTS WILL OCCUPY SLOT Y**
  - WEEK 1 : SLOT Y ---
    - ✓ a – EEE; b – ECE; c – CSE ; d – MCT
  - WEEK 2 : SLOT Y ---
    - ✓ b – EEE; c – ECE; d – CSE ; a – MCT
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

COURSE TITLE	ENGINEERING PHYSICS LABORATORY (Common to all engineering branches)			CREDIT	1
COURSE CODE	PHA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Ability to analyze material's elastic properties	1,2,3,4
2.	Ability to determine thermal conductivity of bad conductor	1,2,3,4
3.	Ability to measure coefficient of viscosity of liquids	1,2,3,4
4.	Ability to determine wavelength of laser	1,2,3,4
5.	Ability to describe V-I characteristics of diode	1,2,3,4

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)

1. Torsional Pendulum – Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending – Determination of Young's Modulus.
3. Uniform Bending – Determination of Young's Modulus.
4. Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
5. Lee's Disc – Determination of thermal conductivity of a bad conductor.
6. Air – Wedge – Determination of thickness of a thin wire
7. Spectrometer – refractive index of a prism
8. Semiconductor laser – Determination of wavelength of laser using grating
9. Semiconductor diode – VI characteristics

TEXT BOOK

1	P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005

REFERENCE BOOKS

1	Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2	P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015

E BOOK

1	http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LABORATORY (Common to ALL branches of Engineering)			CREDITS	1
COURSE CODE	CYA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn to characterize basic properties of refractory ceramics	1,2,4,6
2.	On completion of this course, students learn to prepare resins and composites.	1,2,4,6
3.	Students learn to estimate metal ions present in samples using instrumental techniques.	1,2,4,6
4.	On completion of the course the students learn to develop adsorption isotherm.	1,2,4,6
5.	Students learn to find properties of lubricants and other oil samples.	1,2,4,6

Prerequisites: Knowledge in basic chemistry practical at higher secondary level.

LAB / MINI PROJECT/FIELD WORK

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Determination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS

1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017

E BOOKS

1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

MOOC

1	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER – II

COURSE TITLE	ANALYTICAL MATHEMATICS (Except Aeronautical and Aerospace Engineering)			CREDIT	4
COURSE CODE	MAA4117	COURSE CATEGORY	BS	L-T-P-S	3-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL:1-4				

CO	COURSE OUTCOMES	PO
1	Competent to evaluate surface and volume integrals.	1,2,4,12
2	Able to perform vector operations and interpret the results geometrically.	1,2,4,12
3	Skilled to solve the system of ordinary differential equations using Laplace Transform	1,2,4,12
4	Proficient to know that any periodic function satisfying Dirichlet's conditions can be expressed as a Fourier series	1,2,4,12
5	Able to understand complex variable theory, applications of analytic function and harmonic conjugate.	1,2,4,12

Prerequisites : Nil

MODULE 1 : MULTIPLE INTEGRALS (10L+2P)

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral – Change of variables between Cartesian and polar coordinates.

Suggested Reading: Line Integrals

Lab: Area and Volume of double integration and triple integration.

MODULE 2 : VECTOR CALCULUS (10L+2P)

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces – Solenoidal and Irrotational vector fields. Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

Suggested Reading: Basics of Vectors

Lab: Area using Green's theorem and Volume using Gauss divergence theorem

MODULE 3 : LAPLACE TRANSFORMS (10L+2P)

Laplace transform – Conditions of existence – Transform of elementary functions – properties – Transforms of derivatives– Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients.

Suggested Reading: Basics of Transform

Lab: Finding Laplace and Inverse Laplace Transform of Elementary Functions, Solutions of Ordinary differential equations using Laplace transform

MODULE 4 : FOURIER SERIES (10L+2P)

Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis.

Suggested Reading: Basics of series

Lab: : Fourier series Expansion of simple functions, Harmonic Analysis

MODULE 5 : COMPLEX VARIABLES (10L+2P)
Functions of a complex variable – Analytic function – Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method. **Suggested Reading**: Complex Numbers **Lab: Verification of Analytic Function**
LAB/MINI PROJECT/FIELD WORK
Theory with practical classes

TEXT BOOKS	
1.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	A.P.Santhakumaran, P.Titus, Engineering Mathematics - II, NiMeric Publications, Nagercoil, 2012
3	Chandrasekaran A, Engineering Mathematics- II, Dhanam Publication, 2014
4	Raj Kumar Bansal,Ashok Kumar Goel, Manoj Kumar Sharma, “MATLAB and its Applications in Engineering”, Pearson Publication, Second Edition, 2016.
REFERENCE BOOKS	
1.	Sastry, S.S, —Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014
2.	Wylie, R.C. and Barrett, L.C., —Advanced Engineering Mathematics —Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
3.	Dean G. Duffy., “Advanced Engineering Mathematics with MATLAB”, CRC Press, Third Edition 2013.
E-BOOKS	
1	https://www.khanacademy.org/.../double-integrals.../double-integral.
2	http.// nptel.ac.in/courses/122104017/28
3	nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-1.pdf
4	nptel.ac.in/syllabus/122104017/
5	nptel.ac.in/courses/111105035/22
6	nptel.ac.in/syllabus/111103070/
MOOC	
1	https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x

COURSE TITLE	ENGINEERING PHYSICS (Common to ECE, EEE, CSE & IT)			CREDIT	3
COURSE CODE	PHA4102	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1.	Solve basic problems in mechanics and also understand the properties of matter.	1,2,4,6
2.	Have a knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2,4,6
3.	Knowledge on fundamental concepts of Quantum physics	1,2,4,6
4.	Fundamental knowledge on semiconductors and discrete devices.	1,2,4,6
5.	Understand the concept, working and application of lasers and fiber optics.	1,2,4,6

Prerequisites : Knowledge in fundamentals of physics at higher secondary level.

MODULE 1 : PROPERTIES OF MATTER AND HEAT (9L)

Elasticity - types of moduli of elasticity - Young's modulus - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivities of good and bad conductors – Forbe's method – theory and experiment – Lee's disc method for bad conductors

MODULE 2 : ACOUSTICS AND ULTRASONICS (9L)

Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.

MODULE 3 : QUANTUM PHYSICS (9L)

Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)

MODULE 4 : CRYSTAL PHYSICS AND MAGNETISM (9L)

Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.

MODULE 5 : PHOTONICS AND FIBRE OPTICS (9L)	
Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.	
LAB/MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1.	P.Mani, " Engineering Physics", Vol-I & II, Dhanam Publications, Chennai, 2011.
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi, 2010.
REFERENCE BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications, 2007.
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi, 2003.
E-BOOKS	
1	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2	http://iopscience.iop.org/book/978-1-6817-4585-5
3	https://www.springer.com/in/book/9783319206295
MOOC	
1	http://nptel.ac.in/courses/115106061/
2	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
COURSE CODE	CYA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Student will be able to - Suggest suitable metals for alloying.	1,2,4,6
2.	Identify the materials apt for engineering applications.	1,2,4,6
3	Select high temperature materials for engineering applications.	1,2,4,6
4.	Map the properties of nanomaterials with their applications.	1,2,4,6
5.	Suggest suitable materials for electronic applications.	1,2,4,6

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 : CRYSTAL STRUCTURE AND PHASE RULE (9L)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2: POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES. (9L)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites – Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3 : NANOMATERIALS AND MOLECULAR SIEVES (9L)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4 : MATERIALS FOR ELECTRONIC APPLICATONS (9L)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5 : LUBRICANTS, ADHESIVES AND EXPLOSIVES (9L)	
Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.	
LAB / MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi, 2012
2	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3	Composite materials, K.K. Chawala, 3rd ed., Springer-Verlag, New York, 2012.
4	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, , Wiley-VCH Verlag GmbH Co. KGaA, Weinheim, 2003.
5	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, , Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK, 2001.
E BOOKS	
1	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `
MOOC	
1	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
COURSE CODE	ELA4101	COURSE CATEGORY	BS	L-T-P-S	1-1-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL – 6				

CO	COURSE OUTCOMES	PO
1.	Understanding the importance of professional communication and applying the knowledge.	3
2.	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations; enhance pronunciation skills based on the knowledge of phonetics.	3
3.	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems	3
4.	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments	3
5.	Imbibing soft skills to excel in interpersonal skills essential for workplace	3

Prerequisites : Plus Two English-Intermediate Level

MODULE 1 : THE ELEMENTS OF COMMUNICATION (9)

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business Communication-Professional Communication-barriers to communication –strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short Conversations-Situational communication-dialogue writing -Language Functions-analyse the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

Rogerson, Trish Stott & Derek Utley.2011

Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)

Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2 : AURAL –ORAL COMMUNICATION IN ENGLISH (9)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)-neutral accent- sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as

far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS , Professional Speaking Skills by Aruna Koneru, Oxford Press, Face to face series Cambridge University Press, Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela

MODULE 3 : GRAMMAR AND DEVELOPMENT OF READING SKILLS (9)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles-comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on students area of specialization answering questions- reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins IELTS, Cambridge books Practical English Usage by Michael Swan , Cambridge University Press

MODULE 4 : EFFECTIVE WRITING AND BUSINESS COMMUNICATION (9)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data(bar chart, pie chart, line graphs)

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS,IELTS Academic Writing 1,New Insights into IELTS, CUP

MODULE 5 : SOFT SKILLS (9)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management- Lateral Thinking (De Bono's Six Thinking Hats) and Problem Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.

Soft Skills for Everyone by Jeff Butterfield, Cengage Learning Education and personality development, K. Manoharan English for Life and the Workplace through the LSRW&T skills

Lateral Thinking skills by Edward De Bono

TEXT BOOKS	
2.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press. 2009
REFERENCE BOOKS	
12.	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.
13.	Embark, English for Undergraduates by Steve Hart et al, Cambridge University Press,2016, Edition
14.	Skills for the TOEFL IBT Test, Collins, 2012 edition
15.	Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition
16.	English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition
17.	Professional Speaking Skills by Aruna Koneru, Oxford Publications.
18.	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
19.	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002
20.	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
21.	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation, 2015
22.	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.
E BOOKS	
8.	https://www.britishcouncil.in/english/courses-business
9.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
10.	http://www.bbc.co.uk/learningenglish/english/
11.	http://www.antimoon.com/how/pronunc-soundsipa.htm
12.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
13.	Oneshopenglish.com
14.	Breakingnews.com
MOOC	
1	https://www.mooc-list.com/tags/english
2	https://www.mooc-list.com/course/adventures-writing-stanford-online
3	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	MEA4101	COURSE CATEGORY	BS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.	1,4,6
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids	1,4,6
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models	1,4,6
4	Apply the 3D model commands to generate and solid object	1,4,6
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.	1,4,6
6	Student can able to develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.	1,4,6

Prerequisites : Nil

MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES (12)

Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Suggested Reading: Solid modeling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING (15)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Suggested Reading: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15)

Principles of isometric projection and solid modelling. Isometric drawing – Iso Planes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modelling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

***Suggested Reading**: Surface modeling and solid modeling commands*

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING (15)
Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software. 2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer. ***Suggested Reading***: *CAD commands for modeling and views generation*
MODULE 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING (15)
Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice. **Suggested Reading**: *CAD commands for modeling and views generation*

TEXT BOOKS	
1	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016
REFERENCE BOOKS	
1	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2	Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
3	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2012
4	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
6	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2016.
E BOOKS	
1	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html
MOOC	
1	http://nptel.ac.in/courses/112103019/
2	http://nptel.ac.in/courses/105104148/

COURSE TITLE	SUSTAINABLE ENGINEERING SYSTEMS (Common to ALL Branches of Engineering)			CREDITS	2
COURSE CODE	GEA4102	COURSE CATEGORY	PC	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn the principles of sustainability with case studies.	2,3,6,7,8,9,10,12
2.	Students will be able to understand assessing technologies and their impact on environment.	2,3,6,7,8,9,10,12
3	To learn the concept of Green Engineering and to apply in their projects at higher semesters.	2,3,6,7,8,9,10,12
4.	Management of natural resources and waste management from various types of industries.	2,3,6,7,8,9,10,12
5.	Students learn water technology and behavioral aspects of humans.	2,3,6,7,8,9,10,12

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 : PRINCIPLES OF SUSTAINABLE SYSTEMS (5L)

Sustainability Definitions - Principles of Sustainable Design, Sustainable Engineering -Frameworks for Applying Sustainability Principles - Summary & Activities.

MODULE 2 : TECHNOLOGY DEVELOPMENT AND LIFECYCLE ASSESSMENT (5L)

Technology as a part of anthropogenic environment - Technology readiness levels (TRL) – technical metrics - Emerging, converging, disruptive technologies - Life Cycle Assessment (LCA) methodology - Summary & Activities.

MODULE 3 : GREEN ENGINEERING (5L)

Principles of Green Engineering - Frameworks for assessment of alternatives - Green Engineering examples - Multifunctional Materials and Their Impact on Sustainability - Summary & Activities.

MODULE 4 : RESOURCE MANAGEMENT TECHNOLOGIES (5L)

Waste management purpose and strategies - Recycling: open-loop versus closed-loop thinking - Recycling efficiency - Management of food waste and composting technologies - E-waste stream management - Reuse and redistribution programs - LCA approach to waste management systems - Summary and Activities.

MODULE 5 : SUSTAINABLE WATER AND WASTEWATER SYSTEMS (5L)

Water cycle - Water conservation and protection technologies - Water treatment systems Metrics for assessment of water management technologies-Summary & Activities.

MODULE 6 : BEHAVIORAL ASPECTS AND FEEDBACKS (5L)

Collaborative Decision Making - Role of Community and Social Networking - Human Factor in Sustainability Paradigm - Summary & Activities.

TEXT BOOKS	
1.	Vanek, F.M., and L.D. Albright, Energy Systems Engineering. Evaluation and Implementation, McGraw Hill, 2008.
2.	C.U. Becker, Sustainability Ethics and Sustainability Research, Springer 2012.
3.	J.B. Guinee et al., Life Cycle Assessment: Past, Present, and Future, Environ. Sci. Technol., 2011, 45, 90-96.
4.	Anastas, P.T., Zimmerman, J.B., Innovations in Green Chemistry and Green Engineering, Springer 2013.
5.	Solid Waste Technology & Management, Volume 1 & 2, Christensen, T., Ed., Wiley and Sons., *2010.*
6.	Sterman, J.D., in Sustainability Science: The Emerging Paradigm, Weinstein, M.P. and Turner, R.E. (Eds.), Springer Science+Business Media, LLC 2012.
E BOOKS	
1.	David T. Allen, David R. Shonnard, Sustainable Engineering Concepts, Design and Case Studies, Pearson Education, December 2011. (ISBN: 9780132756587)
2.	Gerald Jonker Jan Harmsen, Engineering for Sustainability 1st Edition, A Practical Guide for Sustainable Design, Elsvier 2012. (**ISBN:** 9780444538475).
MOOC	
1.	https://www.coursera.org/learn/sustainability
2.	https://www.academiccourses.com/Certificate/Sustainability-Studies/India/
3.	https://onlinecourses.nptel.ac.in/noc18_ce08/preview
4.	https://www.coursera.org/learn/ecosystem-services

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To understand basic operation in digital systems and instruments.	1,2,4,6
2	To gain knowledge on basic functioning of sensors and display units.	1,2,4,6
3	To familiarize the concepts of signal processing and converting elements.	1,2,4,6
4	To acquire the knowledge of microcontrollers and applications	1,2,4,6
5	To attain the basic concepts of consumer electronics and communication devices.	1,2,4,6

Prerequisites : Physics and Mathematics

MODULE 1 : INTRODUCTION TO DIGITAL SYSTEMS (9L)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).

Suggested Reading: Basics of number systems.

MODULE 2 : SENSORS AND DISPLAYS (9L)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

MODULE 3 : SIGNAL CONDITIONING CIRCUITS (9L)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

MODULE 4 : INTRODUCTION TO MICRO CONTROLLERS (9L)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

MODULE 5 : CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM (9L)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

LAB / MINI PROJECT/FIELD WORK	
Field trip to consumer electronics industry.	
TEXT BOOKS	
1	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2	Op-amps and Linear Integrated Circuits,Ramakant A. Gayakwad,4th edition,Prentice Hall, 2015.
3	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4	The 8051 Microcontroller And Embedded Systems Using Assembly And C, SepehrNaimi, SarmadNaimi, Muhammad Ali Mazidi, Second edition, 2017.
5	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
2.	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
3.	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
4.	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
5.	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2	https://electronics.howstuffworks.com/home-audio-video-channel.htm
MOOC	
1	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
3	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors %20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
4	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
5	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro /ui/Course_home2_5.html

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	ITB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0-0-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Students will be able to appreciate the different elements involved in good designs and to apply them in practice when called for.	1-12
2	Students will be aware of the product oriented and user oriented aspects that make the design a success.	1-12
3	Students will be able to think of innovative designs incorporating different segments of knowledge gained in the course	1-12
4	Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.	1-12
5	Students learn economic and environmental Issues, trade aspects and IPR	1-12

Prerequisites : Nil

MODULE 1-INTRODUCTION TO INFORMATION TECHNOLOGY DESIGN (7+2 PERIODS)

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions

MODULE 2-PROCESSES IN DESIGN THINKING (7+2 PERIODS)

Design process- Different stages in design and their significance; Defining the design space; Analbgies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed Architectures; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any architecture

MODULE 3 – PROTOTYPE IN IT DESIGN (4+5 PERIODS)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis. Engineering the design - From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; development; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in any IT specialization.

MODULE 4- QUALITY ASPECTS IN IT DESIGN (4+5 PERIODS)
Design for "X"; covering quality, reliability, safety, Development, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. **Project: Example:** List out the design methods for IoT based structure
MODULE 5 – USER CENTRED DESIGNS IN INFORMATION TECHNOLOGY (4+5 PERIODS)
Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Smart phone using Android. Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Tradition and design; Study the evolution of Software Designs; Role of colours in design. Design as a marketing tool; Intellectual Property rights - Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it. **Project:** Examine the possibility of value addition for an existing product.

REFERENCE BOOKS	
1	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919
2	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	OBJECT ORIENTED AND JAVA PROGRAMMING			CREDITS	3
COURSE CODE	ITB4117	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Give examples that exemplify the principles of object orientation	3,4
2.	Write simple programs using basic Java classes and data structures	3,4
3.	Write simple Java programs using the concept of polymorphism	3,4
4.	Write simple multi-threaded Java programs with exception handling	3,4
5.	Illustrate the concept of streams for input and output	3,4

Prerequisites: Fundamentals of Computer Programming.

MODULE 1 : OBJECT ORIENTED PROGRAMMING (7L)

Object oriented paradigm - Object oriented concepts: abstraction, encapsulation, modularity and hierarchy - How the above concepts are realized in Java - Introduction to Java - Java Virtual Machine - Class and primitive data types - Use of packages - CLASSPATH - Import statement - Console input and output - Control structures

MODULE 2 : CLASSES AND OBJECTS (13L)

Classes and objects - Constructor - Constructor Overloading - Method Overloading - Object reference - Passing objects as arguments and Returning objects from methods - new operator, this and static keyword- finalize() method - Access control modifiers - Nested class, Inner class, Anonymous inner class and Abstract class

MODULE 3 : INTERFACES, INHERITANCE AND POLYMORPHISM (9L)

Use of inheritance - Inheritance in Java - Super and sub classes - Inheriting data members and methods - super and final keywords - Method Overriding - Interfaces - Interface inheritances and implementations - Polymorphism and Dynamic binding - Implementing polymorphism in Java

MODULE 4 : EXCEPTION HANDLING AND MULTITHREADING (9L)

Errors in programming - Exceptions - Use of try, catch, throw, throws and finally, Built in exception classes - Custom exception class - Throwable class - Multithreads and multithreaded programming - Thread class and Runnable interface - Thread priority - Thread synchronization - Deadlock - Thread communication

MODULE 5 : IO PROGRAMMING (9L)

Inheritance: Inheriting Classes- Type of Inheritance, Polymorphism: Overloading – Over riding, - Access Modifier: Final. Package : Defining a package, Packaging up multiple classes, Importing and Using Packages - Exception Handling : The concept of Exceptions in Java, Exception Objects, Try - Catch and Finally blocks , Multiple Catch blocks - Understanding ‘Throws’ and ‘Throw‘ - Defining Your Own Exceptions.

TEXT BOOKS

1	Paul J Deitel and Harvey Deitel, 'Java 9 for Programmers', 4th Edition, Prentice-Hall, 2017
2	Cay S Horstmann, 'Core Jave - I - Fundamentals', 11th Edition, Oreilly, 2018
REFERENCE BOOKS	
1.	Herbert Schildt, 'Java - The Complete Reference', 11th Edition, McGraw-Hill, 2019
MOOC	
1.	https://www.edx.org/professional-certificate/microsoft-introduction-to-code-objects-and-algorithms
2.	https://swayam.gov.in/nd1_noc19_cs84/preview

OURSE TITLE	**DATA STRUCTURES AND ALGORITHMS**			**CREDITS**	**4**
COURSE CODE	**ITB4118**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1.	Compute the time complexity of algorithms	1,3
2.	Implement stacks and queues for various applications.	3,5
3.	Implement tree data structure for different applications.	3,5
4.	Implement various sorting and searching techniques.	3,5
5.	Apply the concepts of graph for computing shortest path and construct MST.	1,3,5

Prerequisites: Fundamentals of Computer Programming.

MODULE 1 : PROBLEM SOLVING (9L+3T)

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Space Complexity- Time Complexity – Asymptotic Notations. Problem solving – Top-down Design – Implementation – Sample algorithms.

MODULE 2 : LISTS, STACKS AND QUEUES (9L+3T)

Abstract Data Type (ADT) – The List ADT – Array– Multi Dimensional Array – Singly Linked List -, Doubly linked list - Array of Lists - Polynomial representation and addition The Stack ADT – Infix to Postfix conversion – Postfix evaluation-The Queue ADT-Circular queue- Garbage Collection and Compaction.

MODULE 3 : TREES AND HASHING (9L+3T)

Preliminaries – Binary Trees – The Search Tree ADT –– Tree Traversals – Binary Search Trees – AVL Trees – Splay Trees - Hashing – Collision processing – Open Addressing – Linear Probing – Priority Queues (Heaps) – implementations.

