

Academic Regulations

Program structure & Detailed Syllabus

For

Under Graduate Programme (B. Tech)

INFORMATION TECHNOLOGY

(Applicable for Batches Admitted from 2020 – 2021)



VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY
(AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTUK, Kakinada,
AP)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY
(AUTONOMOUS)

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ACADEMIC REGULATIONS

(VR 20)

**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM**

ACADEMIC REGULATIONS for B. Tech. (Regular)
(Applicable for the batches admitted 2020-21 onwards)

The Admission of students into B. Tech. course shall be as per the Govt. of Andhra Pradesh rules.

1. Award of B. Tech. Degree

A student will be declared eligible for the award of the B. Tech. degree if he/she fulfils the following academic regulations.

- a. Pursue a program of study for not less than four academic years and not more than eight academic years.
- b. For lateral entry scheme admission: Pursue a program of study for not less than three academic years and not more than six academic years.
- c. For the award of a degree, regular candidate has to register for 160 credits and shall secure 160 credits.
- d. Lateral entry candidate has to register for 121 credits from second year onwards and shall secure 121 credits

2. Courses of Study

The following courses of study are offered at present for specialization in the B. Tech. Course.

S. No.	Course Code	Programme & Abbreviation
01	01	Civil Engineering (CE)
02	02	Electrical and Electronics Engineering (EEE)
03	03	Mechanical Engineering (ME)
04	04	Electronics and Communication Engineering (ECE)
05	05	Computer Science and Engineering (CSE)
06	12	Information Technology (IT)
07	19	Electronics and Computer Engineering (E. Com E)
08	54	Artificial Intelligence and Data Science (AI&DS)

And any other Course as approved by the authorities of the Institute from time to time.

3. Registration: A student shall register for courses in each semester as per the courses offered by the concerned department.

4. Curricular Program:

The Curriculum of the four-year B. Tech course has been designed to achieve a healthy balance between theory & lab hours, industry orientated and to develop technical skills, Interdisciplinary skills etc.,

5. Distribution and Weightage of Marks

- i. The performance of a student in each semester shall be evaluated course -wise with a maximum of 100 marks for theory courses and 50 marks for practical course. The project work shall be evaluated for 200 marks.
- ii. For theory course the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Semester Examinations. Distribution of marks for theory course, practical course and Design/Drawing is detailed below:

Internal 30 marks for theory course shall be awarded as follows:

- i) MID exams -18marks
- ii) continuous assessment - 10 marks
- iii) Attendance –2 marks

MID marks shall be calculated with 80% weightage for best of the two MIDs and 20% weightage for other MID exam.

For practical courses (Laboratory): There shall be continuous evaluation during the semester. Each Lab exam is evaluated for 50 marks. 20 marks shall be awarded for internal examination and 30 marks shall be awarded for external examinations.

Internal marks shall be awarded as follows

- i) Day to day assessment including record– 10 Marks
- ii) Internal laboratory exam– 10 Marks

The semester end examinations shall be conducted by the faculty concerned and external examiner

For the courses having design and/or drawing, (Such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation.

Internal marks shall be awarded as follows:

- i) 18 marks for Mid exams
 - Day-to-day assessment - 8 marks
 - Internal exam - 10 marks
- ii) Continuous assessment - 10 marks
- iii) Attendance - 2 marks

There shall be two internal examinations in a semester and the internal marks shall be calculated with 80% weightage for best of the two internals and 20% weightage for other internal exam.

External examination shall be conducted for 70 marks.

Special Courses:

Engineering Exploration (EE) course:

EE course is evaluated for 50 marks.

- i) Internal 20 marks shall be awarded based on the day-to-day performance of the activities.
- ii) External evaluation shall be conducted for 30 marks.
 - Project submission – 20 marks
 - Viva-Voce – 10 marks

Games, Sports & Yoga: Though this course has no credits, it is mandatory to satisfy minimum attendance of 80%.

Mini project (EPICS): It is to be carried out during the second year. Students have an option to choose their own area of interest related to problems impacting the society. It is evaluated for 50 marks.

- i) Internal assessment - 20 marks ii) Project submission and Viva-Voce - 30 marks

Evaluation of the summer internships:

It shall be completed in collaboration with local industries, Govt. organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme.

The minimum duration of this course shall be at least 4-6 weeks.

A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship.

After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development centre shall be included in the report. It shall be evaluated for 50 external marks at the end of the semester. The technical report and the oral presentation shall carry 20 marks and 30 marks respectively. There shall be