MODULE 4 : SORTING AND SEARCHING (9L+3T)

Preliminaries – Insertion Sort – Shell sort – Heapsort – Quicksort – Sorting using multiple keys -

External Sorting – Mergesort – Linear Search – Binary Search.	
MODULE 5 : GRAPHS	**(9L+3T)**
Definitions – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm –Kruskal's Algorithm - Applications of Depth-First Search – Topological Sort - Bi-connectivity –Articulation points.	
TEXT BOOKS	
1	C.V. Sastry ,"Data Structures and Algorithm",1st Edition, 2018.
2	Narasimha Karumanchi, "Data Structures and Algorithm Made Easy", 5th edition, 2017
3	Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C++", 2nd edition, 2012.
REFERENCE BOOKS	
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson, 2013, 4th edition.
E BOOKS	
1.	http://iips.icci.edu.iq/images/exam/DataStructuresAndAlgorithmAnalysisInCpp_2014.pdf
MOOC	
1.	https://www.coursera.org/specializations/data-structures-algorithms

COURSE TITLE	**DATA STRUCTURES LAB USING OBJECT ORIENTED PROGRAMMING**			**CREDITS**	**1**
COURSE CODE	**ITB4141**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1.	Develop program for Basic Class Implementation using array of objects.	3,5
2.	Demonstrate the implementation of constructors, destructors and operator overloading.	3,5
3.	Apply fundamental algorithmic problems including type casting, inheritance, and polymorphism.	1,3
4.	Write programs using generic programming, exception handling, templates, file Handling	3,5
5.	Analyse, design and develop solutions to real-world problems applying OOP Concepts of C++.	5,7

LIST OF EXPERIMENTS

1. Basic Class Implementation using array of objects
2. Implementation of Parameterized Constructors and Destructors.
3. Operator Overloading using Member and Friend functions.
4. Implementation of Multilevel and Multiple Inheritances.
5. Implementation of Virtual Functions.

6. Implementation of Exception Handling.
7. File Manipulations.
8. Implementation of Function and Class Templates.
9. Implement infix to postfix conversion and evaluation of postfix using stack in C++ using friend function.
10. Implement dynamic memory allocation using circular queue in C++ with Inheritance.
11. Implement the following sorting operations using generic data type(template) in C++
    (a) Shell Sort (b) Heap Sort (c) Merge Sort (d) Quick Sort
12. Implement the following search operations in C++
    (a) Linear Search (b) Binary search using recursion (c) Hash Search
13. Implement Tree traversal on the given expression tree in C++
14. Implement Binary search Tree with its primitive operations.
15. Implement the algorithm for construction of Minimum spanning Tree (Prim's & Kruskal) using function overloading.
16. Implement Dijkstra's algorithm to find out the shortest path of the given Graph in C++.

TEXT BOOKS	
1	C.V.Sastry,"Data Structures and Algorithm",1st Edition, 2018.
2	Narasimha Karumanchi, "Data Structures and Algorithm Made Easy", 5th edition, 2017
3	Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C++", 2nd edition, 2012.
REFERENCE BOOKS	
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson, 2013, 4th edition.

COURSE TITLE	**ENGINEERING PHYSICS LABORATORY (Common to all engineering branches)**			**CREDIT**	**1**
COURSE CODE	**PHA4131**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**0-0-2-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1.	Ability to analyze material's elastic properties	1,2,3,4
2.	Ability to determine thermal conductivity of bad conductor	1,2,3,4
3.	Ability to measure coefficient of viscosity of liquids	1,2,3,4
4.	Ability to determine wavelength of laser	1,2,3,4
5.	Ability to describe V-I characteristics of diode	1,2,3,4

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)
1. Torsional Pendulum – Determination of rigidity modulus of the material of a wire. 2. Non Uniform Bending – Determination of Young's Modulus. 3. Uniform Bending – Determination of Young's Modulus. 4. Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow. 5. Lee's Disc – Determination of thermal conductivity of a bad conductor. 6. Air – Wedge – Determination of thickness of a thin wire 7. Spectrometer – refractive index of a prism 8. Semiconductor laser – Determination of wavelength of laser using grating 9. Semiconductor diode – VI characteristics

TEXT BOOK	
1	P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005
REFERENCE BOOKS	
1	Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2	P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015
E BOOK	
1	http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LABORATORY (Common to ALL branches of Engineering)			CREDITS	1
COURSE CODE	CYA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn to characterize basic properties of refractory ceramics	1,2,4,6
2.	On completion of this course, students learn to prepare resins and composites.	1,2,4,6
3.	Students learn to estimate metal ions present in samples using instrumental techniques.	1,2,4,6
4.	On completion of the course the students learn to develop adsorption isotherm.	1,2,4,6
5.	Students learn to find properties of lubricants and other oil samples.	1,2,4,6

Prerequisites: Knowledge in basic chemistry practical at higher secondary level.

LAB / MINI PROJECT/FIELD WORK

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Determination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS	
1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017
E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
MOOC	
1	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER - III

COURSE TITLE	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS (COMMON TO ALL BRANCHES)**			**CREDITS**	**4**
COURSE CODE	**MAA4201**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-1-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL:1-4**				

CO	COURSE OUTCOMES	PO
1	Able to formulate and solve some of the physical problems involving partial differential equations	1,3,4
2	Skilled to classify and solve the Wave and Heat equations	1,3,4
3	Able to classify and solve two dimensional heat equations.	1,3,4
4	Able to solve problems related to engineering applications by using Fourier Transform techniques.	1,3,4
5	Able to understand the discrete transform applied to engineering problems.	1,3,4

Prerequisites : Nil

MODULE 1: PARTIAL DIFFERENTIAL EQUATIONS (9L+3T)

Formation of partial differential equations by elimination of arbitrary constants, arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second order with constant coefficients.

Suggested Reading: Partial Differentiation

MODULE 2: ONE DIMENSIONAL WAVE AND HEAT FLOW EQUATION (9L+3T)

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation (without proof) – One dimensional heat flow equation (without proof) and application in string and rod problems.

Suggested Reading: Partial Differential Equations, Half range sine series.

MODULE 3: TWO DIMENSIONAL HEAT FLOW EQUATION (9L+3T)

Steady state solution of two dimensional heat equations and applications in finite plates and infinite plates problems.

Suggested Reading: Partial Differential Equations, Half range sine series.

MODULE 4: FOURIER TRANSFORM (9L+3T)

Fourier Integral Theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of Simple functions – Convolution theorem – Parseval's identity.

Suggested Reading: Basic integration.

MODULE 5: Z-TRANSFORM AND DIFFERENCE EQUATIONS (9L+3T)	
Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution theorem – Formation of Difference equations – Solution of difference equations using Z-Transform **Suggested Reading**: Basic calculus	
LAB/MINI PROJECT/FIELD WORK	
Theory with practical classes	
TEXT BOOKS	
1	P. Sivarama Krishna Das, C. Vijayakumari., “Transforms and partial differential equations”, Pearson Publication, 2016.
2	Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3	Chandrasekaran A, “A Text Book of Transforms and Partial Differential Equations”, Dhanam Publication, 2015
4	Raj Kumar Bansal,Ashok Kumar Goel, Manoj Kumar Sharma, “MATLAB and its Applications in Engineering”, Pearson Publication, Second Edition, 2016.
REFERENCE BOOKS	
1	Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.
2	Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.
3	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
4	Dean G. Duffy., “Advanced Engineering Mathematics with MATLAB”, CRC Press, Third Edition 2013.
E BOOKS	
1	nptel.ac.in/courses/122107037/
2	nptel.ac.in/courses/122107037/22
MOOC	
1	https://www.mooc-list.com/tags/laplace-transforms
2	https://www.edx.org/course/introduction-differential-equations-bux-math226-1x-1

COURSE TITLE	DATABASE TECHNOLOGIES			CREDITS	3
COURSE CODE	ITB4201	COURSE CATEGORY	PC	L-T-P-S	3-0-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Explore the basic concepts of database systems and different Database languages.	2,3
2	Design relational database, normalization	3,4
3	Create data storage and Query processing.	2,3
4	Implement transaction management.	1,2
5	Develop Object oriented DB, Distributed DB, XML queries and data warehousing.	3,5,12

Prerequisites : IT Essentials

MODULE 1: DATA MODELING (9L+3T)

Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.

MODULE 2: RELATIONAL MODEL (9L+3T)

SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependencies and Normalization for Relational Databases (up to BCNF).

MODULE 3: QUERY PROCESSING (9L+3T)

Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+Tree – Query Processing.

MODULE 4: TRANSACTION MANAGEMENT (9L+3T)

Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.

MODULE 5: UNSTRUCTURED DATABASES (9L+3T)

Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML- Data- XML Document- Schema- Querying and Transformation. – Data Mining and Data Warehousing.

TEXT BOOKS

1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Sixth Edition, McGraw-Hill, 2010.

REFERENCE BOOKS

1 Ramez Elmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Sixth Edition, Pearson Education, 2011.

2 Raghu Ramakrishnan, “Database Management System”, Third Edition, Tata McGraw-Hill Publishing Company, 2014.

E BOOKS	
1	www.ebooks-for-all.com/bookmarks/detail/Database-Management-Systems
2	https://www.amazon.com/Database-Management-Systems...ebook/dp/B002K8Q9PA
MOOC	
1	https://onlinecourses.nptel.ac.in/noc18_cs15
2	https://swayam.gov.in/course/220-database-management-system

COURSE TITLE	ADVANCED JAVA PROGRAMMING			CREDITS	4
COURSE CODE	ITB4202	COURSE CATEGORY	PC	L-T-P-S	3-1-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Write GUI based programs using Java Swing toolkit	1,2,4
2	Write Java programs to fetch and update data using JDBC	1,2,4
3	Write simple web based applications using JSP and Servlet technologies	1,2,4
4	Illustrate the concept of remote method invocation using Java RMI classes	1,2,4
5	Illustrate the security mechanisms provided by Java by developing sample code	2,3,5,6

Prerequisites : Object Oriented and Java Programming

MODULE 1: DEVELOPING DESKTOP APPLICATIONS (9L+3T)

Graphical user interfaces - Event handling concept in GUI - Introduction to AWT and Swing toolkit - Using Swing toolkit to build windows applications - Components and Containers - Layouts - Message and Dialog boxes - Event handling in Swing components - 2D graphics painting fundamentals.

MODULE 2: DATABASE CONNECTIVITY (9L+3T)

Database connectivity - JDBC principles - Accessing data from tables in an RDBMS - Inserting and updating data in tables - Executing SQL query statements and getting the result set - Using parametrized queries - Accessing meta data pertaining to tables and databases - Accessing data from a Swing based windows application

MODULE 3: DEVELOPING WEB APPLICATIONS (9L+3T)

Introduction to the concept of multi-tiered web application - Java Servlets – Servlet life cycle – Handling HTTP get and post request – Accessing context and init parameters - Use of cookies - Session Tracking – Java Server Pages - Implicit objects – Standard actions – Directives – Custom Tag libraries - Input validation using javascript

MODULE 4: ADVANCED NETWORKING (9L+3T)

Client- Server computing – Sockets – Content and Protocols handlers –Developing distributed applications –RMI – Remote objects – Object serialization

MODULE 5: JAVA SECURITY	(9L+3T)
Java Class loaders - Security in JVM - Security managers - Permission checking - Message digests - Verifying signatures and certificates - Cryptographic techniques using Java Security API	
TEXT BOOKS	
1	Cay.S.Horstmann,Gary Cornell, " Core Java Volume –II Advanced Features", Prentice Hall, Eighth Edition, 2008
2	Herbert Schildt, "Java The Complete Reference" , 8th Edition, Tata McGraw Hill,2011
REFERENCE BOOKS	
1	Philip Conrod & Lou Tylee, 'Learn Java GUI Applications', 8th Edition, Kidware Software, 2015
2	Jim Manico and August Detlefsen, 'Iron-clad Java - Building Secure Web Applications', McGraw-Hill, 2015
E BOOKS	
1	http://java.sun.com/developer/onlineTraining/Programming/JDCBook
2	http://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf
MOOC	
1	https://freevideolectures.com/course/3690/advanced-java
2	https://www.edx.org/learn/java

COURSE TITLE	PROFESSIONAL ETHICS AND LIFE SKILLS (Common to all Branches)			CREDITS	2
COURSE CODE	GEA4216	COURSE CATEGORY	BS	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Describe the basic perception of profession, professional ethics, various moral & social issues, industrial standards, code of ethics and role of professional ethics in engineering field	1,2,8
2	Have awareness on professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.	1,2,8
3	Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.	1,8
4	Develop life skills required to live in a society	1,8

Prerequisites : Nil

MODULE 1: HUMAN VALUES	(6L)
Definition of ethics-Morals values and ethics – integrity-Work ethics- Service learning-Civic virtue-Respect for others-Caring-Sharing-Honesty-Courage-Valuing time-Cooperation-Commitment-Empathy-Self confidence-Character-Spirituality-Introduction to Yoga and meditation for professional	

excellence and stress management *Self-Study: Case study of Discovery failure*.	
MODULE 2: ENGINEERING ETHICS	**(6L)**
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories. *Self-study: Study the Bhopal gas tragedy*.	
MODULE 3: SAFETY, REPOSIBILITIES AND RIGHTS	**(6L)**
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. *Self-study: Chernobyl explosion, Nuclear and thermal power plant issues*.	
MODULE 4: LIFE SKILLS	**(6L)**
Definition, Relevance, Types of values, changing concepts of values-aims and values of value education- basic etiquette-morals and values in life-dealing with people. Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses Self-study: Influences - Peer pressure, familial and societal expectations, media.	
MODULE 5: SOCIETIES IN PROGRESS	**(6L)**
Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility *Self-study: Personal value and professional value of Engineers on societies perception*.	
TEXT BOOKS	
1	Subramanian R., Professional ethics, Oxford University press, 2010
2	Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2008
REFERENCE BOOKS	
1	Megan J. Murphy (Editor),**Editor), Ethics and Professional Issues in Couple and) Lorna Hecker Family Therapy**
2	Andrew Belsey (Editor), **,(Editor) Ruth Chadwick** Ethical Issues in Journalism and the Media (Professional Ethics)
3	Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics)
4	RuchikaNath, Value Education, APH Publishing Corporation, New Delhi, 2008

COURSE TITLE	ADVANCED JAVA PROGRAMMING LAB			CREDITS	1
COURSE CODE	ITB4231	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Explore the database connectivity using java	1,2,4
2	Design a servlet program	2,3,4
3	Create a program using RMI	4,5

Prerequisites : Nil

LIST OF EXPERIMENTS

1. HTML to Servlet Applications
2. Applet to Servlet Communication
3. Designing online applications with JSP
4. Creating JSP program using JavaBeans
5. Working with Enterprise JavaBeans
6. Performing Java Database Connectivity.
7. Creating Web services with RMI.
8. Creating and Sending Email with Java
9. Building web applications

TEXT BOOKS

1	Herbert Schildt,“Java The Complete Reference”, 10th Edition, Oracle press,2017.
2	Jame Jaworski, “Java Unleashed”, SAMS Techmedia Publications, 1999.

REFERENCE BOOKS

1	Deitel M. and Deitel P.J., “Java how to program”, Prentice Hall, Eighth Edition, 2009.
2	Herbert Schildt, “Java The Complete Reference”, McGraw-Hill Publications, 2011.

COURSE TITLE	DATABASE TECHNOLOGIES LAB			CREDITS	1
COURSE CODE	ITB4232	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Explore the basic concepts of database systems and different Database languages.	2,4
2	Design relational database with grouping commands (group by, order by), normalization.	3,4,5
3	Create database with data constraints, joins, string functions, and indexes storage and Query processing.	2,4,5
4	Implement a database with conditional controls, case statement, procedures and triggers.	1,4

Prerequisites : Nil

LIST OF EXPERIMENTS

1. To study Basic SQL commands (create table, use , drop, insert) and execute the following queries using these commands:
   - Create a table 'Emp' with attributes 'ename','ecity','salary','enumber','eaddress','depttname'.
   - Create another table 'Company' with attributes 'cname', ccity','empnumber' in the database 'Employee'.
2. To study the viewing commands (select , update) and execute the following queries using these commands:
   - Find the names of all employees who live in Delhi.
   - Increase the salary of all employees by Rs. 5,000.
   - Find the company names where the number of employees is greater than 10,000.
   - Change the Company City to Gurgaon where the Company name is 'TCS'.
3. To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands:
   - Add an attribute named ' Designation' to the table 'Emp'.
   - Modify the table 'Emp', Change the datatype of 'salary' attribute to float.
   - Drop the attribute 'depttname' from the table 'emp'.
   - Delete the entries from the table ' Company' where the number of employees are less than 500.
4. To study the commands that involve compound conditions (and, or, in , not in, between , not between , like , not like) and execute the following queries using these commands:
   - Find the names of all employees who live in ' Gurgaon' and whose salary is between Rs.

20,000 and Rs. 30,000.

- Find the names of all employees whose names begin with either letter 'A' or 'B'.
- Find the company names where the company city is 'Delhi' and the number of employees is not between 5000 and 10,000.
- Find the names of all companies that do not end with letter 'A'.

5. To study the aggregate functions (sum, count, max, min, average) and execute the following queries using these commands:

- Find the sum and average of salaries of all employees in computer science department.
- Find the number of all employees who live in Delhi.
- Find the maximum and the minimum salary in the HR department.

6.To study the grouping commands (group by, order by) and execute the following queries using these commands:

- List all employee names in descending order.
- Find number of employees in each department where number of employees is greater than 5.
- List all the department names where average salary of a department is Rs.10,000.

7. To study the commands involving data constraints and execute the following queries using these commands:

- Alter table 'Emp' and make 'enumber' as the primary key.
- Alter table 'Company' and add the foreign key constraint.
- Add a check constraint in the table 'Emp' such that salary has the value between 0 and Rs.1,00,000
- Alter table 'Company' and add unique constraint to column cname
- Add a default constraint to column ccity of table company with the value 'Delhi'

8. To study the commands for joins (cross join, inner join, outer join) and execute the following queries using these commands:

- Retrieve the complete record of an employee and its company from both the table using joins.
- List all the employees working in the company 'TCS'.

9. To study the various set operations and execute the following queries using these commands:

- List the enumber of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true.
- List the enumber of all employees who live in Delhi but whose company is not in Gurgaon.

10. To study the various scalar functions and string functions (power, square, substring, reverse, upper, lower, concatenation) and execute the following queries using these commands:

- Reverse the names of all employees.
- Change the names of company cities to uppercase.
- Concatenate name and city of the employee.

11. To study the commands involving indexes and execute the following queries:

- Create an index with attribute ename on the table employee.
- Create a composite index with attributes cname and ccity on table company.
- Drop all indexes created on table company.

12. To study the conditional controls and case statement in PL-SQL and execute the following queries:

- Calculate the average salary from table 'Emp' and print increase the salary if the average salary is less that 10,000.
- Display the deptno from the employee table using the case statement if the deptname is 'Technical' then deptno is 1, if the deptname is 'HR' then the deptno is 2 else deptno is 3.

13. To study procedures and triggers in PL-SQL and execute the following queries:

- Create a procedure on table employee to display the details of employee to display the details of employees by providing them value of salaries during execution.
- Create a trigger on table company for deletion where the whole table is displayed when delete operation is performed.

14. Consider the tables given below. The primary keys are made bold and the data types are specified.

PERSON(driver_id:string , name:string , address:string)
CAR(regno:string , model:string , year:int)
ACCIDENT(report_number:int , accd_date:date , location:string)
OWNS(driver_id:string , regno:string)
PARTICIPATED(driver_id:string , regno:string , report_number:int , damage_amount:int)

a. Create the above tables by properly specifying the primary keys and foreign keys.
b. Enter at least five tuples for each relation.
c. Demonstrate how you

- Update the damage amount for the car with specific regno in the accident with report number 12 to 25000.

d. Find the total number of people who owned cars that were involved in accidents in the year 2008.
e. Find the number of accidents in which cars belonging to a specific model were involved.

MATLAB ASSIGNMENTS

1. Analyze Large Data in Database Using Tall Arrays.
2. Analyze Large Data in Database Using MapReduce.
3. Determine Dependencies of Services in Network.
4. Find Shortest Path Between People in Social Neighborhood.
5. Find Friends of Friends in Social Neighborhood.

TEXT BOOKS

1	Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2010.
2	SQL The Complete Reference, 3rd Edition - McGraw-Hill Education, 2011.

REFERENCE BOOKS

1	Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Sixth Edition, Pearson Education, 2011.
2	Raghu Ramakrishnan, "Database Management System", Third Edition, Tata McGraw-Hill

	Publishing Company, 2014.

COURSE TITLE	DESIGN PROJECT – I			CREDITS	1
COURSE CODE	ITB4233	COURSE CATEGORY	PC	L-T-P-S	0-0-2-1
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-6				

CO	COURSE OUTCOMES	PO
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10, 11,12
2	Give practical solutions to the societal problem	1,2,3,5,6,9,10, 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10, 11,12

Prerequisites : Data Structures, Java Programming, Database Technologies

LAB / MINI PROJECT

In this project, each group consisting of four/five members is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. At the end of the course the group should submit a complete report of the project work carried out.

COURSE OBJECTIVE:

- To enable the students to apply the theoretical knowledge in practice
- To enable them to plan and organize a small Information Technology project and write a report on the work
- To improve the level of confidence in presenting the Information Technology concepts.

SEMESTER – IV

COURSE TITLE	PROBABILITY AND STATISTICS (Common to IT, Auto, Mechanical & Civil)			CREDITS	4
COURSE CODE	MAA4216	COURSE CATEGORY	BS	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL:1-4				

CO	COURSE OUTCOMES	PO
1	Able to understand the concept of Probability and one dimensional random variable	1,3,4
2	To improve the ability to understand the importance of discrete and continuous distributions	1,3,4
3	To explore the random experiments specified by two dimensional random variables	1,3,4
4	Perform test of hypothesis as well as calculate confidence interval for the population parameter.	1,3,4

Prerequisites : Nil

MODULE 1: PROBABILITY AND RANDOM VARIABLES (9L+3T)

Axioms of Probability- Bayes' Theorem -Random variables – Moments – Moment generating functions.

Suggested Reading: Basic Probability

MODULE 2: STANDARD DISTRIBUTIONS (9L+3T)

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions

Suggested Reading: Discrete and Continuous Functions

MODULE 3: TWO-DIMENSIONAL RANDOM VARIABLES (9L+3T)

Joint distribution – Marginal and conditional distribution – Co-variance – Correlation and Regression

Suggested Reading: Random Variables

MODULE 4: TESTING OF HYPOTHESIS (9L+3T)

Sampling distributions – Testing of Hypothesis – Small samples – t Test, F Test and Chi-square Test – Large samples – Single mean – Difference in means – single proportion and difference in proportions.

Suggested Reading: Sampling Problems

MODULE 5: DESIGN OF EXPERIMENTS (9L+3T)

Analysis of variance – One Way Classification – Completely Randomized block design – Two Way Classification – Randomized block design – Latin Square design

Suggested Reading: Analysis of variance	
LAB/MINI PROJECT/FIELD WORK	
Theory only	
TEXT BOOKS	
1	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2	Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007
3	A. Chandrasekaran, G. Kavitha, "Probability, Statistics, Random Processes and Queuing Theory", Dhanam Publications, 2014
4	Raj Kumar Bansal,Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson Publication, Second Edition, 2016.
REFERENCE BOOKS	
1	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004 .
2	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3	Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.
E BOOKS	
1	http.// nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
2	https://www.khanacademy.org
MOOC	
1	https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2

COURSE TITLE	DATA COMMUNICATION AND NETWORKING			CREDITS	4
COURSE CODE	ITB4216	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the data communication models.	1,3,4
2	Remember the various layers and its standards	1,3,4
3	Configure the switches and networks	1,3,4

Prerequisites : Introduction to Digital Systems

MODULE 1: DATA COMMUNICATIONS (9L+3T)

Networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences

MODULE 2: DATA LINK LAYER (9L+3T)

Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC. - LAN - Ethernet IEEE 802.1Bridging protocol – Transparent Bridging, Virtual LAN - IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11

MODULE 3: NETWORK LAYER (9L+3T)

Internetworks – Packet Switching and Datagram approach – IP addressing methods – Dynamic IPv4 Address assignment – IPv4 DHCP working – Limitations of IPv4 – NAT and IPv6- Subnetting – Internet Routing protocol –Mobile IP- Routing – Distance Vector Routing – Link StateRouting–Routers

MODULE 4: TRANSPORT LAYER (9L+3T)

Duties of transport layer – Multiplexing – Demultiplexing – Transport layer port numbers - Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services

MODULE 5: APPLICATION LAYER (9L+3T)

Domain Name Space (DNS) – SMTP – FTP Client software - HTTP –HTML – Using telnet- SSH–Instant messaging – Instant Phone calls- Security – Cryptography

TEXT BOOKS

1 Behrouz A. Forouzan, “Data communication and Networking”, 5th Ed., Tata McGraw Hill, 2012.

REFERENCE BOOKS

1 L.Peterson and Peter S. Davie, “Computer Networks”, 5th Ed., Morgan Kaufmann, 2011.

2 Andrew S. Tanenbaum, “Computer Networks”, 5th Ed., Prentice Hall, 2010.

E BOOKS

1	https://books.google.co.in/books/about/Data_Communications_and_Computer_Network.html?id=FjV-BAAAQBAJ&redir_esc=y
MOOC	
1	https://www.mooc-list.com/course/data-communications-and-network-services-coursera

COURSE TITLE	**OPERATING SYSTEMS**			**CREDITS**	**4**
COURSE CODE	**ITB4217**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	COURSE OUTCOMES	PO
1	Understand system software and its functions.	1,2
2	Devise computational strategies for operating services and solving problems.	3,4
3	Develop applications using C and Shell programming	3,4,5,6

Prerequisites :Fundamentals of Computer Programming

MODULE 1: SYSTEM PROGRAMMING (9L+3T)

System software and machine architecture - The Simplified Instructional Computer (SIC) -Machine architecture - Data and instruction formats - addressing modes - instruction sets - I/O and programming - Basic assembler functions - A simple SIC assembler - Basic loader functions - Design of an Absolute Loader - Program Linking - Linkage Editors - Dynamic Linking - Basic macro processor functions - Macro Definition and Expansion

MODULE 2: OPERATING SYSTEM AND ITS SERVICES (9L+3T)

Introduction - Operating System Services - System Calls - System Programs - Process Concept - Process Scheduling - Operations on Processes - Cooperating Processes - Inter-process Communication - Threads - Overview - Threading issues - CPU Scheduling - Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Multiple-Processor Scheduling - Real Time Scheduling - The Critical-Section Problem - Synchronization Hardware - Semaphores - Classic problems of Synchronization - Critical regions - Monitors.

MODULE 3: DEADLOCK (9L+3T)

System Model - Deadlock Characterization - Methods for handling Deadlocks -Deadlock Prevention - Deadlock avoidance - Deadlock detection - Recovery from Deadlocks - Storage Management - Swapping - Contiguous Memory allocation - Paging - Segmentation - Segmentation with Paging.

MODULE 4 : PAGING AND FILE SYSTEM (9L+3T)

Virtual Memory - Demand Paging - Process creation - Page Replacement - Allocation of frames - Thrashing - File Concept - Access Methods - Directory Structure - File System Mounting - File Sharing - Protection

MODULE 5 : FILE SYSTEM (9L+3T)

File System Structure - File System Implementation - Directory Implementation - Allocation Methods - Free-space Management. Kernel I/O Subsystems - Disk Structure - Disk Scheduling - Disk Management - Swap-Space Management	
TEXT BOOKS	
1	Leland L. Beck, "System Software - An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2011.
2	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons Pvt. Ltd, 2012.
REFERENCE BOOKS	
1	D. M. Dhamdhere, "Systems Programming", First Edition, Tata McGraw-Hill, 2011.
2	Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education Pvt. Ltd, 2014.
E BOOKS	
1	https://lembehresort.zendesk.com/hc/en-us/community/posts/115003630863-Download-d-m-dhamdhere-systems-programming-and-operating-torrent-free-crack-serial
2	http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts---9th2012.12.pdf
MOOC	
1	https://swayam.gov.in/course/237-operating-system

COURSE TITLE	**WEB AND MOBILE PROGRAMMING**			**CREDITS**	**4**
COURSE CODE	**ITB4218**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Describe the basic concepts of Internet and create a HTML pages and forms.	1,3,4
2	Create web pages using HTML5 features.	1,4
3	Develop the building blocks of mobile apps.	1,4,5
4	Design and develop mobile apps, using Android as development platform and Perform testing	1,4,5,6
5	Promote distribution of mobile apps	10,11

Prerequisites: Java Programming, Networking concepts, Database Technologies

MODULE 1: INTRODUCTION (9L+3T)

Introduction – Network concepts – Web concepts – Internet addresses - Common Gateway Interface: Programming CGI Scripts – HTML - basic HTML tags – Cascading Style Sheets HTML Forms– Server Side Includes – Custom Database Query Scripts - Server security issues.

MODULE 2: RICH INTERNET APPLICATION &HTML5 (9L+3T)
AJAX enabled rich internet applications-HTML review, Feature detection, The HTML5 new Elements, Canvas, Video and audio, Web storage, Geolocation, Offline Webpages, Microdata, HTML5 APLS, Migrating from HTML4 to HTML5, CSS312
MODULE 3: BUILDING BLOCKS OF MOBILE APPS (9L+3T)
App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)
MODULE 4: ANDROID FOR PROGRAMMERS AND TESTING APPS (9L+3T)
Cannongame app, Spot on game app, Doodlz app, addressbook app, , route tracker app, Weather forecast app. Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk
MODULE 5: TAKING APPS TO MARKET (9L+3T)
Versioning, signing and packaging mobile apps, distributing apps on mobile market place

TEXT BOOKS	
1	Deitel, “Android for Programmers: An App driven approach”, Prentice Hall Pub, 2012.
2	AnubhavPradhan, Anil V Deshpande, Mobile Apps Development, Edition I, 2013
REFERENCE BOOKS	
1	Elliotte Rusty Herold, “Java Network Programming”, O’Reilly Publications, 3rd Edition, 2004.
E BOOKS	
1	https://www.packtpub.com/packt/free-ebook/practical-web-development
2	https://www.hongkiat.com/blog/free-ebooks-mobile-app-developers/
MOOC	
1	Web programming: http://nptel.ac.in/courses/106106156/3
2	Mobileprogramming: https://www.youtube.com/playlist?list=PL2UlrhJ_JwyC_urKftByX_j6138PMTs8w

COURSE TITLE	WEB AND MOBILE PROGRAMMING LAB			CREDITS	1
COURSE CODE	ITB4241	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Create simple programs using HTML.	1,2,4,5,8,9,12
2.	Create programs using HTML with CSS	1,2,4,5,8,9,12
3.	Develop android applications using java programming	1,2,4,5,6,8,9

Prerequisites : Nil

MODULE 1: INTRODUCTION (9L+3T)

1. Create a Registration Form with Table using HTML.
2. Create an HTML file to link to different html page which contains images, tables, and also link within a page.
3. Create a HTML page for signing up an E-Mail with client side validation with database connectivity.
4. Create a personal website using HTML with Cascading Style Sheet.
5. Create an HTML file by applying the different styles using inline, external & internal style sheets
6. Introduction to Android platform. Introduction to the tools used in the lab. Develop a native calculator application.
7. Develop an application that uses GUI Components, Fonts and Colors.
8. Develop an application that makes use of database.
9. Develop a native application that uses GPS location information.
10. Develop an application that draws basic graphical primitives on the screen.

TEXT BOOKS

1. Deitel, “Android for Programmers: An App driven approach”, Prentice Hall Pub, 2012
2. AnubhavPradhan, Anil V Deshpande, Mobile Apps Development, Edition I, 2013

REFERENCE BOOKS

1. Elliotte Rusty Herold, “Java Network Programming”, O’Reilly Publications, 3rd Edition, 2004

COURSE TITLE	SYSTEMS PROGRAMMING LAB			CREDITS	1
COURSE CODE	ITB4242	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Develop system software with its functionalities.	3,4,5
2	Develop applications using C and Shell programming	3,4,5
3	Devise computational strategies for operating services and solving problems.	3,4

Prerequisites : Nil

List of Experiments

1. Implement a symbol table with functions to create, insert, modify, search, and display.

2. Implement a single pass assembler.
3. Implement a macro processor.
4. Implement an absolute loader.

   Implement the following on LINUX platform. Use C for high level language implementation)
5. Shell programming

   - command syntax , - write simple functions , - basic tests
6. Shell programming

   - loops, - patterns, - expansions , - substitutions
7. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
8. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
9. Write C programs to simulate UNIX commands like ls, grep, etc.
10. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
11. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
12. Implement the Producer - Consumer problem using semaphores.
13. Implement some memory management schemes - I for eg

    Free space is maintained as a linked list of nodes with each node having the starting byte address and the ending byte address of a free block. Each memory request consists of the process-id and the amount of storage space required in bytes. Allocated memory space is again maintained as a linked list of nodes with each node having the process-id, starting byte address and the ending byte address of the allocated space.
14. Implement some memory management schemes - II for eg

    When a process finishes (taken as input) the appropriate node from the allocated list should be deleted and this free disk space should be added to the free space list. [Care should be taken to merge contiguous free blocks into one single block. This results in deleting more than one node from the free space list and changing the start and end address in the appropriate node]. For allocation use first fit, worst fit and best fit.

TEXT BOOKS	
1	Leland L. Beck, “System Software - An Introduction to Systems Programming”, 3rd Edition, Pearson Education Asia, 2011.
2	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, Ninth Edition, John Wiley & Sons Pvt. Ltd, 2012.
REFERENCE BOOKS	
1	D. M. Dhamdhere, “Systems Programming”, First Edition, Tata McGraw-Hill, 2011.
2	Andrew S. Tanenbaum, “Modern Operating Systems”, Pearson Education Pvt.Ltd, 2014.

COURSE TITLE	DESIGN PROJECT – II			CREDITS	1
COURSE CODE	ITB4243	COURSE CATEGORY	PC	L-T-P-S	0-0-2-1
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-6				

CO	COURSE OUTCOMES	PO
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10 , 11,12
2	Give practical solutions to the societal problem	1,2,3,5,6,9,10 , 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10 , 11,12

Prerequisites: Operating Systems, Web and Mobile Programming

LAB / MINI PROJECT

In this project, each group consisting of four/five members is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. At the end of the course the group should submit a complete report of the project work carried out.

COURSE OBJECTIVE:

- To enable the students to apply the theoretical knowledge in practice
- To enable them to plan and organize a small Information Technology project and write a report on the work
- To improve the level of confidence in presenting the Information Technology concepts.

SEMESTER – V

COURSE TITLE	OPTIMIZATION TECHNIQUES (Common to all Branches except CSE & Mechatronics)			CREDITS	4
COURSE CODE	MAA4301	COURSE CATEGORY	BS	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BT:1L-4				

CO	COURSE OUTCOMES	PO
1	Able to formulate engineering problems as mathematical optimization problems.	1,3,4
2	Skilled to apply the concept of linear and nonlinear programming problem to the engineering problem	1,3,4
3	Competent to apply the concept of integer programming problem to the engineering problem	1,3,4
4	Proficient to recognize the solution for assignment problem and transportation problem for optimal solution.	1,3,4

5	Able to understand the designs of networks	1,3,4
6	Able to formulate engineering problems as mathematical optimization problems.	1,3,4

Prerequisites : Nil

MODULE 1 : INTRODUCTION TO OPTIMIZATION (9L+3T)

Introduction to operations research – objective – scope of OR – Limitations of OR – Introduction and formulation of linear programming – Solving LPP using Graphical method.

Suggested Reading: Basics of inequalities.

MODULE 2 : LINEAR PROGRAMMMING PROBLEM (9L+3T)

Solving LPP using simplex method – Big-M method – Two phase method – conversion of primal to dual.

Suggested Reading: System of equations

MODULE 3 : INTEGER PROGRAMMING (9L+3T)

Integer programming – Cutting plane method – Gomory's Mixed integer method – Branch and Bound method

Suggested Reading: System of equations.

MODULE 4 : ASSIGNMENT AND TRANSPORTATION PROBLEM (9L+3T)

Hungarian Method – Maximization and unbalanced assignment problem – Basic feasible solution of transportation problem – Modi method – Degeneracy – Unbalanced Transportation problem.

Suggested Reading: Arithmetic Calculation.

MODULE 5 : PERT AND CPM (9L+3T)

Network diagram – Representation – Labeling – CPM – PERT probabilities of CPM – PERT probabilities of project duration.

Suggested Reading: Basics of graphs.

TEXT BOOKS

1	Chandrasekaran A, "A Text book of Operation Research", Dhanam Publications, Chennai, 2017
2	V. Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan, "Resource Management Techniques", A. R. Publications, 2004
3	S. D. Sharma, "Operation Research", Kedarnath Ramnath & Co, 2002

REFERENCE BOOKS

1	Hamdy A. Taha, "Operations Research: An Introduction (9th Edition)", Prentice Hall, 2010
2	D S Hira & Prem Kumar Gupta, "Introduction to Operations Research", S. Chand Publishing, 2012

E BOOKS

1	http://nptel.ac.in/courses/112106134/1
2	https://onlinecourses.nptel.ac.in/noc17_mg10/preview

MOOC

1	https://www.edx.org/course/operations-management-iimbx-om101-1x

COURSE TITLE	ARTIFICIAL INTELLIGENCE			CREDITS	4
COURSE CODE	ITB4301	COURSE CATEGORY	PC	L-T-P-S	3-1-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Identify problems that are amenable to solution by AI methods	1,4
2	Identify appropriate AI search method to solve a given problem	1,3,4
3	Formulate a given problem in the framework of different AI methods	1,3,4
4	Understand about expert systems	1,3

Prerequisites : Mathematics and Programming basics

MODULE 1 : ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING (9L+3T)

Introduction to AI- Applications of Artificial Intelligence-Problem formulation-Problem definition - Problem as a state space search - Problem types-Well-defined problems, Constraint satisfaction problem, Game playing

MODULE 2 : SEARCH TECHNIQUES (9L+3T)

Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison, Informed search techniques-hill climbing- best first search- greedy search-A* search- Adversarial search techniques-minimax procedure- alpha beta procedure- Measure of performance and analysis of search algorithms.

MODULE 3 : REPRESENTATION OF KNOWLEDGE (9L+3T)

Game playing-Formal logic-connectives, truth table- syntax- semantics- tautology- validity- wellformed-formula- propositional logic- predicate logic- FOPL- interpretation- quantification- horn clauses- rules of inference- unification, resolution refutation system (RRS)- answer extraction from RRS, rule based deduction system – Structured representation of knowledge –Approaches to Knowledge Representation, Issues in Knowledge Representation.

MODULE 4 : KNOWLEDGE INFERENCE (9L+3T)

Knowledge representation – Production based system-Frame based system – Inference – Backward chaining – Forward chaining – Rule value approach- Fuzzy reasoning –Certainty factors- Bayesian Theory – Bayesian network- Dempster- Shafer theory.

MODULE 5 : EXPERT SYSTEMS (9L+3T)

Expert System – Architecture of expert system- Roles of expert system- Knowledge acquisition- Heuristics- Typical expert systems- MYCIN,DART- Expert system shells.

TEXT BOOKS

1	E. Rich and Knight, Artificial Intelligence, McGraw Hill, 2009
2	Kevin Night and Elaine Rich, Nair B, "Artificial Intelligence (SIE)", Mc Graw Hill-2008
3	Deepak Khemani " Artificial Intelligence ", Tata Mc Graw Hill Education 2013
REFERENCE BOOKS	
1	D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.
2	Peter Jackson," Introduction to Expert System ", 3rd Edition, Pearson Education 2007
E BOOKS	
1	https://archive.org/details/handbookofartific01barr
2	http://www.cs.bham.ac.uk/research/projects/poplog/computers-and-thought/
MOOC	
1	https://www.udacity.com/course/intro-to-machine-learning–ud120
2	https://www.class-central.com/course/edx-cs188-1x-artificial-intelligence-445

COURSE TITLE	**SOFTWARE DESIGN AND MODELING**			**CREDITS**	**4**
COURSE CODE	**ITB4302**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				
CO	**COURSE OUTCOMES**				**PO**
1	Learn and develop a software model based on upcoming life cycle models				2,4,5,12
2	Devise computational strategies for software modeling, solving problems and develop projects using software tools.				2,4,5,6
3	To be aware of software cost and maintenance				1,2,4
Prerequisites : Nil					
MODULE 1 : SOFTWARE PROCESS					**(9L+3T)**
Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system					

engineering hierarchy.	
MODULE 2 : SOFTWARE REQUIREMENTS	**(9L+3T)**
Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping - S/W document. Analysis and modeling – data, functional and behavioral models – data dictionary.	
MODULE 3 : DESIGN CONCEPTS AND PRINCIPLES	**(9L+3T)**
Design process and concepts – modular design – design heuristic – design model and document. Architectural design – software architecture – data design – architectural design – transform and transaction mapping – user interface design – user interface design principles. SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items.	
MODULE 4 : SOFTWARE TESTING	**(9L+3T)**
Taxonomy of software testing – levels – test activities – types of s/w test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing . S/W testing strategies – strategic approach and issues - unit testing – integration testing – validation testing – system testing and debugging.	
MODULE 5 : SOFTWARE PROJECT MANAGEMENT	**(9L+3T)**
Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphi method.- Defining a Task Network – Scheduling – Earned Value Analysis – Error Tracking - Software changes – program evolution dynamics – software maintenance – Architectural evolution. Taxonomy of CASE tools.	
TEXT BOOKS	
1	Roger S. Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 6th edition, 2012.
REFERENCE BOOKS	
1	Ian Sommerville, Software engineering, Pearson education Asia, 10th edition, 2015.
E BOOKS	
1	https://archive.org/details/SoftwareEngineering7thEDByRogerS.Pressman
2	https://downloadnema.com/wpcontent/uploads/2017/02/Software%20Engineering%20A%20Practitioner%E2%80%99s%20Approach%20eighth%20edition-(www.downloadnema.com).pdf
MOOC	
1	https://www.edx.org/course/software-engineering-essentials

COURSE TITLE	EMBEDDED SYSTEM PROGRAMMING			CREDITS	4
COURSE CODE	ITB4303	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Knowledge of embedded system hardware.	1,4
2	Insight into embedded system programming.	1,4,5
3	Overview of C programming toolchain in linux	1,4,5
4	Programming in embedded C.	1,4,5
5	Knowledge about embedded OS.	1,3,4

Prerequisites :Computer hardware and C language

MODULE 1 : INTRODUCTION TO EMBEDDED SYSTEMS (9L+3T)

Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock

MODULE 2 : EMBEDDED PROGRAMMING (9L+3T)

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

MODULE 3 : C PROGRAMMING TOOL CHAIN IN LINUX (9L+3T)

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library

MODULE 4 : EMBEDDED C (9L+3T)

9 Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

MODULE 5 : EMBEDDED OS (9L+3T)

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system.

TEXT BOOKS

1	Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
2	Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
3	Michael J Pont, "Embedded C", Pearson Education, 2007.
REFERENCE BOOKS	
1	Peter Prinzs, Tony Crawford, "C in a Nutshell",O'Reilly,2016.
2	Dr.Bandu Meshram, "Object Oriented Paradigm C++ BeginnersGuide C&C++",SPD, 2016.
3	David Griffiths, Dawn Griffiths, "Head First C", O'reilly,2015.
E BOOKS	
1	http://freecomputerbooks.com/Embedded-System-Design-A-Unified-Hardware-Software-Introduction.html
MOOC	
1	Embedded system design: http://nptel.ac.in/courses/106105159/
2	Software for embedded system: http://nptel.ac.in/courses/108102045/19
3	Embedded programming:https://www.youtube.com/watch?v=asEpcl-fNgw

COURSE TITLE	**EMBEDDED SYSTEMS PROGRAMMING LAB**			**CREDITS**	**1**
COURSE CODE	**ITB4331**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Create a working environment in Labview and CANoe software.	4,5
2	Interface various hardware devices with ARM7 LC2148 microcontroller.	1,4,5
3	To learn about Arduino board.	1,4

List of Experiments

1. Interfacing with USB using Labview.
2. Creating distributed system using CANoe software tool.

3.	Interfacing temperature sensor using ARM7 LPC2148 microcontroller
4.	Interfacing traffic light controller using ARM7 LPC2148 microcontroller.
5.	Interfacing Analog to Digital Converter using ARM7 LPC2148 microcontroller.
6.	Interfacing a buzzer using ARM7 LPC2148 microcontroller.
7.	Interfacing a night lamp using Arduino Uno board
8.	Build a simple Arduino based calculator.
9.	Lightning Detection using Arduino board.
TEXT BOOKS	
1	Lyla B Das," Embedded Systems-An Integrated Approach",Pearson,2013
2	Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.

COURSE TITLE	**SOFTWARE DESIGN AND MODELLING LAB**			**CREDITS**	**1**
COURSE CODE	**ITB4332**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Understand, design and build software and also perform testing through test cases	3, 4, 5

Prerequisites : Design and Engineering

LIST OF EXPERIMENTS

Apply the following to typical an application problem:

1. Project Planning
2. Software Requirement Analysis

3. Software Estimation
4. Software Design
5. Data Modelling & Implementation
6. Software Testing
7. Software Debugging

A possible set of applications may be the following:

a. Library System
b. Student Marks Analyzing System
c. Text Editor.
d. Create a dictionary.
e. Telephone dictionary.
f. Simulator Software for Parallel Processing Operation.
g. Inventory System.

TEXT BOOKS	
1	Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Edition, 6th edition, 2012.
REFERENCE BOOKS	
1	Ian Sommerville, Software engineering, Pearson education Asia, 10th edition, 2015.

COURSE TITLE	**DESIGN PROJECT – III**			**CREDITS**	**1**
COURSE CODE	**ITB4333**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-2-1**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-6**				

CO	**COURSE OUTCOMES**	**PO**
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10, 11,12
2	Give practical solutions to the societal problem	1,2,3,5,6,9,10, 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10, 11,12

Prerequisites : Artificial Intelligence, Software Design and Modeling, Embedded System
LAB / MINI PROJECT
In this project, each group consisting of four/five members is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. At the end of the course the group should submit a complete report of the project work carried out. COURSE OBJECTIVE: • To enable the students to apply the theoretical knowledge in practice • To enable them to plan and organize a small Information Technology project and write a report on the work To improve the level of confidence in presenting the Information Technology concepts.

SEMESTER - VI

COURSE TITLE	**OBJECT OREINTED ANALYSIS AND DESIGN**			**CREDITS**	**4**
COURSE CODE	**ITB4316**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-3**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Approach new complex software development with confidence.	1,3
2	Utilize the UML diagrams that —best fit in an organization	1,3,4
3	Understand about Object Oriented Analysis process.	1,2,4

4	An ability to extract and refine classes, identify use cases	1,4

Prerequisites : Software Design and Modeling

MODULE 1 : INTRODUCTION (9L + 3T)

Categories of Information systems – Traditional Paradigm Vs. Object Oriented Paradigm – Objects and Classes – Inheritance – Object relationship – Examples of UML class modeling –Unified Process – Iteration and incrementation within the Unified Process.

MODULE 2 : UML AND THE UNIFIED PROCESS (9L + 3T)

Overview of requirements – Initial understanding of the domain – Business Model – Requirements workflow – Osbert Oglesby case study – MSG Foundation case study – Revising the requirements – MSG Foundation Case Study – Continuing the requirements workflow – MSG Foundation Case Study - Refining the revised requirements – MSG Foundation Case Study.

MODULE 3 : OBJECT ORIENTED ANALYSIS (9L + 3T)

Extracting Entity Classes – Initial dynamic model – Extracting control classes refining use cases – Incrementing the Class Diagram – Initial dynamic model – MSG Foundation case study – Revising the entity classes – Extracting – USE case realization – MSG Foundation case study – Incrementing the Class Diagram – More on use cases – Risk

MODULE 4 : OBJECT ORIENTED DESIGN (9L + 3T)

Design workflow – Format of the Attributes – Allocation of Operations – Osbert Oglesby Case Study – Workflows of the Unified Process – Phases of the Unified Process – Class Diagrams – Use Case Diagrams – Interaction Diagrams – State Charts – Package Diagrams – Deployment Diagrams.

MODULE 5 : TESTING AND MANAGEMENT (9L + 3T)

Quality Issues – Non Execution Based Testing – Execution Based Testing – Cost Benefit Analysis – Risk Analysis – Improving the Process – Metrics – CPM/PERT – Choice of Programming Language – Reuse Case Studies – Portability – Planning and Estimating Duration and Cost – Testing the Project Management 75 CS-Engg&Tech-SRM-2013 Plan – Maintenance and the Object Oriented Paradigm – CASE Tools for Maintenance.

TEXT BOOKS

1	John Deacon, “Object Oriented Analysis and Design”, Pearson Education, First Edition, 2009.
2	Grady Booch, James Rumbaugh, Ivar Jacobson, “The unified modeling Language user Guide”, Pearson Education, Third Edition, 2012

REFERENCE BOOKS

1	Grady Booch, “Object Oriented Analysis and Design with application”, Pearson Education, Third Edition, 2012.

E BOOKS

1	http://kmvportal.co.in/Course/OOAD/object-oriented-analysis-and-design-with-applications-2nd-edition.pdf.

MOOC

1	http://mooc.es/course/object-oriented-design/
2	https://ce.uci.edu/courses/sectiondetail.aspx?year=2013&term=FALL&sid=00185

COURSE TITLE	**NETWORKS AND INFORMATION SECURITY**			**CREDITS**	**4**
COURSE CODE	**ITB4317**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-3**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Define the Security Concepts	1,2
2	Identify and interpret the various Crypto Algorithms to build Secured Systems	2,3
3	Describe the type of attacks and discover the methodology to develop solutions to mitigate the attacks	3,4
4	Identify the concepts to develop Secure Software Solutions	3,4,5

Prerequisites: Data Communication and Networking

MODULE 1 : INTRODUCTION (9L+3T)

An Overview of Computer Security-Security Services-Security Mechanisms-Security Attacks- Access Control Matrix, Security policies: Types of Security Policies, The Role of Trust, Types of Access Control, Policy Languages.

MODULE 2 : CRYPTOSYSTEMS (9L+3T)

Classical Cryptography-Substitution Ciphers-permutation Ciphers-Block Ciphers-DES- Modes of Operation- AES-Linear Cryptanalysis, Differential Cryptanalysis- Hash Function - SHA 512

MODULE 3 : INCIDENTS AND INFORMATION ATTACKS (9L+3T)

Investigation Types, Evidence, Investigation Process – Major Categories of Computer Crime – Military and Intelligence Attacks – Business Attacks – Terrorist Attacks – Grudge Attacks – Thrill Attacks – Artificial Intelligence Attacks – IOT Attacks - Biometric Attacks.

MODULE 4 : ATTACKS AND SECURITY (9L+3T)

Web Security: Cross-Site Scripting (XSS) , SQL Injection – Reconnaissance Attacks: IP Probs, Port Scans, Vulnerability Scans – Masquerading Attacks: IP Spoofing, Session Hijacking.

MODULE 5 : SECURE SOFTWARE DEVELOPMENT (9L+3T)

Secured Coding - OWASP/SANS Top Vulnerabilities – Broken Authentication- XML External Entities – Sensitive Data Exposure - Broken Access Control – Security Misconfiguration – Insecure Deserialization – Using components with vulnerabilities – Insufficient logging & Monitoring.

TEXT BOOKS

1	James Michael Stewart, Mike Chapple, Darril Gibson, CISSP(ISC)2 Certified Information Systems Security Professional Official Guide, 7th edition , 2015.
	Mark Rhodes Ousley, "Information Security: The Complete Reference", 2nd edition, McGraw Hill Education, 2013
REFERENCE BOOKS	
1	Jaydip Sen, Advances in Security in Computing and Communications, InTech, 2017
E BOOKS	
1	https://ziw.mit.edu/getfile3/09-prof-jannie-jacobs-1/9783319462974-network-and-system-security-cnlb8kFqF.pdf
MOOC	
1	https://www.udemy.com/courses/it-and-software/network-and-security/

COURSE TITLE	**MACHINE LEARNING**			**CREDITS**	**4**
COURSE CODE	**ITB4318**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-2**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Identify methods to formulate machine learning problems corresponding to different applications.	3,4
2	Understand and apply decision tree learning.	2,4
3	Understand a range of machine learning algorithms along with their strengths and weaknesses.	3,4
4	Able to apply machine learning algorithms to solve problems of moderate complexity.	1,2,3,4

Prerequisites : Artificial Intelligence

MODULE 1 : INTRODUCTION TO MACHINE LEARNING (9L+3T)

Introduction to Machine Learning - How do machines learn- Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

MODULE 2 : CONCEPT LEARNING AND DECISION TREE LEARNING (9L+3T)

The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypothesis. FIND-S , candidate elimination algorithm.

Introduction, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, hyper space search in decision tree learning, issues in decision tree learning

MODULE 3 : CLASSIFICATION AND REGRESSION (9L+3T)

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.	
MODULE 4 : NEURAL NETWORKS AND GENETIC ALGORITHMS	**(9L+3T)**
Biological motivation - Perceptron - Activation functions - Network Models - Cost Function - Back-propagation algorithm. Introduction to deep learning. Introduction to genetic algorithms, genetic operators, genetic programming, models of evolution & learning, parallelizing genetic algorithm.	
MODULE 5 : TRENDS IN MACHINE LEARNING	**(9L+3T)**
Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.	
TEXT BOOKS	
1	Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2	Vinod Chandra S S, Anand Hareendran S., “Artificial Intelligence and Machine Learning”, Prentice Hall (2014)
REFERENCE BOOKS	
1	Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
2	Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.
3	Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, WileyIEEE Press, Edition July 2012.
E BOOKS	
1	http://ai.stanford.edu/~nilsson/mlbook.html
2	http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/courses.html
MOOC	
1	https://www.coursera.org/learn/machine-learning

COURSE TITLE	**BUSINESS ECONOMICS (Common to all Branches)**			**CREDITS**	**2**
COURSE CODE	**GEA4304**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**2-0-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-2**				

CO	**COURSE OUTCOMES**	**PO**
1	Demonstrate an understanding the introduction of economics	1,11
2	Demonstrating to know knowledge about cost analysis	3,11
3	Able to build knowledge about consumer’s and producer’s behaviour	3,11

4	Enabling to know about budget	3,7,11
5	Educate about financial services	3,5,11

Prerequisites : Basic Economics

MODULE 1: INTRODUCTION TO ECONOMICS (6)

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics

MODULE 2: COST ANALYSIS (6)

Types of Cost, Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Economies of Scale Cost Classification

MODULE 3: CONSUMER'S AND PRODUCER'S BEHAVIOUR (6)

Consumer Behavior: Law of Diminishing Marginal utility – Equi marginal Utility – Consumer's Equilibrium - Indifference Curve – Production: Law of Variable Proportion – Laws of Returns to Scale – Producer's equilibrium – Economies of Scale Cost Classification

MODULE 4: BUDGET (6)

Process of budgeting in India –classification of budgets trends – evaluation systems – types of deficits – fiscal policy – indicators –– taxation – centre, state and local – public debt and management.

MODULE 5: FINANCE (6)

Basics of finance and financial environment – instruments of financial markets – financial intermediation – investment banking and brokerage services – securities – types of securities – market for securities – how and where traded – initial public offering (IPO) – secondary markets – trading on exchanges and trading with margins.

TEXT BOOKS

1	S.Shankaran, Business Economics - Margham Publications.
2	H.L. Ahuja, Business Economics – Micro & Macro - Sultan Chand & Sons - New Delhi – 55.

REFERENCE BOOKS

1	S.A.Ross, R.W.Westerfield, J.Jaffe and Roberts: Corporate Finance, McGraw-Hill.
2	Joseph E Stiglitz: Economics of the Public Sector.

E BOOKS

1	https://sites.google.com/site/readbookpdf7734/pdf-download-business-economics-by---mark-taylor-read-online
2	https://bookboon.com/en/economics-ebooks

COURSE TITLE	**MACHINE LEARNING LAB**			**CREDITS**	**1**
COURSE CODE	**ITB4341**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	COURSE OUTCOMES	PO
1	Implement and apply machine learning algorithms to solve problems.	1,3,4
2	Select appropriate algorithms for solving a of real-world problems.	4,5

3	Use machine learning techniques in high-performance computing environment to solve real-world problems	3,4,5

Prerequisites : Nil

List of Experiments

1. Exercises to solve the real-world problems using the following machine learning methods:
   - Linear Regression
   - Logistic Regression
   - Multi-Class Classification
   - Neural Networks
   - Support Vector Machines
   - K-Means Clustering & PCA
2. Develop programs to implement Anomaly Detection & Recommendation Systems
3. Implement GPU computing models to solving some the problems mentioned in the experiment

TEXT BOOKS

1	Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2	Vinod Chandra S S, Anand Hareendran S., “Artificial Intelligence and Machine Learning”, Prentice Hall (2014)

REFERENCE BOOKS

1	Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
2	Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.
3	Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, WileyIEEE Press, Edition July 2012.

COURSE TITLE	**NETWORKS AND INFORMATION SECURITY LAB**			**CREDITS**	**1**
COURSE CODE	**ITB4342**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	COURSE OUTCOMES	PO
1	Implement and apply security algorithms to solve problems.	1,2,3
2	Select appropriate algorithms for solving a of real-world problems.	1,2,3,4

3	Use latest network and security techniques in high-performance computing environment to solve real-world problems	4,5,7

Prerequisites : Nil

List of Experiments

1. Implement any two of the following Substitution Technique concepts.
   i) Caesar Cipher
   ii) Playfair Cipher
   iii) Hill Cipher
   iv) Vigenere Cipher
2. Implement any one of the following algorithms.
   i) DES
   ii) MD5
   iii) SHA-1
3. Implement any one of the following algorithms
   i) RSA Algorithm
   ii) Diffiee-Hellman
4. Demonstrate Intrusion Detection System (IDS) using any tool (snort or equivalent software)
5. Installation of rootkits and study about the variety of options
6. Demonstrate how a sniffer attack is done using Wireshark Tool.
7. Install Jcrypt Tool (or any equivalent) to demonstrate Asymmetric and Symmetric Crypto algorithm.

Demonstrate how to inject JavaScirpt using Cross Site Scripting (XSS).

TEXT BOOKS

1	James Michael Stewart, Mike Chapple, Darril Gibson, CISSP(ISC)2 Certified Information Systems Security Professional Official Guide, 7th edition , 2015.
2	Mark Rhodes Ousley, “Information Security: The Complete Reference”, 2nd edition, McGraw Hill Education, 2013

REFERENCE BOOKS

1	Jaydip Sen, Advances in Security in Computing and Communications, InTech, 2017

COURSE TITLE	**DESIGN PROJECT – IV**			**CREDITS**	**1**
COURSE CODE	**ITB4343**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-2-1**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-6**				

CO	COURSE OUTCOMES	PO
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10 , 11,12

2	Give practical solutions to the societal problem	1,2,3,5,6,9,10 , 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10 , 11,12

Prerequisites: Object Oreinetd Analysis and Design, Networks and Information Security, Machine Learning

LAB / MINI PROJECT

In this project, each group consisting of four/five members is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. At the end of the course the group should submit a complete report of the project work carried out.

COURSE OBJECTIVE:

- To enable the students to apply the theoretical knowledge in practice
- To enable them to plan and organize a small Information Technology project and write a report on the work

To improve the level of confidence in presenting the Information Technology concepts.

SEMESTER – VII

COURSE TITLE	**SOFTWARE PROJECT PLANNING AND MANAGEMENT**			**CREDITS**	**4**
COURSE CODE	**ITB4401**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Able to develop the project plan	2,3,4

2	Able to estimate the cost of the software project	2,3,4
3	Able to schedule to project implementation	2,3,4
4	Able to understand the latest project management model	1,2

Prerequisites : Object Oriented Analysis and Design

MODULE 1 : MODERN PROJECT MANAGEMENT	**(9L+ 3P)**
Modern Project Management - Project Management in Action - Organization Strategy and Project Selection - Project Code Names replaced HP's Strategy Revision. – Organization - Structure and Culture · - Defining the Project	
MODULE 2 : ESTIMATING PROJECT TIMES AND COSTS	**(9L+ 3P)**
Estimating Project Times and Costs · - Developing a Project Schedule · - Managing Risk · - The Critical-Chain Approach - Reducing Project Duration ·	
MODULE 3 : LEADERSHIP	**(9L+ 3P)**
Leadership: Being an Effective Project Manager · - Managing Project Teams · - Outsourcing: Managing Inter organizational Relations · - RFP process. ·	
MODULE 4 : PROGRESS AND PERFORMANCE MEASUREMENT AND EVALUATION	**(9L+ 3P)**
Progress and Performance Measurement and Evaluation - Discussion of milestone schedules -· Discussion of Management Reserve Index. · Project Closure · - Project audit and closing activities.	
MODULE 5 : PROJECT MANAGEMENT MATURITY MODEL	**(9L+ 3P)**
Project Management Maturity model - International Projects · - An Introduction to Agile Project Management	

TEXT BOOKS	
1	E. Larson and C. Gray, Project Management: The Managerial Process, Sixth Edition, 2013.
REFERENCE BOOKS	
1	Reflections on Management: How to Manage Your Software Projects, Your Teams, Your Boss, and Yourself, 2010.
2	A Guide to the Project Management Body of Knowledge, Fifth Edition (PMBOK Guide), Project Management Institute, 2013.
E BOOKS	
1	https://free-management-ebooks.tradepub.com/free/w_frec123/prgm.cgi?a=1
MOOC	
1	https://www.edx.org/course/introduction-project-management-adelaidex-project101x-1

COURSE TITLE	**CYBER PHYSICAL SYSTEMS**			**CREDITS**	**4**
COURSE CODE	**ITB4402**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Understand the concepts of Cypher physical system in real world application	1,3,4,7
2	Design his own model for cyber physical system	3,4,5

3	Remember the security practices in cyber physical system	1,4

Prerequisites: Networks and Information Security

MODULE 1 : INTRODUCTION TO CYBER PHYSICAL SYSTEMS (CPS) (9L+6P)

Cyber-Physical Systems (CPS) in the real world - Basic principles of design and validation of CPS - Industry 4.0, AutoSAR, IIOT implications - Building Automation, Medical CPS -- CPS - Platform components - CPS HW platforms - Processors, Sensors, Actuators - CPS Network – Wireless Hart, CAN, Automotive Ethernet - CPS Sw stack - RTOS - Scheduling Real Time control tasks.

MODULE 2 : PRINCIPLES OF AUTOMATED CONTROL DESIGN (9L+6P)

Principles of Automated Control Design - Dynamical Systems and Stability - Controller Design Techniques - Stability Analysis: CLFs, MLFs, stability under slow switching - Performance under Packet drop and Noise.

MODULE 3 : CPS IMPLEMENTATION (9L+6P)

CPS implementation - From features to software components, Mapping software components to ECUs - CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion.

MODULE 4 : FORMAL METHODS FOR SAFETY ASSURANCE OF CPS (9L+6P)

Formal Methods for Safety Assurance of Cyber-Physical Systems - Advanced Automata based modeling and analysis - Basic introduction and examples - Timed and Hybrid Automata - Definition of trajectories, zenoness - Formal Analysis: Flowpipe construction, reachability analysis - Analysis of CPS Software: - Weakest Pre-conditions - Bounded Model checking.

MODULE 5 : SECURE DEPLOYMENT OF CPS (9L+6P)

Secure Deployment of CPS - Attack models - Secure Task mapping and Partitioning - State estimation for attack detection - Automotive Case study : Vehicle ABS hacking - Power Distribution Case study : Attacks on SmartGrids.

TEXT BOOKS

1	Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2018
2	E. A. Lee, Sanjit Seshia , Introduction to Embedded Systems – A Cyber–Physical Systems Approach, MIT Press, 2017
3	Platzer, Andre, Logical Foundations of Cyber-Physical Systems, Springer, 2018

REFERENCE BOOKS

1	Möller, Dietmar P.F.Guide to Computing Fundamentals in Cyber-Physical Systems Concepts, Design Methods, and Applications, Springer, 2016.

E BOOKS

1	Cyber-Physical Systems Foundations, Principles and Applications, Academic Press, 2017

MOOC

1	https://www.mooc-list.com/tags/cyber-physical-systems

COURSE TITLE	DATA ANALYTICS			CREDITS	4
COURSE CODE	ITB4403	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Build their own Data warehousing architecture for the application	3,4
2	Implement different techniques of data mining like association rule, classification and clustering.	4,5
3	Apply the data mining techniques with real world	1,3,4

Prerequisites : Data Mining basics

MODULE 1 : INTRODUCTION AND DATA WAREHOUSING (9L + 3T)

Introduction, Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Implementation, Further Development, Data Warehousing to Data Mining.

MODULE 2 : DATA PREPROCESSING, LANGUAGE, ARCHITECTURES, CONCEPT DESCRIPTION (9L+ 3T)

Why Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Data Mining Primitives, Query Language, Graphical User Interfaces, Architectures, Concept Description, Data Generalization, Characterizations, Class Comparisons, Descriptive Statistical Measures.

MODULE 3 : ASSOCIATION RULES (9L +3T)

Association Rule Mining, Single-Dimensional Boolean Association Rules from Transactional Databases, Multi-Level Association Rules from Transaction Databases.

MODULE 4 : CLASSIFICATION AND CLUSTERING (9L +3T)

Classification and Prediction, Issues, Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Cluster Analysis, Types of data, Categorization of methods, Partitioning methods, Outlier Analysis.

MODULE 5 : DATA MINING TRENDS AND RESEARCH FRONTIERS (9L +3T)

Mining Complex Data Types - Other Methodologies of Data Mining - Data Mining Applications - Data Mining and Society - Data Mining Trends

TEXT BOOKS

1 J. Han, M. Kamber, “Data Mining: Concepts and Techniques”, Harcourt India / Morgan Kauffman, 3rd Revised Edition 2013

REFERENCE BOOKS

1 Charru C.Agarwal, “Data Mining: The Text Book”, Springer 2015.

2 M.Bramer, “Principles of Data Mining”, Springer 2016.

E BOOKS

1	https://advanceddataanalytics.net/ebooks
2	https://www.birst.com/business-insights/data-analytics/
MOOC	
1	https://in.udacity.com/course/data-analyst
2	https://www.coursera.org/browse/data-science/data-analysis

COURSE TITLE	**INTERNET OF THINGS**			**CREDITS**	**4**
COURSE CODE	**ITB4404**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Have knowledge of Internet of Things, components of IoT Architecture and platforms of IoT ecosystem	3,4
2	Analyse problems, choose Sensors and Actuators design and develop edge network	3,4
3	Big Data Analytics, transform data and Identify the DIY (Do it yourself) open source electronics platforms for building IoT prototypes	1,3,5

Prerequisites :Knowledge about Sensors

MODULE 1 : INTRODUCTION TO IOT (9L+6P)

Definition of IoT - Evolution of IoT - IoT and related terms - Business Scope.
Lab : Application of gas sensor

MODULE 2 : ELEMENTS OF IOT (9L+6P)

Introduction to Elements of IoT - Basic Architecture of an IoT Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA
Lab : Detection of fire

MODULE 3 : COMMUNICATION AND CONNECTIVITY TECHNOLOGIES (9L+6P)

Cloud Computing in IoT - IoT Communication Model – Cloud Connectivity
Lab : Implementation of GSM shield

MODULE 4 : DATA ANALYTICS AND IOT PLATFORMS (9L+6P)

Big Data Analytics - Data Visualization - IoT Platforms
Lab : Implementation of Bluetooth relay shield

MODULE 5 : CONCERNS AND FUTURE TRENDS (9L+6P)

Different Players of IoT - Security Concerns and Challenges - Future Trends – Standards – Hands on Projects - DIY Kits - IFTTT and other apps.
Lab : Application of Heartbeat sensor

TEXT BOOKS

1	The Internet of Things: Applications and Protocols,. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi, Wiley publications, 2012
2	Architecting the Internet of Things, Author(s): Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer publications, 2011.
3	Internet of Things with Arduino Cookbook, Author(s): Marco Schwatrz, Packt Publication, 2016
REFERENCE BOOKS	
1	Internet of Things and Data Analytics, Wiley Publications
E BOOKS	
1	https://www.oreilly.com/iot/free/internet-as-material.csp
MOOC	
1	https://www.edx.org/course/introduction-to-the-internet-of-things-iot

COURSE TITLE	**DATA ANALYTICS LAB**			**CREDITS**	**1**
COURSE CODE	**ITB4431**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-3-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	COURSE OUTCOMES	PO
1	Process big data using Hadoop framework	1, 4
2	Build and apply linear and logistic regression models	1,3,5
3	Perform data analysis with machine learning methods	3,4,5
4	Perform graphical data analysis	4,5,6

Prerequisites : Nil

List of Experiments

Hadoop
1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset R
4. Implement Linear and logistic Regression
5. Implement SVM / Decision tree classification techniques
6. Implement clustering techniques
7. Visualize data using any plotting framework
8. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

TEXT BOOKS

1	J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Harcourt India / Morgan Kauffman, 3rd Revised Edition 2013

REFERENCE BOOKS

1	Charru C.Agarwal, "Data Mining: The Text Book", Springer 2015.
2	M.Bramer, "Principles of Data Mining", Springer 2016.

COURSE TITLE	DESIGN PROJECT – V / INTERNSHIP			CREDITS	1
COURSE CODE	ITB4432	COURSE CATEGORY	PC	L-T-P-S	0-0-2-1
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-6				

CO	COURSE OUTCOMES	PO
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10 , 11,12
2	Give practical solutions to the societal problem	1,2,3,5,6,9,10 , 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10 , 11,12

Prerequisites: Software Project Planning and management, Cyber Physical Systems , Data Aalytics, Internet of things

LAB / MINI PROJECT

In this project, each group consisting of four/five members is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject should be applied to develop effective solutions to various computing problems. At the end of the course the group should submit a complete report of the project work carried out.

COURSE OBJECTIVE:

- To enable the students to apply the theoretical knowledge in practice
- To enable them to plan and organize a small Information Technology project and write a report on the work

To improve the level of confidence in presenting the Information Technology concepts.

COURSE TITLE	COMPREHENSION			CREDITS	1
COURSE CODE	ITB4433	COURSE CATEGORY	PC	L-T-P-S	1-0-0-1
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To learn the analytical and technical skills	1,10
2	To improvise the aptitude skills	1,10

Prerequisites : Nil

Goal:

To encourage the students to comprehend the knowledge acquired from the first semester to Sixth semester of B.Tech Degree Course through periodic exercise.

SEMESTER – VIII

COURSE TITLE	PROJECT WORK AND VIVA VOCE			CREDITS	8
COURSE CODE	ITB4441	COURSE CATEGORY	PC	L-T-P-S	0-0-24-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-6				

CO	COURSE OUTCOMES	PO
1	Identify and work for the real life needs of the society	1,2,3,5,6,9,10 , 11,12
2	Give practical solutions to the societal problem	1,2,3,5,6,9,10 , 11,12
3	Realize the importance of Engineering concepts and its relevant application	1,2,3,5,6,9,10 , 11,12

Prerequisites : All core courses

The Project Work shall be carried out in any of the Information Technology areas such as Software Development, Communication, Cyber Security and Data. Students shall work in convenient groups of not more than four members in a group. Every Project Work shall have a Guide who is a member of the faculty of the University. During this period the students shall receive directions from the guide for the progress of the Project Work. The students shall give periodical presentations of the progress made in the Project Work.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, Project work details and conclusions. This final report shall be typewritten form as specified in the guidelines.

LIST OF DEPARTMENT ELECTIVES - SEMESTER – III

COURSE TITLE	INFORMATION THEORY AND CODING	CREDITS	3

COURSE CODE	ITC4251	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Evaluate the information rate of various information sources	1,3,4
2	Select and design simple convolutional codes	1,3,4
3	Evaluate the information capacity of discrete memoryless channels and determine possible code rates to achievable on such channels	1,3,4
4	Design lossless data compression codes for discrete memoryless sources	1,3,4
5	Understand information theoretic security issues	1,4

Prerequisites : Basic knowledge about data and information

MODULE 1: FUNDAMENTAL LIMITS IN INFORMATION THEORY (9L)

Uncertainty, Information and Entropy – Source Coding Theorem – Discrete Memoryless Channels – Channel Coding Theorem – Information Capacity Theorem.

MODULE 2: INFORMATION MEASURES (9L)

The Science of Information – Independence and Markov Chain – Shanon's Information Measures – Continuity of Shanon's Information Measures for Fixed Finite Alphabets – Shanon's Codes.

MODULE 3: ZERO-ERROR DATA COMPRESSION (9L)

The Entropy Bound – Prefix Codes: Code tree, Instantaneous Decoding,D- adic distributions – Huffman Codes – Redundancy of Prefix Codes.

MODULE 4: Error Control Coding (9L)

Linear Block Codes : Syndrome, error detection, error correction– Cyclic Codes – Convolutional Codes: Viterbi algorithm, BCJR algorithm – Turbo Codes

MODULE 5: COMPRESSION TECHNIQUES (9L)

Principles - Text compression - Static Huffman Coding - Dynamic Huffman coding - Arithmetic coding - Image Compression - Graphics Interchange format - Tagged Image File Format - Digitized documents - Introduction to JPEG standards.

TEXT BOOKS

1	Yeung, Raymond, "Information Theory and Network Coding", Springer, 2007.
2	Murlidhar Kulkarni,"Information Theory and coding", Wiley Publications, ISBN :9788126553051, 2014**ISBN: 97881SBN: 9788126553051**
3	Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.

REFERENCE BOOKS

1	Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002.

E BOOKS

1	https://www.springer.com/in/book/9783642203466

MOOC

1	Introduction to ITC: https://www.youtube.com/watch?v=f8RvFlr5wRk
2	ITC: http://www.nptelvideos.in/2012/11/information-theory-and-coding.html

COURSE TITLE	**DISTRIBUTED SYSTEM**			**CREDITS**	**3**
COURSE CODE	**ITC4252**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Understand about Distributed system.	1,4
2	Describe distributed objects and file system.	1,3,4
3	Develop Operating system architecture.	1,4
4	Identify the different distributed transactions.	1,4
5	Implementation of various security techniques.	1,4

Prerequisites :Operating systems

MODULE 1 : INTRODUCTION (9L)

Introduction to Distributed systems - challenges - architectural models - fundamental models - P2P systems - Introduction to interprocess communications - external data representation and marshalling- client server communication - group communication-multicast/pubsub - Energy Efficient Computing - Cloud computing

MODULE 2 : DISTRIBUTED OBJECTS AND FILE SYSTEM (9L)

Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - Java RMI case Study - Introduction to DFS - File service architecture – Google file system - Introduction to Name Services- Name services and DNS - Directory and directory services- ClusterComputing-mapreduce/bigtable.

MODULE 3 : DISTRIBUTED OPERATING SYSTEM SUPPORT (9L)

The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed mutual exclusion - Overlay Networks – DHT.

MODULE 4 : TRANSACTION AND CONCURRENCY CONTROL-DISTRIBUTED TRANSACTIONS (9L)

Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Data- Intensive Computing and Map Reduce.

MODULE 5 : FAULT TOLERANCE, SECURITY AND REPLICATION (9L)

Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics – Distributed Replication - CDNs and replication – Fault tolerant services - Byzantine

Fault Tolerance - Detecting and Correcting Local Faults - Logging and Crash Recovery – Highly available services – Transactions with replicated data.	
TEXT BOOKS	
1	Tanenbaum, A. and van Steen, M., Distributed Systems: Principles and Paradigms, 2nd ed, Prentice Hall, 2007. ISBN: 0132392275.
2	Maarten van steen,"Distributed sytems", third edition, 2017.
3	Coulouris, G, Dollimore, J., and Kindberg, Distributed Systems: Concepts and Design, 4rd ed T., Addison-Wesley, 2006. ISBN: 0321263545
REFERENCE BOOKS	
1	Kenneth P. Birman, "Reliable Distributed Systems: Technologies, Web Services, and Applications", Springer, 2005.
2	HaggitAttiya, "Distributed Computing: Fundamentals, Simulations, 2nd Edition John wiley and sons, New York 2005.
E BOOKS	
1	http://www.allitebooks.in/designing-distributed-systems/
MOOC	
1	Basic concepts: http://nptel.ac.in/courses/106106107/
2	DS: https://onlinecourses.nptel.ac.in/noc17_cs42/preview

COURSE TITLE	**IT INFRASTRUCTURE AND MANAGEMENT**			**CREDITS**	**3**
COURSE CODE	**ITC4253**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	COURSE OUTCOMES	PO
1	Describe the ITSM activities and processes in an organization and apply that knowledge and skill with initiative to a workplace scenario.	1,3
2	Critically analyze the impact of customer requirements and component identification.	3,4
3	Describe the effectiveness of multiple computing environment.	3,4
4	Understand the role of IT management system.	1,4
5	Analyze the Cost-Benefit Analysis of information system.	7,8,11

Prerequisites: Data Communications and Networking

MODULE 1: IT INFRASTRUCTURE: OVERVIEW	(9L)
Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their Management.	
MODULE 2: IT INFRASTRUCTURE MANAGEMENT	**(9L)**
Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management.	
MODULE 3: SERVICE DELIVERY PROCESS	**(9L)**
IT services continuity management, Capacity management, Availability management and service desk.	
MODULE 4: SERVICE SUPPORT PROCESS	**(9L)**
Service support process, Configuration Management. Incident management. Problem management, Change management, Release management.	
MODULE 5: STORAGE AND SECURITY MANAGEMENT	**(9L)**
Types of Storage management, Benefits of storage management, backups, Archive, Recovery, Disaster recovery. Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management.	

TEXT BOOKS	
1	Surendra Keshari and Narendra Kumar, “IT Infrastructure & Management”, IK International Publishing House, 2013.
2	Anita Sengar, “IT Infrastructure Management”, S. K. Kataria & Sons, 2012.
REFERENCE BOOKS	
1	Phalguni Gupta, Surya Prakash, Umarani Jayaraman, “IT Infrastructure & Its Management”, Tata McGraw Hill Education Private Limited, 2010.
E BOOKS	
1	https://inframanage.com/tag/infrastructure-management-ebook/
MOOC	
1	https://online-learning.tudelft.nl/courses/the-next-generation-of-infrastructure/
2	https://actu.epfl.ch/news/mooc-urban-infrastructure-management-edx/

COURSE TITLE	IT SECURITY ENGINEERING			CREDITS	4
COURSE CODE	ITC4254	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0

CIA	50%	ESE	50%
LEARNING LEVEL	BTL-3		

CO	COURSE OUTCOMES	PO
1	Understanding of fundamental concepts of security models	1-10,12
2	Describe the Security Capabilities of Information Systems	1-10,12
3	Generalize the effects of Vulnerabilities in Architecture, System and Software	1-10,12

Prerequisites: Basic Concepts of Security

MODULE 1 : FUNDAMENTAL CONCEPTS OF SECURITY MODELS (9L)

Common System Components – Enterprise Security Architecture – Common Architecture Frameworks – Zachman Framework - Capturing and Analyzing Requirements - Creating and Documenting Security Architecture.

MODULE 2 : INFORMATION SYSTEMS SECURITY EVALUATION MODELS (9L)

Common Formal Security Models - Product Evaluation Models - Industry and International Security Implementation Guidelines - Security Capabilities of Information Systems - Access Control Mechanisms - Secure Memory Management.

MODULE 3 : VULNERABILITIES OF SECURITY ARCHITECTURES (9L)

Vulnerabilities in Systems - Technology and Process Integration - Single Point of Failure (SPOF) - Client-Based Vulnerabilities - Server-Based Vulnerabilities.

MODULE 4 : SOFTWARE AND SYSTEM VULNERABILITIES AND THREATS (9L)

Web-Based Vulnerability - Vulnerabilities in Mobile Systems - Risks from Remote Computing - Risks from Mobile Workers - Vulnerabilities in Embedded Devices and Cyber-Physical Systems.

MODULE 5 : APPLICATION AND USE OF CRYPTOGRAPHY (9L)

The History of Cryptography - Emerging Technology - Core Information Security Principles - Additional Features of Cryptographic Systems - The Cryptographic Lifecycle - Public Key Infrastructure (PKI) - Digital Signatures – Hashing - Methods of Cryptanalytic Attacks.

TEXT BOOKS

1	Official Guide to Certified Information Systems Security Professional (CISSP), CBK, 2017

REFERENCE BOOKS

1	Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead , Software Security Engineering: A Guide for Project Managers (book), 2008

E BOOKS

1	http://www.cl.cam.ac.uk/~rja14/book.html

MOOC

1	https://www.mooc-list.com/tags/security

COURSE TITLE	PYTHON PROGRAMMING			CREDITS	3
COURSE CODE	ITC4255	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0

CIA	50%	ESE	50%
LEARNING LEVEL	BTL-3		

CO	COURSE OUTCOMES	PO
1	Develop skill in system administration and network programming by learning Python	3,4,5
2	Use Python's powerful processing primitives and modeling.	1,3
3	Develop algorithmic solutions to simple computational problems	3,4
4	Read, write, execute by hand simple Python programs.	3,4,5

Prerequisites :Object Oriented and Java Programming

MODULE 1 : INTRODUCTION TO PYTHON (9L)

Introduction to Python language – Using the interpreter – Python data types and functions – Working with Data – List, Dictionary and Set – Processing Primitives – List comprehensions – File Handling – Object model including Variables, Reference counting, Copying, and Type checking – Error handling.

MODULE 2 : PROGRAM ORGANIZATION AND FUNCTIONS (9L)

9 Organize Large programs into functions – Python functions including scoping rules and documentation strings – Modules and Libraries – Organize programs into modules – System administration, Text processing, Sub processes, Binary data handling, XML parsing and Database Access – Installing third-party libraries.

MODULE 3 : CLASSES AND OBJECTS (9L)

Introduction to Object-oriented programming – Basic principles of Object-oriented programming in Python – Class definition, Inheritance, Composition, Operator overloading and Object creation – Python special modules – Python Object System – Object representation, Attribute binding, Memory management, and Special properties of classes including properties, slots and private attributes.

MODULE 4 : TESTING, DEBUGGING, AND SOFTWARE DEVELOPMENT PRACTICE (9L)

Python Software development – Use of documentation string – Program testing using doc test and unit test modules – Effective use of assertions – Python debugger and profiler – Iterators and Generators to set up data processing pipelines – An effective technique for addressing common system programming problems (e.g. processing large data files, handling infinite data streams, etc.)

MODULE 5 : TEXT I/O HANDLING (9L)

Text generation, Template strings and Unicode-packages – Python Integration Primer – Network programming – Accessing C code – Survey on how Python interacts with other language programs.

TEXT BOOKS

1 Robert Sedgewick,Kevin Wayne ,Robert Dondero,Intr Programming in Python, Pearson,2016.

REFERENCE BOOKS

1 Mark J.Guzdial,Barbara Ericson,"Introduction to Computing & Programming in Python,4th

	Edition Pearson,2015.
2	Budd, Timothy. Exploring Python. McGraw-Hill science,2009.
3	Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013.
E BOOKS	
1	http://www.davekuhlman.org/python_book_01.pdf
2	https://medium.mybridge.co/19-free-ebooks-to-learn-programming-with-python-8f6f.
MOOC	
1	https://onlinecourses.nptel.ac.in/noc16_cs11
2	https://www.edureka.co/python/course

COURSE TITLE	**SOFT COMPUTING**			**CREDITS**	**3**
COURSE CODE	**ITC4256**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Apply various soft computing frame works.	1, 3
2	Design of various neural networks	3, 4
3	Use fuzzy logic	3,4
4	Discuss hybrid soft computing	1,4
5	Apply genetic programming in real time	4,8

Prerequisites : Fuzzy Logic

MODULE 1: INTRODUCTION TO SOFT COMPUTING (9L)

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models – important technologies – applications. Fuzzy logic: Introduction – crisp sets- fuzzy sets – crisp relations and fuzzy relations: cartesian product of relation – classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

MODULE 2: NEURAL NETWORKS (9L)

McCulloch-Pitts neuron – linear separability – hebb network – supervised learning network: perceptron networks – adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN-associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

MODULE 3: FUZZY LOGIC (9L)

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle – fuzzy measures – measures of fuzziness -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.	
MODULE 4: HYBRID SYSTEMS	**(9L)**
Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.	
MODULE 5: GENETIC ALGORITHM	**(9L)**
Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem –Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming**.**	
TEXT BOOKS	
1	S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011
2	J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004
REFERENCE BOOKS	
1	Soft Computing and Intelligent System Design -Fakhreddine 0 Karray, Clarence D Silva, Pearson Edition, 2004
2	David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013
3	Fundamentals of Neural Networks: Architectures, Algorithms And Applications, LaureneFausett, Pearson Education, Inc, 2008 .
4	Fuzzy Logic With Engineering Applications, Third Edition Thomas, Timothy Ross, John Wiley & Sons,2010
E BOOKS	
1	https://bookboon.com/en/introduction-to-soft-computing-ebook
MOOC	
1	https://www.class-central.com/course/nptel-introduction-to-soft-computing-10053
2	https://swayam.gov.in/course/4574-introduction-to-soft-computing

COURSE TITLE	E-LEARNING TECHNIQUES			CREDITS	3
COURSE CODE	ITC4257	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Analyze and compare different on-line E-Learning tools	4,7
2	Design course content for a specific subject from different perspective	3,4
3	Design and Implement an E-Learning Course Content for a complete online course	3,4

Prerequisites : Design and Engineering

MODULE 1 : INTRODUCTION (9L)

E-Learning - E-Learning cycle - E-Learning types - challenges and opportunities – cognitive presence – Approaches to design E-Learning - E-Learning framework - 6C framework - E-Learning Tools

MODULE 2 : E-LEARNING STRATEGY (9L)

Role of tutor - E-Learning strategy - Blended E-Learning – M-Learning- problem based learning- Enterprise learning- Corporate Learning- Web based Learning - Pod casting -Learning Management systems – Content development process – E-Learning standards SCORM standard- managing e-learning quality - case studies

MODULE 3 : PRINCIPLES OF E-LEARNING (9L)

Philosophy of E-Learning – theory of learning – Applying principles of multimedia – Applying principles of contiguity - Applying principles of modality - Applying principles of redundancy - Applying principles of coherency - Applying principles of personalization- web-based learning communities - knowledge sharing and Knowledge management in e-learning- social networks and social media in e-learning.

MODULE 4 : DESIGN (9L)

On line E-Learning technologies – visual communication techniques- Computer-based technologies - Computer-mediated communication (CMC) - Assessment and evaluation Organizing and designing learning sequences, Characteristics of Interactive Online Learning Media.

MODULE 5 : IMPLEMENTATION (9L)

Leverages example in E-Learning – collaborative E-Learning- Learner control in E-Learning guidelines to solve issues in E-Learning – Implementation of an E-Learning Course Content for a complete online course, Research in content retrieval and generation for E-Learning, Role of cloud and semantic Grid in E-Learning.

TEXT BOOKS	
1	D.Randy Garrison “E-Learning in the 21st century a framework for research and practice”, 2 nd edition, Taylor and Francis, 2011.
2	Robin Mason, “E-Learning : the key concepts”, Routledge, 2007.
3	William Horton, “E-Learning by Design”, Pfeiffer Wiley, 2006.
4	John Gardner, Bryn Holems, “E-Learning : Concepts and practice” SAGE Publications, 2006.
REFERENCE BOOKS	
1	R.C.Clark and R.E.Mayer, “E-Learning and the science of instruction”, Pfeiffer Wiley,2011.
2	Mark J Rosenberg, “E-Learning: strategies for delivering knowledge in the Digital Age”, McGraw- Hill, 2001.
3	Kjell E. (Erik) Rudestam , Judith Schoenholtz-Read, “Handbook of Online Learning”, Sage Publications Inc., Second Edition, 2009.
4	Topics (Wiley Series on Parallel and Distributed Computing)
E BOOKS	
1	https://www.elearninglearning.com/ebook/
MOOC	
1	https://www.lynda.com/Elearning-training-tutorials/33-0.html

LIST OF DEPARTMENT ELECTIVES - SEMESTER - IV

COURSE TITLE	PRINCIPLES OF MOBILE COMPUTING			CREDITS	3
COURSE CODE	ITC4266	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Recall the Wireless communication technologies	1,3
2	Design the MANET	1,3,4
3	Implement the protocols and tools	1,3,4
4	Memorize the wireless systems and standards	1,3

Prerequisites :Basic concepts of wireless communications

MODULE 1 : INTRODUCTION TO WIRELESS COMMUNICATION (9L)

Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems.

MODULE 2 : MOBILE RADIO PROPAGATION (9L)

Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading.

MODULE 3 : MANET (9L)

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

MODULE 4 : PROTOCOLS AND TOOLS (9L)

Wireless Application Protocol-WAP.(Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

MODULE 5 : WIRELESS SYSTEMS AND STANDARDS (9L)

Second Generation and Third Generation Wireless Networks and Standards, WLL, Blue tooth. AMPS, GSM, IS-95 and DECT.

TEXT BOOKS

1	T.S.Rappaport, "Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
2	Pattnaik Mall," Fundamentals of mobile computing",Second edition, Kindle edition, ISBN9788120351813, 2016.
3	Mazliza Othman,"Principles of mobile computing and communications", CRC Press, ISBN 9781420061581, 2007

REFERENCE BOOKS	
1	W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw-Hill International, 1998.
E BOOKS	
1	http://www.dailymotion.com/video/x67shw3
MOOC	
1	Mobile computing:http://www.digimat.in/nptel/courses/video/106106147/L02.html

COURSE TITLE	VIRTUALIZATION AND CLOUD COMPUTING			CREDITS	3
COURSE CODE	ITC4267	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Compare the strengths and limitations of cloud computing	3, 4
2	Identify the architecture, infrastructure and delivery models of cloud computing	3,4
3	Apply suitable virtualization concept	3,4
4	Choose the appropriate cloud player, Programming Models and approach	3,4
5	Set up a private cloud	4,9

Prerequisites :Cloud computing

MODULE 1 : CLOUD ARCHITECTURE AND MODEL	(9L)
Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.	
MODULE 2 : VIRTUALIZATION	**(9L)**
Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.	
MODULE 3 : CLOUD INFRASTRUCTURE	**(9L)**
Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.	
MODULE 4 : PROGRAMMING MODEL	**(9L)**
Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim.	

MODULE 5 : CLOUD SECURITY	(9L)
Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.	
TEXT BOOKS	
1	Nick Antonopoulos, Cloud computing, Springer Publications, 2010
2	Humble Devassy,"Mastering KVM Virtualization",Kindle edition, ***ISBN***-13: 9781784396916,2016
3	Enterprise Cloud Computing by GautamShroff, Cambridge,2010
REFERENCE BOOKS	
1	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2	John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
E BOOKS	
1	https://www.amazon.com/Value-Virtualization-Cloud-Computing-accelerate/dp/1492198331
MOOC	
1	Data centres and cloud computing:https://www.youtube.com/watch?v=_fGrYN5rxhs

COURSE TITLE	**CYBER CRIME INVESTIGATIONS AND DIGITAL FORENSICS**			**CREDITS**	**3**
COURSE CODE	**ITC4268**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Understand the various ideas about cybercrime.	1,3
2	Describe the Cyber Crime Strategy.	3,4
3	Identify the Cyber Crime Investigation Methodology.	2,4
4	Generalize the knowledge on Digital Forensics.	3,4
5	Apply the Concepts of Cyber Crime and Digital Forensics in Real Time Scenarios.	3,4,7

Prerequisites: Data Communications and Networking	
MODULE 1: UNDERSTANDING THE THREAT FROM CYBER CRIME	**(9L)**
Introduction - Cyber Threat – Definition of Cyber Crime – Classification – Current Threats and Trends – Diversity of Cyber Crime – Cyber Hate Crimes – Cyber Terrorism.	
MODULE 2: RESPONDING TO CYBER CRIME	**(9L)**
Cyber Strategy – National Security Strategy – Cyber Security Strategy – Organized Crime Strategy – Cyber Crime Strategy - Policy Cyber Crime – International Response – National Cyber Security Structure – Strategic Policy Requirements – Police and Crime Commissioners.	

MODULE 3: INVESTIGATING CYBER CRIME	**(9L)**
Preventing Cyber Crime – Password Protection – Get Safe Online – Cyber Security Guidance for Business - Cyber Crime Investigation Skills – Criminal Investigation – Code of Ethics – Evidence – Hi-Tech Investigations – Capturing and Analyzing Digital Evidence. /	
MODULE 4: DIGITAL FORENSICS	**(9L)**
Introduction to Digital Forensics - Forensic Software and Hardware - Analysis and Advanced Tools - Forensic Technology and Practices - Forensic Ballistics and Photography - Face, Iris and Fingerprint Recognition - Audio Video Analysis - Windows System Forensics - Linux System Forensics - Network Forensics.	
MODULE 5: CASE STUDY	**(9L)**
Latest Study Topics on Cyber Crime and Investigations - Recent Cyber Crime Cases – Recent Digital Forensics Cases – Bridging the Gaps in Cyber Crime Investigations between the cyber security stake holders.	
TEXT BOOKS	
1	Thomas Halt, Adam M. Bossler and Kathryn C.Seigfried Spellar, “Cybercrime and Digital Forensics: An Introduction”, Routledge Taylor and Francis Group 2017.
REFERENCE BOOKS	
1	Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004
E BOOKS	
1	https://books.google.co.in/books/about/Cybercrime_and_Digital_Forensics.html?id=7SA6DwAAQBAJ&redir_esc=y
MOOC	
1	https://www.mooc-list.com/tags/cybercrime
2	https://www.mooc-list.com/tags/digital-forensics

COURSE TITLE	IT SECURITY OPERATIONS			CREDITS	3
COURSE CODE	ITC4269	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the security operations, security management and preventive measures.	1-10,12
2	Describe the disaster recovery process.	1-10,12
3	Develop a test plan for a specific security threat.	1-10,12

Prerequisites: IT Security Engineering

MODULE 1 : INVESTIGATIONS	(9L)
The Crime Scene - Policy, Roles, and Responsibilities - Incident Handling and Response - Recovery Phase - Evidence Collection and Handling - Reporting and Documenting - Evidence Collection and Processing - Continuous and Egress Monitoring - Data Leak/Loss Prevention (DLP).	
MODULE 2 : SECURITY MANAGEMENT	**(9L)**
Provisioning of Resources through Configuration Management - Foundational Security Operations Concepts – Resource Protection – Incident Response.	
MODULE 3 : PREVENTIVE MEASURES AGAINST ATTACKS	**(9L)**
Unauthorized Disclosure - Network Intrusion Detection System Architecture - Third-party Security Services, Sandboxing, Anti-malware, Honeypots and Honeynets - Patch and Vulnerability Management - Change and Configuration Management.	
MODULE 4 : DISASTER RECOVERY PROCESS	**(9L)**
Documenting the plan – Response – Personnel – Communications – Employee Notification – Assessment – Restoration – Provide Training – Exercise, Assess and Maintain the Lab.	
MODULE 5 : TESTPLAN REVIEW	**(9L)**
Tabletop Exercise/Structured Walk-Through Test - Walk-Through Drill/Simulation Test - Functional Drill/Parallel Test - Full-Interruption/Full-Scale Test - Update and Maintenance of the Plan.	

TEXT BOOKS	
1	Official Guide to Certified Information Systems Security Professional (CISSP), CBK, 2017.
2	Joseph Muniz, Gary McIntyre and Nadhem AlFardan, Security Operations Center: Building, Operating, and Maintaining your SOC, 2015.
REFERENCE BOOKS	
1	David Nathans, Designing and Building Security Operations Center, 2014.
E BOOKS	
1	https://www.amazon.com/Information-Security-Operations-Matthew-Hackling-ebook/dp/B00D6Q1TRI
MOOC	
1	https://hrtraining.com.au/certificate-iii-in-security-operations/

COURSE TITLE	DECISION MODELING			CREDITS	3
COURSE CODE	ITC4270	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Develop quantitative models for unstructured decision problems by identifying controllable factors, uncontrollable factors, performance measures, and relationships.	4, 5
2	Measure uncertainty using probability, and perform Monte Carlo simulation to gain insight into practical business problems.	4,5
3	Develop and analyze decision tree models for sequential decision problems and determine value of information.	4,5
4	Develop regression models to explain variation, measure relationships, and make predictions.	4, 5, 8
5	Identify patterns in time series data, develop appropriate models, and make forecasts.	4, 6

Prerequisites : Database Technologies

MODULE 1 : DECISION MODELS, SENSITIVITY ANALYSIS, DESCRIPTIVE STATISTICS (9L)

Introduction to Decision Modeling - Sensitivity Analysis Using Excel - Installing SensIt, RiskSim, and TreePlan - Sensitivity Analysis Using SensIt - Introduction to Data Analysis - Univariate Numerical Data.

MODULE 2 : UNCERTAIN QUANTITIES, MONTE CARLO SIMULATION, SIMPLE REGRESSION (9L)

Introduction to Monte Carlo Simulation - Uncertain Quantities - Simulation Without Add-Ins - Monte Carlo Simulation Using RiskSim - Bivariate Numerical Data - One-Sample Inference for the Mean - Simple Linear Regression - Simple Nonlinear Regression.

MODULE 3 : DECISION TREES, MULTIPLE REGRESSION (9L)

Introduction to Decision Trees - Decision Trees Using Tree Plan - Strategies in Decision Trees - Sensitivity Analysis for Decision Trees - Multiple Regression - Regression Using Categorical Variables - Regression Models for Cross-Sectional Data.

MODULE 4 : MULTI ATTRIBUTE UTILITY, VALUE OF INFORMATION, RISK ATTITUDE UTILITY, TIME SERIES (9L)

Multiattribute Utility - Decision Trees with Multi attribute Outcomes - Value of Information in Decision Trees - Data Analysis - Time Series Data and Forecasts - Autocorrelation and Autoregression - Time Series Smoothing - Time Series Seasonality - Regression Models for Time Series Data.

MODULE 5 : MULTIPERIOD MODELS, REVISION OF PROBABILITY, RISK ATTITUDE UTILITY, PIVOT TABLES (9L)

Multiperiod What-If Modeling - Modeling Uncertain Relationships - Multiperiod Simulation Modeling - Modeling Inventory Decisions - Modeling Waiting Lines - Value of Imperfect Information - Modeling Attitude Toward Risk - Risk Attitude Using TreePlan - Making Choices Under Uncertainty.

TEXT BOOKS	
1	Middleton, Decision Analysis Using Microsoft Excel: March 2010.
REFERENCE BOOKS	
1	Practical Management Science (5th edition), by Wayne Winston and Chris Albright, 2016.
2	Essentials of Business Analytics (1st edition), by Jeffrey D. Camm et al., 2015.
E BOOKS	
1	https://www.amazon.com/Statistics-Data...Decision-Modeling-ebook/dp/B002PHN580
2	http://www.eighbooks.com/read-now.php?q=statistics-data-analysis-and-decision-modeling-pdf
MOOC	
1	https://onlinecourses.nptel.ac.in/noc17_mg21
2	https://www.mooc-list.com/tags/decision-model

COURSE TITLE	BUSINESS INTELLIGENCE AND ITS APPLICATIONS			CREDITS	3
COURSE CODE	ITC4271	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Have knowledge on Transaction Processing and Analytical applications and need for Business Intelligence	1, 4
2	Demonstrate understanding of Business Intelligence framework data Warehouse implementation methodology	3, 4
3	Design an enterprise dashboard and demonstrate application of concepts	3, 4

Prerequisites : Analytics Basics

MODULE 1 : INTRODUCTION TO BUSINESS INTELLIGENCE (9L)

Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities

MODULE 2 : BASICS OF DATA INTEGRATION (EXTRACTION RANSFORMATION LOADING) (9L)

Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL using SSIS.

MODULE 3 : DATA QUALITY (9L)

Introduction to data quality, data profiling concepts and applications.

MODULE 4 : INTRODUCTION TO MULTI-DIMENSIONAL DATA MODELING (9L)

Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

MODULE 5 : BASICS OF ENTERPRISE REPORTING	(9L)
Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.	
TEXT BOOKS	
1	David Loshin, Business Intelligence, 2003
2	Mike Biere, Business intelligence for the enterprise, 2003
3	Larissa Terpeluk Moss, Shaku Atre, Business intelligence roadmap, 2008
4	Cindi Howson, Successful Business Intelligence: Secrets to making Killer BI Applications
5	Wilfried Grossmann,"Fundamentals of Business Intelligence (Data Centric systems and Applications)", Springer, 2016
REFERENCE BOOKS	
1	Brain, Larson, Delivering business intelligence with Microsoft SQL server, 2008
2	Lynn Langit, Foundations of SQL Server 2005 Business Intelligence
3	Stephen Few, Information dashboard design
E BOOKS	
1	https://www.elsevier.com/books/business-intelligence/loshin/978-0-12-385889-4
2	https://www.amazon.com/Business-Intelligence-Dummies...ebook/dp/B004THRNG4
MOOC	
1	https://www.edx.org/learn/business-intelligence
2	https://www.coursera.org/learn/business-intelligence-tools

COURSE TITLE	ADVANCED COMPUTER ALGORITHMS			CREDITS	3
COURSE CODE	ITC4272	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the dynamic programming strategies	1, 4
2	Explain NP- hard	4, 10
3	Differentiate the concepts of approximation, parallel, probabilistic and randomized algorithms	4, 5

Prerequisites : Data Structures and Algorithms

MODULE 1 : DESIGN PARADIGMS (9L)

Overview of Divide and Conquer, Greedy and Dynamic Programming strategies. Basic search and traversal techniques for graphs, - String Matching - Introduction to string-matching problem, Naïve algorithm, Rabin Karp

MODULE 2 : THEORY OF NP- HARD AND NP-COMPLETE PROBLEMS (9L)

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs; Other complexity classes.

MODULE 3 : APPROXIMATION ALGORITHMS (9L)

Introduction, Combinatorial Optimization, approximation factor, PTAS, FPTAS, Approximation algorithms for vertex cover, set cover, TSP, knapsack, bin packing, subset-sum problem etc. Analysis of the expected time complexity of the algorithms.

ODULE 4 : PARALLEL ALGORITHMS (9L)

Introduction, Models, speedup and efficiency, Some basic techniques, Examples from graph theory, sorting, Parallel sorting networks. Parallel algorithms and their parallel time and processors complexity.

MODULE 5 : PROBABILISTIC ALGORITHMS & RANDOMIZED ALGORITHMS (9L)

Numerical probabilistic algorithms, Las Vegas and Monte Carlo algorithms, Game-theoretic techniques, Applications on graph problems.

TEXT BOOKS

1	Steven S.Skiena ,"The Algorithm design Manual", 2nd Edition, Springer, 2010
2	T.H. Cormen, C.E.Leiserson and R.L. Rivest, Introduction to Algorithms, 2009
3	G.Brassard and P.Bratley, Fundamentals of Algorithmics, Prentice Hall, 1996
4	Vijay V.Vazirani, Approximation Algorithms, Springer, 2004

REFERENCE BOOKS

1	D.Harel, Algorithmics :The spirit of computing, Addison Wesley, 2004

E BOOKS

1	http://www.freebookcentre.net/CompuScience/free-computer-algorithm-books.html

MOOC

1	http://www.openculture.com/2017/12/advanced-algorithms-a-free-course-from-harvard-university.html

LIST OF DEPARTMENT ELECTIVES - SEMESTER – V

COURSE TITLE	ADVANCED NETWORKS			CREDITS	3
COURSE CODE	ITC4351	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Understand Advanced concepts of network programming	1,4
2	Differentiate the networking models	1,4
3	Understand the concepts of data centre's and software based networking	4,6

Prerequisites : Network concepts

MODULE 1 : INTRODUCTION OF ADVANCED NETWORKING	(9L)
Introduction. - Network architecture and protocols. Packet switching -Performance of networks: delay and throughput.	
MODULE 2 : APPLICATION LAYER	**(9L)**
Application layer: HTTP and other protocols - Socket programming -DNS, HTTP transport: recent developments -P2P, wrap-up application layer.	
MODULE 3 : TRANSPORT LAYER	**(9L)**
Transport layer: introduction. - TCP congestion control - Analysis of TCP - TCP implementation details, multipath TCP - QoS and fairness, traffic shaping -Router scheduling algorithms.	
MODULE 4 : NETWORK AND LINK LAYER	**(9L)**
Network layer: introduction - -network/IP layer introduction - Linux IP networking, advanced topics in IP - IP and MPLS Routers - Router architectures, MPLS, routing protocols. -BGP: introduction. - BGP: advanced topics.- Link layer.	
MODULE 5 :DATACENTER NETWORKING	**(9L)**
Data center networking - Software defined networking - Networking and Virtualization. - More recent topics in networking and systems.	

TEXT BOOKS	
1	James Kurose and Keith Ross, "Computer Networking, A Top-Down Approach",7th Edition, 2017
2	Bertsekas and Gallager, "Data Networks" , 2nd Edition, 1992
REFERENCE BOOKS	
1	Larry Peterson and Bruce Davie, "Computer Networks, A Systems Approach".
E BOOKS	
1	http://www.freebookcentre.net/networking-books-download/Introduction-to-Network-Programming.html
MOOC	
1	https://www.class-central.com/course/coursera-networks-and-communications-security-10339

COURSE TITLE	DIGITAL SIGNAL PROCESSING			CREDITS	3
COURSE CODE	ITC4352	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Describe about the various types of analog signals and digital signals and their mathematical transformations.	1,4
2	Compute the Fast Fourier Transformation model of the signal and understand its significance.	3,4
3	Design the IIR and FIR filters using approximate transformations.	3,4
4	Illustrate spectral analysis of signals and understand about spectral leakage.	3,4

Prerequisites :Signals and systems

MODULE 1 : SIGNALS AND TRANSFORMATION (9L)

Analog signals- Digital signals – Types and properties –Vector space-Signal space- Z Transform – Fourier series – Fourier transform

MODULE 2 : FAST FOURIER TRANSFORM (9L)

Need for FFT – Decimation In Time (DIT-FFT) – Decimation In Frequency (DIF – FFT) – Algorithm – Benefits of FFT.

MODULE 3 : DIGITAL FILTERING (9L)

FIR filter design: Linear Phase filter – Windowing Technique – Frequency Sampling Technique – Structure of filters. IIR filter design: Impulse Invariance transformation – Bilinear Transformation – Structure of filters.

MODULE 4 SPECTRAL ANALYSIS LEAKAGE AND BIAS (9L)

Spectral analysis – Windowing tradeoff – Window design considerations - Bias reduction by Multitaper spectrum estimates – Blackman Tukey spectral estimate.

MODULE 5 :IMAGE COMPRESSION (9L)

Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding- DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

TEXT BOOKS

1	Rafael C Gonzalez, Richard E Woods, Digital Image Processing, 3rd Edition, Pearson Education 2009.
2	Tharun Kumar,"Digital Signal processing",Oxford University press, ***ISBN***: 9780198081937, 2015
3	William K Pratt, Digital Image Processing, John Willey, 2001

REFERENCE BOOKS

1	A.K. Jain, Fundamentals of Digital Image Processing, PHI, New Delhi, 2010.

E BOOKS	
1	Signal processing:http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Books-Download.html
2	DSP:https://dspguru.com/dsp/books/free-online-dsp-books/
MOOC	
1	DSP: https://www.youtube.com/watch?v=6dFnpz_AEyA
2	Rafael C Gonzalez, Richard E Woods, Digital Image Processing, 3rd Edition, Pearson Education 2009.

OURSE TITLE	**ETHICAL HACKING AND CYBER SECURITY**			**CREDITS**	**3**
COURSE CODE	**ITC4353**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Knowledge about Ethical Hacking.	1,4
2	Understand the basic concepts of Open Source Intelligence.	1,4
3	Outline the Cyber Issues in Real World.	1,4,7
4	Inspect the Ethical Hacking Tools.	3,4,7
5	Describe about Malware Insertion and Keylogger Access into devices.	3,4

Prerequisites: Cyber Crime Investigations and Digital Forensics

MODULE 1 : INTRODUCTION TO ETHICAL HACKING AND CYBER SECURITY	**(9L)**
Requirements to get started to enter into world of Hacking and Cyber Security – Methodology of Ethical Hacking and Cyber Security – Ethical Hacking Process.	
MODULE 2 : OPEN SOURCE INTELLIGENCE	**(9L)**
Information Gathering - Open Source Intelligence Training - Google Hacking Database and Google Dorks - Google Hacking Database and Google Dorks Tool.	
MODULE 3 : CYBER ISSUES	**(9L)**
Window Password Hacking and Cracking – Steganography - Hiding Secret Message - Anonymous Call, Message and Email Header Analysis - Access Darknet or Darkweb Using TOR : Anonymous Browsing - Access Darknet or Darkweb Using TOR : Anonymous Browsing.	
MODULE 4 : ETHICAL HACKING LAB SETUP	**(9L)**
Cyber Security and Penetration Testing Lab - Learn Basics of Kali Linux: Hackers Operating System - Metasploit Extreme on Kali Linux : Hacking Windows 7,8,10 Like Blackhat - Bug Bounty Hunting : Web Application Penetration Testing.	

MODULE 5 : MALWARE AND KEYLOGGER ANALYSIS	(9L)
Malware Analysis and Investigation – Introduction to Malware – Static Malware Analysis - Mobile Phone Hacking & Penetration Testing - Introduction of Keylogger: Art of Spying.	
TEXT BOOKS	
1	Gautam Kumawat, Ethical Hacking & Cyber Security Course : A Complete Package, Udemy Course, 2017
2	Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
REFERENCE BOOKS	
1	Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland, 2015
E BOOKS	
1	https://itechhacks.com/best-hacking-ebooks-free-download/
MOOC	
1	https://www.mooc-list.com/course/penetration-testing-and-ethical-hacking-cybrary

COURSE TITLE	IDENTITY AND ACCESS MANAGEMENT			CREDITS	3
COURSE CODE	ITC4354	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the basic concepts of Identity and Access Management.	1,4
2	Describe the implementation procedures for Identity management.	1,4
3	Prepare the need for Service Oriented Analysis.	1,4
4	Knowledge of Identity management life cycle.	4,11

Prerequisites: IT Security Operations

MODULE 1 : BASIC GADGETS FOR IDENTITY AND ACCESS MANAGEMENT	(9L)
Physical and Logical Access to Assets - Identification and Authentication of People and Devices - Identification, Authentication, and Authorization.	
MODULE 2 : IDENTITY MANAGEMENT IMPLEMENTATION	**(9L)**
Password Management - Account Management - Profile Management - Directory Management - Directory Technologies - Single/Multi-Factor Authentication – Accountability - Session Management - Registration and Proof of Identity - Credential Management Systems.	
MODULE 3 : SERVICE ORIENTED ANALYSIS	**(9L)**
Identity as a Service (IDaaS) - Integrate Third-Party Identity Services - Implement and Manage Authorization Mechanisms.	

MODULE 4 : ATTACKS AND COMMANDS	(9L)
Prevent or Mitigate Access Control Attacks - Windows PowerShell Equivalent Commands.	
MODULE 5 : Identity Management Lifecycle	**(9L)**
Identity and Access Provisioning Lifecycle – Provisioning – Review – Revocation.	
TEXT BOOKS	
1	Official Guide to Certified Information Systems Security Professional (CISSP), CBK, 2017.
2	Omondi Orondo, "Identity & Access Management: A Systems Engineering Approach" IAM Imprints, USA, 2014.
REFERENCE BOOKS	
1	Ertem Osmanoglu, "Identity and Access Management : Business Performance through Connected Intelligence", 2013.
E BOOKS	
1	https://www.onelogin.com/resource-center/ebooks/leading-trends-in-identity-access-management-iam-ebook
MOOC	
1	https://www.coursera.org/learn/gcp.../lecture/.../identity-and-access-management-iam

COURSE TITLE	NATURAL LANGUAGE PROCESSING			CREDITS	3
COURSE CODE	ITC4355	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Understand the fundamentals of syntax including a basic parse	1,4
2	Devise the advanced feature like feature structures and realistic parsing methodologies	1,4
3	Understand the basic concepts of remote processing	1,4
4	Develop typical natural language processing applications	4,6

Prerequisites : Programming basics

MODULE 1 : INTRODUCTION	(9L)
Introduction: Knowledge in speech and language processing – Ambiguity – Models and Algorithms – Language, Thought and Understanding. Regular Expressions and automata: Regular expressions – Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology – Finite-State Morphological parsing – Combining FST lexicon and rules – Lexicon-Free FSTs: The porter stammer – Human morphological processing	
MODULE 2 : SYNTAX	**(9L)**
Word classes and part-of-speech tagging: English word classes – Tagsets for English – Part-of-speech tagging – Rule-based part-of-speech tagging – Stochastic part-of-speech tagging – Transformation-based tagging – Other issues. Context-Free Grammars for English: Constituency – Context-Free rules and trees – Sentence-level constructions	

MODULE 3 : ADVANCED FEATURES AND SYNTAX	(9L)
Features and Unification: Feature structures – Unification of feature structures – Features structures in the grammar – Implementing unification – Parsing with unification constraints – Types and Inheritance.	
MODULE 4 : SEMANTIC	**(9L)**
Representing Meaning: Computational desiderata for representations – Meaning structure of language – First order predicate calculus – Some linguistically relevant concepts – Related representational approaches – Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis	
MODULE 5 : APPLICATIONS	**(9L)**
Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation – Robust word sense disambiguation – Information retrieval – other information retrieval tasks. Natural Language Generation: Introduction to language generation – Architecture for generation	

TEXT BOOKS	
1	Daniel Jurafsky & James H.Martin, “Speech and Language Processing”, Pearson Education (Singapore) Pte. Ltd., 2002.
REFERENCE BOOKS	
1	James Allen, “Natural Language Understanding”, Pearson Education, 2003.
E BOOKS	
1	https://www.kobo.com/us/en/ebooks/natural-language-processing
2	https://www.amazon.com/Natural-Language-Processing-Text...ebook/dp/B00FBS7Z0..
MOOC	
1	https://www.coursera.org/learn/language-processing
2	https://onlinecourses.nptel.ac.in/noc17_cs03

COURSE TITLE	PREDICTIVE ANALYTICS			CREDITS	3
COURSE CODE	ITC4356	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the concepts of data analysis and virtualization	1, 4
2	Devise predicting the binary outcome	1,4
3	Understand the concept of supervised learning.	1,4
4	Understand and develop trees and other predictive models.	4, 5

Prerequisites : Data Analytics

MODULE 1 : EXPLORATORY DATA ANALYSIS AND VISUALIZATIONS (9L)

Introduction - Why Exploratory Data Analysis is Important - Data Cleanup and Transformation - Dealing With Missing Values - Dealing with Outliers - Adding and Removing Variables - Common Graphs - What is Good Data Visualization? - Data Exploration.

MODULE 2 : PREDICTING A CONTINUOUS VARIABLE (9L)

Introduction to Linear Regression - Assessing Predictive Accuracy Using Cross-Validation - Multiple Regression - Improving Model Fit - Model Selection - Challenges of Predictive Modeling - How to Build a Model using XLMiner - Reflection on Statistical Techniques.

MODULE 3 : PREDICTING A BINARY OUTCOME (9L)

Introduction to Logistic Regression - Building Logistic Regression Model - Multiple Logistic Regression - Cross Validation and Confusion Matrix - Cost Sensitive Classification - Comparing Models Independent of Costs and Cutoffs - Building Logistic Regression Models using XLMiner - The Best Prediction Method.

MODULE 4 : SUPERVISED LEARNING (9L)

Classification with Simple Rules - Learning Rules - Sequential Covering - From Rules to Trees – Entropy - Measuring Entropy - Using Information Gain to Build Trees - Building Trees: ID3 Algorithm - Building Trees: C.45 Algorithm - Evaluation: Leave One Out Cross Validation - Nearest Neighbor - Similarity Functions - Curse of Dimensionality.

MODULE 5 : TREES AND OTHER PREDICTIVE MODELS (9L)

Introduction to Trees - Classification Trees - Regression Trees - Bagging, Boosting, Random Forest - Neural Networks - Building Trees with XLMiner - Building Neural Networks using XLMiner - Reflection: Trees & Neural Networks.

TEXT BOOKS

1	Applied Predictive Modeling, Max Kuhn (Author), Kjell Johnson, 2013.

REFERENCE BOOKS

1	Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modelling and Analysis of Big Data, Bruce Ratner, 2nd Edition.
2	Predictive Analytics For Dummies (For Dummies Series), Dr. Anasse Bari, Mohamed Chaouchi, Tommy Jung, 2014.

E BOOKS	
1	https://tdwi.org/research/2012/07/tdwi-ebook-predictive-analytics.aspx
2	https://www.predictiveanalyticsworld.com/book/.../Predictive_Analytics_by_Eric_Sieg
MOOC	
1	https://www.coursera.org/courses?query=predictive%20analytics
2	https://hexaware.com/fileadd/e-book-predictive-analytics.pdf

COURSE TITLE	**BUILDING ENTERPRISE APPLICATIONS**			**CREDITS**	**3**
COURSE CODE	**ITC4357**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize with concept of Enterprise Analysis and Business Modeling.	1, 4
2	Design and document the enterprise application architecture, application framework and application components.	3, 4
3	Construct and develop different solution layers, perform Code review, Code analysis, build process and perform testing.	3, 4, 5

Prerequisites : Software Design and Modeling

MODULE 1 : INTRODUCTION (9L)

Introduction to enterprise applications and their types, software engineering methodologies, life cycle of raising an enterprise application, introduction to skills required to build an enterprise application, key determinants of successful enterprise applications, and measuring the success of enterprise applications

MODULE 2 : MODELING (9L)

Inception of enterprise applications, enterprise analysis, business modeling, requirements elicitation, use case modeling, prototyping, non-functional requirements, requirements validation, planning and estimation

MODULE 3 : ARCHITECTURE (9L)

Concept of architecture, views and viewpoints, enterprise architecture, logical architecture, technical architecture – design, different technical layers, best practices, data architecture and design – relational, XML, and other structured data representations, Infrastructure architecture and design elements – Networking, Internetworking, and Communication Protocols, IT Hardware and Software, Middleware, Policies for Infrastructure Management, Deployment Strategy, Documentation of application architecture and design.

MODULE 4 : ENTERPRISE APPLICATION (9L)

Construction readiness of enterprise applications – defining a construction plan, defining a package structure, setting up a configuration management plan, setting up a development environment, introduction to the concept of Software Construction Maps, construction of technical solutions layers, methodologies of code review, static code analysis, build and testing, dynamic code analysis – code profiling and code coverage

MODULE 5 : TESTING	(9L)
Types and methods of testing an enterprise application, testing levels and approaches, testing environments, integration testing, performance testing, penetration testing, usability testing, globalization testing and interface testing, user acceptance testing, rolling out an enterprise application	
TEXT BOOKS	
1	Raising Enterprise Applications – Published by John Wiley, authored by AnubhavPradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu
2	Building Java Enterprise Applications – Published by O'Reilly Media, authored by Brett McLaughlin
REFERENCE BOOKS	
1	Software Requirements: Styles & Techniques – published by Addison-Wesley Professional, 2003
2	Software Systems Requirements Engineering: In Practice – published by McGraw-Hill/Osborne Media,2009
3	Managing Software Requirements: A Use Case Approach, 2/e – published by ***Pearson*** Education (US, 2012
4	SOFTWARE TESTING Principles and Practices – published by Oxford University Press,2010
E BOOKS	
1	usersmanual.ddns.net/download-raising-enterprise-applications-a-software-engineering-perspective-with-cd-pdf
2	campusconnect.infosys.com/homedownloads/BEA/1_Overview-of-BEA.pdf
3	http://disi.unal.edu.co/dacursci/sistemasycomputacion/docs/SWEBOK/Systems%20Engineering%20-%20EAA%20-%20Patterns%20of%20Enterprise%20Application%20Architecture%20-%20Addison%20Wesley.pdf
MOOC	
1	https://open.sap.com/channels/enterprise

COURSE TITLE	UI TECHNOLOGIES			CREDITS	3
COURSE CODE	ITC4358	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Acquire knowledge about Server-side JS framework to make Database Connectivity and functionalities of Client-side and Server-side JS frameworks	1, 4
2	Explore Angular features, create component based web pages and design Front-end web pages and connect to the Back-end Databases	3, 4
3	Implement NoSQL Database CURD operations	3, 4

Prerequisites : Fundamentals of Computer Programming

MODULE 1 : INTRODUCTION TO NOSQL DATABASE - MONGODB (9L)

What is NoSQL Database - Why to Use MongoDB - Difference between MongoDB & RDBMS - Download & Installation - Common Terms in MongoDB – Implementation of Basic CRUD Operations using MongoDB

MODULE 2 : INTRODUCTION TO SERVER-SIDE JS FRAMEWORK – NODE.JS (9L)

Introduction - What is Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP (Request & Response) – Event Handling - GET & POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.

MODULE 3 : INTRODUCTION TO TYPESCRIPT (9L)

TypeScript : Introduction to TypeScript – Features of TypeScript – Installation setup – Variables – Datatypes – Enum – Array – Tuples – Functions – OOP concepts – Interfaces – Generics – Modules – Namespaces – Decorators – Compiler options – Project Configuration

MODULE 4 : INTRODUCTION TO CLIENT-SIDE JS FRAMEWORK – BASICS OF ANGULAR 4.0 (9L)

Introduction to Angular 4.0 - Needs & Evolution – Features – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Data Binding - Pipes – Nested Components

MODULE 5 : INTRODUCTION TO CLIENT-SIDE JS FRAMEWORK – FORMS AND ROUTING IN ANGULAR 4.0 (9L)

Template Driven Forms - Model Driven Forms or Reactive Forms - Custom Validators - Dependency Injection - Services - RxJS Observables - HTTP - Routing

TEXT BOOKS

1	Nathan Rozentals, “Mastering TypeScript”, April 2015
2	Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, “ng-book, The Complete Book on Angular 4” September 2016
3	Nayak, “MongoDB Cookbook Paperback” , November 2014

REFERENCE BOOKS

1	Krasimir Tsonev, “Node.js by Example Paperback”, May 2015

E BOOKS	
1	www.allitebooks.in/mastering-typescript
2	https://www.getfreeebooks.com/250-free-web-design-ui-ux-css-usability-and-programming-ebooks/
MOOC	
1	https://www.coursera.org/specializations/user-interface-design

LIST OF DEPARTMENT ELECTIVES - SEMESTER – VI

COURSE TITLE	NETWORK PROGRAMMING			CREDITS	3
COURSE CODE	ITC4366	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Write our own network programs using an application program interface	1,4,5
2	Modify and enhance the existing network programs to reinforce the concepts and techniques.	4,5
3	Gain knowledge about routing sockets	1,4
4	Gain knowledge about raw sockets.	1,4

Prerequisites : Unix programming

MODULE 1 : INTRODUCTION TO SOCKETS (9L)

Elementary TCP Sockets, Elementary UDP Sockets, Reserved Ports – Well-known ports, registered ports, dynamic or private ports, Stream Pipes, I/O Multiplexing: The select and poll functions, I/O models. Advanced Socket System Calls: Asynchronous I/O: Introduction, Non-blocking reads and writes, connect, and accept.

MODULE 2 : ADVANCED I/O FUNCTIONS (9L)

Socket Timeouts, recv and send functions, readv and writev functions, recvmsg, sendmsg functions, ancillary data – NON blocking I/O - Data queing – sockets and standard I/O – TCP transactions- Threads – Socket names and DNS – Hostnames and sockets – Five socket coordinators – Network data and network errors

MODULE 3 : UNIX DOMAIN PROTOCOLS (9L)

Unix domain socket address structure, socket pair function, socket functions, Passing file descriptors- IPV4 client and IPV6 server – IOCTL options- Client and server design alterations – UDP- Port numbers –Connecting UDP Sockets – UDP fragmentation

MODULE 4 : ROUTING SOCKETS (9L)

Routing Sockets: Introduction, Datalink socket address structure, Reading and Writing, Broadcasting: Introduction, Broadcast addresses, Unicast versus broadcast, Multicasting: Introduction, Multicast addresses, Multicasting versus broadcasting on a LAN, Sending and Receiving, Signal driven I/O Introduction, Signal-Driven I/O for Sockets, UDP Echo Server using SIGIO.

MODULE 5 : RAW SOCKETS (9L)

Raw socket creation, Raw socket input, Raw socket output, Data link access: libpcap: packet capture library, STREAMS: ioctl function, getmsg and putmsg functions. Remote procedure calls: Doors: Different door functions, Descriptor passing, Sun RPC: Introduction, Multithreading, Server binding.

TEXT BOOKS	
1	Brandon Rhodes, "Foundations of python network programming", Third edition, Kindle edition, ISBN 9781430258544, 2014.
2	Steavens, Bill, "UNIX Network Programming" Volume -1, Pearson Pub, ***ISBN*** : 0131411551, 2015.
REFERENCE BOOKS	
1	Bogdan,Gabriel, "Advanced Network Programming – Principles and Techniques", Springer publications, ISBN: 978144
2	W.Richard Stevens, Unix Network Programming, (Vol.I and II), PHI, 2005
E BOOKS	
1	http://www.drdobbs.com/architecture-and-design/free-linux-network-programming-ebook/228701326
MOOC	
1	Client server programming in java:https://www.youtube.com/watch?v=XlryaovT_3k
2	TCP ports and sockets: https://www.youtube.com/watch?v=txmcyRj3UYM

COURSE TITLE	**WEB APPLICATION SECURITY**			**CREDITS**	**3**
COURSE CODE	**ITC4367**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Understand the concepts of Web Application Security	1,4
2	Design his/her own model for to avoid vulnerability	4,5,6
3	Understand the testing process and guidelines	1,4

Prerequisites: Ethical Hacking and Cyber Security

MODULE 1 : OVERVIEW OF WEB APPLICATION (9L)

Definition of Web Application – Definition of Client – History of Web Application – Interface and Structure – Benefits of Web Application – Drawbacks of Web Application – Web Application vs Cloud Application – Future of Web Application

MODULE 2 : INTRODUCTION TO WEB APPLICATION SECURITY (9L)

Web Application Security – Work knowledge of Web Application Security - Web Application Lifecycle Maintenance – Importance of Web Application Security – Web Application Security vs Network Security

MODULE 3 : WEB APPLICATION VULNERABILITIES (9L)

Web Application Vulnerability Check – Broen Access Control – Broken Authentication and Session Management – Buffer Overflows – Cross Site Scripting Flaws – Denial of Service – Improper error handling – Insecure Configuration Management – Insecure Storage – SQL Inection Flaws – Unvalidated Input – Defensive Measures

MODULE 4 : WEB APPLICATION SECURITY SCANNER AND TESTING	(9L)
Definition of Web Application Security Scanner – Tool Types – Functional Requirements – Issues with Web Application Security Scanner – Strengths and Weakness – Definition of Web Application Security Testing – Importance of Web Application Security Testing – Guide for Web Application Security Testing	
MODULE 5 : PROTECTING, IMPROVING AND GUIDELINES FOR WAS	**(9L)**
Protection against attack and misuse – Basic Guidelines for Proviing Security – Improving Security – Web Application Security Plan	
TEXT BOOKS	
1	Bryan Sullivan, Vincent Liu, Web Application Security, A Beginner's Guide, McGraw-Hill, 2012
REFERENCE BOOKS	
1	https://mhebooklibrary.com/doi/book/10.1036/9780071776127
E BOOKS	
1	https://mhebooklibrary.com/doi/book/10.1036/9780071776127
MOOC	
1	https://www.udemy.com/web-application-security/

COURSE TITLE	**IT SECURITY ASSESSMENT AND TESTING**			**CREDITS**	**3**
COURSE CODE	**ITC4368**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				
CO	**COURSE OUTCOMES**				**PO**
1	Understand the basic need for testing strategies				1,4
2	Construct collaborative study of Security Assessment, testing and audits concepts				1,4
3	Discover the test cases for assessment and testing in real time scenarios.				1,4,7
Prerequisites: Identity and Access Management					
MODULE 1 : ASSESSMENT AND TEST STRATEGIES					**(9L)**
Software Development as Part of System Design – Log Reviews –Synthetic transactions – Code review and Testing – Negative testing / Misuse Case Testing – Interface Testing					
MODULE 2 : SECURITY ASSESSMENT					**(9L)**
Threat Assessment – Threat Modelling – Secure Code Review – Application Based Assessment (Web, IoT, Cloud, Mobile Apps)					
MODULE 3 : SECURITY TESTING					**(9L)**
Vulnerabilty Scanning – Security Scanning – Penetration Testing – Risk Assessment.					

MODULE 4 : SECURITY AUDITS	(9L)
Collect Security Process Data - Internal and Third Party Audits – SOC Reporting	
MODULE 5 : CASE STUDY	**(9L)**
VAPT Test Cases – Security Breach Test Cases – Agile Security Test Cases – OWASP Top 10 Vulnerabilities.	
TEXT BOOKS	
1	Official Guide to Certified Information Systems Security Professional (CISSP), CBK, 2017.
2	Leighton Johnson, ”Security Controls Evaluation, Testing and Assessment Handbook”, Elsevier Publications, 2016
REFERENCE BOOKS	
1	Michael Gregg, “The Network Security Test Lab: A Step–by–Step Guide”, Wiley Publications, 2015
E BOOKS	
1	https://www.amazon.com/Network-Security-Assessment-Know-Your-ebook/dp/B01N6E0BG2
MOOC	
1	https://www.edx.org/course/subject/business-management/risk-management
2	https://www.owasp.org/index.php/OWASP_Online_Academy

COURSE TITLE	DEEP LEARNING			CREDITS	3
COURSE CODE	ITC4369	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Develop algorithms simulating human brain.	4 , 5
2	Implement Neural Networks in Tensor Flow for solving problems.	3, 4
3	Explore the essentials of Deep Learning and Deep Network architectures.	3, 4
4	Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.	3, 4

Prerequisites : Machine Learning basics

MODULE 1 : BASICS OF DEEP LEANING	(9L)
Deep learning architectures: Convolutional Neural Networks : Neurons in Human Vision-The Shortcomings of Feature Selection-Vanilla Deep Neural Networks Don’t Scale-Filters and Feature Maps-Full Description of the Convolutional Layer-Max Pooling-Full Architectural Description of Convolution Networks-Closing the Loop on MNIST with Convolutional Networks-Image Preprocessing Pipelines Enable More Robust Models-Accelerating Training with Batch Normalization-Building a Convolutional Network for CIFAR-10-Visualizing Learning in Convolutional Networks Leveraging Convolutional Filters to Replicate Artistic Styles-Learning Convolutional Filters for Other Problem Domains-Training algorithms.	

MODULE 2 : MEMORY AUGMENTED NEURAL NETWORKS	(9L)
Neural Turing Machines-Attention-Based Memory Access-NTM Memory Addressing Mechanisms-Differentiable Neural Computers-Interference-Free Writing in DNCs-DNC Memory Reuse-Temporal Linking of DNC Writes-Understanding the DNC Read Head-The DNC Controller Network Visualizing the DNC in Action-Implementing the DNC in TensorFlow-Teaching a DNC to Read and Comprehend.	
MODULE 3 : DEEP REINFORCEMENT LEARNING	**(9L)**
Deep Reinforcement Learning Masters Atari GamesWhat Is Reinforcement Learning?-Markov Decision Processes (MDP)-Explore Versus Exploit-Policy versus Value Learning-Pole-Cart with Policy Gradients-Q-Learning and Deep Q-Networks-Improving and Moving Beyond DQN.	
MODULE 4 : IMPLEMENTING NEURAL NETWORKS IN TENSORFLOW	**(9L)**
What Is TensorFlow?-How Does TensorFlow Compare to Alternatives?-Installing TensorFlow-Creating and Manipulating TensorFlow Variables-TensorFlow Operations-Placeholder Tensors-Sessions in TensorFlow-Navigating Variable Scopes and Sharing Variables-Managing Models over the CPU and GPU-Specifying the Logistic Regression Model in TensorFlow-Logging and Training the Logistic Regression Model-Leveraging TensorBoard to Visualize Computation Graphs and Learning-Building a Multilayer Model for MNIST in TensorFlow.	
MODULE 5 : APPLICATIONS	**(9L)**
Deep learning for computer vision, Deep Learning Applications at the Enterprise Scale, Deep Learning Models for Healthcare Applications.	
TEXT BOOKS	
1	Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O'Reilly Media, 2017.
REFERENCE BOOKS	
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, ”Deep Learning (Adaptive Computation and Machine Learning series”, MIT Press, 2017.
E BOOKS	
1	https://www.pyimagesearch.com/2018/.../7-best-deep-learning-books
2	http://www.deeplearningbook.org/
MOOC	
1	https://www.coursera.org/specializations/deep-learning
2	www.edureka.co/TensorFlow/course

COURSE TITLE	DATA VISUALIZATION			CREDITS	3
COURSE CODE	ITC4370	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Remember about different Visualization Techniques	1, 4
2	Use the Interaction techniques in information visualization fields	3, 4
3	Understand Various abstraction mechanisms	1, 4
4	Create interactive visual interfaces	3, 4

Prerequisites : Predictive Analytics

MODULE 1 : FOUNDATIONS FOR DATA VISUALIZATION (9L)

Introduction to Visualization - Visualization stages - Experimental Semiotics based on Perception - Gibson's Affordance theory - A Model of Perceptual Processing - Costs and Benefits of Visualization - Types of Data

MODULE 2 : COMPUTER VISUALIZATION (9L)

Non-Computer Visualization - Computer Visualization: Exploring Complex Information Spaces - Fisheye Views – Applications - Comprehensible Fisheye views – Fisheye views for 3D data - Non Linear Magnification - Comparing Visualization of Information Spaces - Abstraction in computer Graphics - Abstraction in user interfaces

MODULE 3 : MULTIDIMENSIONAL VISUALIZATION (9L)

1D, 2D, 3D Visualization techniques - Trees - Web Works - Data Mapping: Document Visualization - Workspaces

MODULE 4 : TEXTUAL METHODS OF ABSTRACTION (9L)

From Graphics to Pure Text - Figure Captions in Visual Interfaces - Interactive 3D illustrations with images and text – Related work - Consistency of rendered – images and their textual labels - Architecture - Zoom techniques for illustration purpose - Interactive handling of images and text

MODULE 5 : ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS (9L)

Animating non Photo realistic Computer Graphics - Interaction Facilities and High Level Support for Animation Design - Zoom Navigation in User Interfaces - Interactive Medical Illustrations - Rendering Gestural Expressions - Animating design for Simulation - Tactile Maps for Blind People - Synthetic holography - Abstraction Versus Realism, Integrating spatial and non-spatial

TEXT BOOKS

1 Colin Ware "Information Visualization Perception for Design", 3 rd edition, Morgan Kaufman 2012.

REFERENCE BOOKS

1 Chaomei Chan, "Information Visualization", Beyond the horizon, 2nd edition, Springer Verlag, 2004

2 Pauline Wills, "Visualisation: A Beginner's Guide", Hodder and Stoughlon, 1999.

E BOOKS	
1	https://visualrsoftware.com/Downloads/ebooks.html
2	https://newprediction.com/free-data-visualization-books/
MOOC	
1	https://www.coursera.org/courses?query=data%20visualization
2	https://www.class-central.com/tag/data%20visualization

COURSE TITLE	**WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE**			**CREDITS**	**3**
COURSE CODE	**ITC4371**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	To acquire knowledge to understand web services and its technical forces driving web services, SOA	1, 4
2	Understand the web services and SOA	1, 4
3	Gain knowledge on SOAP	1, 4

Prerequisites : Fundamentals of Computer Programming, Software Design and Modelling

MODULE 1 : INTRODUCTION	**(9L)**
Service Oriented Architecture overview – Services – Connections – Architecture Web Services – History –Web Services specification – opportunity and importance of standardized semantic vocabularies Relationship of Web Services and SOA- Identification and design of services	
MODULE 2 : TECHNICAL FORCES DRIVING THE ADOPTION OF WEB SERVICES	**(9L)**
Force Field Analysis overview – Adopting Standard data element definitions and Standard Communications protocol – Adopting Web services	
MODULE 3 : TECHNICAL FORCES DRIVING THE ADOPTION OF SOA	**(9L)**
Adopting standard, Enterprise-Wide Software – Adopting an Object Request Broker – Adopting an Enterprise Data Warehouse – Adopting an Enterprise Service Bus – Adopting a Service Oriented Architecture	
MODULE 4 : WEB SERVICES AND SOA	**(9L)**
Impact of Web Services – Use an external service – Develop an internal service – Exchange data between Existing Systems – Enterprise database warehouse- connect components to web services – Additional systems – Staffing issues – Likely change Issues - Establish Service Oriented Architecture – Design considerations – Staffing issues – Likely Change issues – Services and service oriented architecture – SOA Governance	
MODULE 5 : SOAP	**(9L)**
Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments.	

TEXT BOOKS	
1	"Web Services, Service-Oriented Architectures, and Cloud Computing" : The Savvy Manager's Guide Feb 2013 Second Edition by Douglas K. Barry with David Dick , Morgan Kaufmann Publishers.
REFERENCE BOOKS	
1	Frank. P. Coyle, XML, "Web Services And The Data Revolution", Pearson Education, 2002.
E BOOKS	
1	https://www.sciencedirect.com/science/book/9781558609068
2	https://www.safaribooksonline.com/library/view/web-services-service-oriented/9780123983572/
MOOC	
1	https://www.coursera.org/learn/ruby-on-rails-web-services-mongodb/lecture/7MHzi/introduction-to-web-services
2	https://www.coursera.org/learn/service-oriented-architecture

COURSE TITLE	SOFTWARE AGENTS			CREDITS	3
COURSE CODE	ITC4372	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Understand the how software agents reduce information overhead	1, 4
2	Gain knowledge in use of software agents for cooperative learning and personal assistance	1, 4
3	Understand about know how agent can communicate and share knowledge using agent communication language	4, 10

Prerequisites : Software Design and Modeling

MODULE 1 : AGENT AND USER EXPERIENCE (9L)

Agent characteristics- object Vs agent. Agent types- Interacting with Agents - Agent From Direct Manipulation to Delegation - Interface Agent, Metaphor with Character – Designing Agents – problem solving agent, rational agent. Direct Manipulation versus Agent Path to Predictable

MODULE 2 : AGENTS FOR LEARNING AND ASSISTANCE (9L)

Agents for Information Sharing and Coordination - Agents that Reduce Work Information Overhead - Agents without Programming Language - Life like Computer character - S/W Agents for cooperative Learning – Multiple Reasoning agents –M system. Learning agents: computational architectures for learning agents; evolution, adaptation; multi-agent learning.

MODULE 3 : AGENT COMMUNICATION AND COLLABORATION (9L)

Overview of Agent Oriented Programming - Agent Communication Language – KQML-Per formatives. Agent Based Framework of Interoperability. Virtual agents: agents in games and virtual environments; companion and coaching agents; modeling personality, emotions; multimodal interaction; verbal and non-verbal expressiveness.

MODULE 4 : AGENT ARCHITECTURE	(9L)
Strategies for agent design. Agent interpreter- BDI architecture. Architecture of Intelligent Agents. Agents for Information Gathering - Open Agent Architecture - Communicative Action for Artificial Agent. Agent societies and societal issues.	
MODULE 5 : MOBILE AGENTS	**(9L)**
Mobile agent paradigm - Mobile agent concepts -Mobile agent technology – programming mobile agents –application of mobile agents- Teleshopping. Mobile agent security- trust, reliability and reputation.	
TEXT BOOKS	
1	Jeffrey M.Bradshaw," Software Agents ", MIT Press 2000, Pearson Indian Reprint 2010.
REFERENCE BOOKS	
1	Murch Richard, Johnson Tony 'Intelligent Software Agents, 'Prentice Hall,1998.
2	Joseph P.Bigus & Jennifer Bigus, "Constructing Intelligent agents with Java: A Programmer's Guide to Smarter Applications ", Wiley, 1997.
E BOOKS	
1	www.scribd.com/Ebooks
MOOC	
1	https://www.coursera.org/learn/modeling-simulation-natural-processes/lecture/kAKyC/multi-agent-systems

LIST OF DEPARTMENT ELECTIVES - SEMESTER – VII

COURSE TITLE	DIGITAL IMAGE PROCESSING			CREDITS	3
COURSE CODE	ITC4451	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Learn digital image fundamentals.	1,4
2	Be exposed to simple image processing techniques.	1,4
3	Be familiar with image compression and segmentation technique	1,4
4	Learn to represent image in form of features.	1,4

Prerequisites : Introduction to Digital Systems, Basics of Programming

MODULE 1 : DIGITAL IMAGE FUNDAMENTALS (9L)

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models.

MODULE 2 : IMAGE ENHANCEMENT (9L)

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

MODULE 3 : IMAGE RESTORATION AND SEGMENTATION (9L)

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

MODULE 4 : WAVELETS AND IMAGE COMPRESSION (9L)

Wavelets – Subband coding – Multiresolution expansions – Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

MODULE 5 : IMAGE REPRESENTATION AND RECOGNITION (9L)

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors –Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

TEXT BOOKS

1	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, ISBN 10: 9332570329, 2016.
2	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, ISBN-13: 978-0133356724, 2017.

REFERENCE BOOKS	
1	Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
2	Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
3	**Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011**
E BOOKS	
1	http://web.ipac.caltech.edu/staff/fmasci/home/astro_refs/Digital_Image_Processing_3rdEd_truncated.pdf
MOOC	
1	https://www.my-mooc.com/en/mooc/digital/

COURSE TITLE	**MOBILE PROGRAMMING**			**CREDITS**	**3**
COURSE CODE	**ITC4452**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Remember the concepts of objective C	1,4
2	Use navigation, SQLite and animation in iOS application	3,4,5
3	Develop a iOS application using objective C	4,5,6

Prerequisites :Database technologies

MODULE 1 - INTRODUCTION TO OBJECTIVE-C (9L)

Objective-C - Classes, Objects, and Methods - Declared Properties - Memory Management - Automatic Reference Counting (ARC) - Categories and Extensions - Formal and Informal Protocols - Blocks - Application Patterns and Architecture - Model View Controller (MVC) - IBOutlets and IBActions - Subclassing and Delegation

MODULE 2 - VIEWS AND WINDOWS (9L)

The View Hierarchy - Containers - Controls - Text and Web Views - Navigation View and Tab Bars - Alert Views and Action Sheets - Controlling Rotation Behavior - View Autosizing - Autolayout - Storyboards - Adding Scenes - Segues - Transitions o Using in a Tab Bar Application - Table Views - Static and Dynamic Table Views - Delegates and DataSources - Table View Styles - Custom Cells

MODULE 3 - NAVIGATION BASED APPLICATIONS (9L)

Adding the Root View Controller - Creating the Navigation Controller - Controlling the Stack Navigation Programmatically - UIPickerView and UIDatePicker - Designing the UI - Coding for the Data Picker o Hiding the Keyboard o Memory Management - Directories and Files - NSFileManager, NSFileHandle, and NSData - Problems Solved by ADO.NET Entity Framework - Pathnames in Objective-C - Working with Directories - Working with Files - Reading and Writing from a File - iCloud - Key-Value Data - Archiving

MODULE 4 - WORKING WITH DATA (9L)
- SQLite Integration - Using SQLite Directly - Overview of Core Data - Managed Objects - Persistent Store Coordinator - Entity Descriptions - Retrieving and Modifying Data
MODULE 5 - MULTITOUCH, TAPS, GESTURES AND ANIMATION (9L)
- The Responder Chain - Touch Notification Methods - Enabling Multitouch on the View - Gesture Motions - Gesture Recognizers - Drawing - Core Graphics and Quartz 2D - Lines, Paths, and Shapes - Animation - Core Animation Blocks - Animation Curves - Transformations

TEXT BOOKS	
1	Kochan Stephen,"Programming in Objective C, Pearson India, ISBN 10: 8131791408, 2012
2	John Harton, "Android programming for beginners", Kindle edition, ISBN 978 1 785883262, 2015.
REFERENCE BOOKS	
1	Objective-C Programming: The Big Nerd Ranch Guide, Pearson India, 2011
E BOOKS	
1	https://www.cs.cmu.edu/~bam/uicourse/830spring09/BFeiginMobileApplicationDevelopment.pdf
MOOC	
1	https://www.class-central.com/course/coursera-programming-mobile-applications-for-android-handheld-systems-part-1-1178

COURSE TITLE	MOBILE SECURITY			CREDITS	3
COURSE CODE	ITC4453	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Recall the security requirement for mobile and its application	1,4
2	Explain the various security standards for mobile applications	1,3,4
3	Apply the security technique for mobile	3,4,5
4	Demonstrate the various security techniques in distributed and mobile application	4,5

Prerequisites : Knowledge of basic Security Concepts
MODULE 1 : BASIC SECURITY CONCEPTS (11L)
Introduction to wireless networks -802.11 WEP and WPA – Key management in sensor Networks- Wireless jamming attacks – Device fingerprinting and Wireless pairing – Attack Detection.
MODULE 2 : MOBLIE SECURITY SCENARIO (9L)
Mobile HEALth Security – Vehicle Network Security – RFID hacking and authentication – Smartphone system security – Smartgrid security.

MODULE 3 : SECURITY TECHNIQUES	(11L)
Overview: Security - Threats, Vulnerabilities, Attacks, Integrity, Confidentiality, Policy and relevant definitions -Authentication –Cryptography – Symmetric Key Cryptography, Asymmetric key Cryptography, Key management, Digital signatures.	
MODULE 4 : DISTRIBUTED SYSTEMS SECURITY	**(7L)**
Cipher techniques, Protection systems, Example protocols	
MODULE 5 : WIRELESS AND MOBILE SYSTEM SECURITY	**(7L)**
Strategies, Routing security, Different schemes for MANET.	

TEXT BOOKS	
1	"Wi-Foo: The Secrets of Wireless Hacking" by Andrew Vladimirov, Konstantin V. Gavrillenko, and Andrei A. Mikhailovsky, Addision-Wesley Professional; 1st Edition, July 2007.
2	Man Ho Au, Raymond Choo, Mobile Security and Privacy, Syngress Publications, 2016.
REFERENCE BOOKS	
1	802.11 Wireless Networks: The Definitive Guide", by Matthew Gast, O'reilly Mideia; 2nd Edition; October 2011.
2	"Hacking Exposed Wireless", by Johnny Cache, Joshua Wright, and Vincent Liu, McGraw-Hill Osborne Media; 2nd Edition; July 2010.
E BOOKS	
1	https://www.zdnet.com/article/executives-guide-to-mobile-security-free-ebook/
MOOC	
1	https://www.mooc-list.com/tags/mobile-security

COURSE TITLE	APPLIED CRYPTOGRAPHY			CREDITS	3
COURSE CODE	ITC4454	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Analyze the attacks.	3,4,6,7
2	Implement symmetric & asymmetric cipher.	3,4,5
3	Implement the algorithm for Message Authentication, Hash and Digital Signatures.	3,4,5

Prerequisites : Basics of Cryptography

MODULE 1 : INTRODUCTION	(9L)
Cryptography and modern cryptography – The setting of private-key encryption – Historical ciphers and their cryptanalysis – Basic principles of modern cryptography – Services, Mechanisms and Attacks – OSI security architecture.	

MODULE 2 : SYMMETRIC TECHNIQUES	(9L)
Definition – Substitution ciphers – Transposition ciphers - Stream and block ciphers - A5, RC4 .Characteristics of good ciphers - Data Encryption Standard (DES) – International Data Encryption Algorithm – Advanced Encryption Standard – Block cipher modes of operation – Confidentiality using symmetric encryption.	
MODULE 3 : ASYMMETRIC TECHNIQUES	**(9L)**
Principles of Public Key Cryptosystems – The RSA Algorithm – Key Management – Diffie Hellman Key Exchange – Elliptic Curve Cryptography – over reals, prime fields and binary fields, Applications, Practical considerations. Cryptography in Embedded Hardware.	
MODULE 4 : MESSAGE AUTHENTICATION	**(9L)**
Authentication requirements – Authentication functions – Message Authentication Codes (MAC) – Hash functions – Security of hash functions and MACs.	
MODULE 5 : VHASH AND DIGITAL SIGNATURES	**(9L)**
MD5 Message Digest Algorithm – Secure Hash Algorithm (SHA) –RIPMED160 - HMAC - Digital Signatures - Authentication Protocols - Digital Signature Standard (DSS).	

TEXT BOOKS	
1	"Wi-Foo: The Secrets of Wireless Hacking" by Andrew Vladimirov, Konstantin V. Gavrillenko, and Andrei A. Mikhailovsky, Addision-Wesley Professional; 1st Edition, July 2007.
2	Man Ho Au, Raymond Choo, Mobile Security and Privacy, Syngress Publications, 2016.
REFERENCE BOOKS	
1	IngemarJ.Cox, Matthew L.Miller, Jeffrey A.Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.
E BOOKS	
1	https://www.kobo.com/us/en/ebook/applied-cryptography
MOOC	
1	https://www.mooc-list.com/course/applied-cryptography-udacity

COURSE TITLE	REAL TIME ANALYTICS			CREDITS	3
COURSE CODE	ITC4455	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Build their own Data warehousing architecture for the application	3, 4
2	Implement different techniques of data mining like association rule, classification and clustering.	4, 5
3	Apply the data mining techniques with real world	3, 4

Prerequisites : Predictive Analytics

MODULE 1 : INTRODUCTION TO STREAM COMPUTING	(9L)
Streaming Data – Sources – Difference between Streaming Data and Static Data. Overview of Large Scale Stream Processing Engines – Issues in Stream Processing	
MODULE 2 : STREAMING ANALYTICS ARCHITECTURE	**(9L)**
Phases in Streaming Analytics Architecture - Vital Attributes - High Availability – Low Latency – Horizontal Scalability-Fault Tolerance - Service Configuration and Management - Apache ZooKeeper	
MODULE 3 : DATA FLOW MANAGEMENT	**(9L)**
Distributed Data Flows – At Least One Delivery – Apache Kafka – Apache Flume – Zero MQ - Messages, Events, Tasks & File Passing	
MODULE 4 : PROCESSING & STORING STREAMING DATA	**(9L)**
Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions. Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing a storage system – NoSQL Storage Systems	
MODULE 5 : DELIVERING STREAMING METRICS	**(9L)**
Visualizing Data – Mobile Streaming Apps –Times Counting and Summation - Stochastic Optimization – Delivering Time Series Data	

TEXT BOOKS	
1	Byron Ellis, “Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data”, Wiley, 1st edition, 2014
2	Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw-Hil, 1st edition, 2011

REFERENCE BOOKS	
1	Sherif Sakr, “Large Scale and Big Data: Processing and Management”, CRC Press, 2014. 2014
2	Bill Franks, “Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics”, Wiley, 2012
3	Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014

E BOOKS	
1	https://www.amazon.com/Real-Time-Analytics-Techniques...ebook/dp/B00JUUZQP0
2	https://www.wiley.com/en-us/Real+Time+Analytics%3A+Techniques+to+Analyze+and+Visualize+Streaming+Data

MOOC	
1	https://www.coursera.org/learn/real-time-streaming-big-data
2	https://www.edx.org/course/implementing-real-time-analytics-hadoop-microsoft-dat20.

COURSE TITLE	SOFTWARE TESTING TECHNOLOGIES			CREDITS	3
COURSE CODE	ITC4456	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understands the testing process and testing principles.	1,2,3
2	Devise testing strategies for software testing and solving problems.	1,3,5
3	Know how to control and monitor the testing process.	1,2,3

Prerequisites : Software Design and Modeling

MODULE 1 : INTRODUCTION (9L)

Testing as an Engineering Activity, Role of Process in Software Quality, Testing as a Process, Basic Definitions, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Defect Classes, The Defect Repository and Test Design, Defect Examples, Developer/Tester Support for Developing a Defect Repository

MODULE 2 : TEST CASE DESIGN (9L)

Introduction to Testing Design Strategies, The Smarter Tester, Test Case Design Strategies, Using Black Box Approach to Test Case Design, Random Testing, Equivalence Class Partitioning, Boundary Value Analysis, Other Black-box Test Design Approaches, Black-box testing and COTS, Using White-Box Approach to Test design, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Paths: Their Role in White-box Based Test Design, Additional White Box Test Design Approaches, Evaluating Test Adequacy Criteria

MODULE 3 : LEVELS OF TESTING (9L)

The Need for Levels of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests. The Class as a Testable Unit, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, System Test - The Different Types, Regression Testing, Alpha, Beta and Acceptance Tests

MODULE 4 : TEST MANAGEMENT (9L)

Introductory Concepts, Testing and Debugging Goals and Policies, Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, Reporting Test Results, The role of three groups in Test Planning and Policy Development, Process and the Engineering Disciplines, Introducing the test specialist, Skills needed by a test specialist, Building a Testing Group

MODULE 5 : CONTROLLING AND MONITORING (9L)

Defining Terms, Measurements and Milestones for Controlling and Monitoring, Status Meetings, Reports and Control Issues, Criteria for Test Completion, SCM, Types of reviews, Developing a review program, Components of Review Plans, Reporting review results

TEXT BOOKS	
1	Ilene Burnstein, "Practical Software Testing", Springer International Edition, Chennai, 2003
2	Glenford J Myers, Corey Sandler, Tom Badgett, '" Art of Testring", 3rd edition, Jon Wiley, 2011
REFERENCE BOOKS	
1	Srinivasan Desikan, Ramesh Gopalaswamy, "Software Testing Principles and Practices", Pearson education Asia, 1st edition, 2005.
E BOOKS	
1	https://www.cigniti.com/e-books/
2	https://www.softwaretestinghelp.com/manual-testing-help-ebook-free-download/
MOOC	
1	https://www.edx.org/course/software-testing-fundamentals-usmx-university-maryland-university-stv1-1x

COURSE TITLE	AGILE SOFTWARE DEVELOPMENT			CREDITS	3
COURSE CODE	ITC4457	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Have an insight in Agile approach to software development	1, 4
2	Understand the Agile development practices	1, 4
3	Apply design principles, refactoring to achieve Agility and perform testing activities within an Agile project	3, 4

Prerequisites : Software Design and Modeling

MODULE 1 : FUNDAMENTALS OF AGILE (9L)

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

MODULE 2 : AGILE SCRUM FRAMEWORK (9L)

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

MODULE 3 : AGILE TESTING	(9L)
The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester	
MODULE 4 : AGILE SOFTWARE DESIGN AND DEVELOPMENT	**(9L)**
Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control	
MODULE 5 -: INDUSTRY TRENDS	**(9L)**
Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies	

TEXT BOOKS	
1	www.it-ebooks.info/tag/agile
2	http://martinfowler.com/agile.html
REFERENCE BOOKS	
1	Ken Schawber, Mike Beedle , Agile Software Development with Scrum, Pearson,2008
2	Lisa Crispin, Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison Wesley,2014
E BOOKS	
1	www.it-ebooks.info/tag/agile
2	http://martinfowler.com/agile.html
3	http://www.e-booksdirectory.com/listing.php?category=619
MOOC	
1	https://www.edx.org/course/agile-software-development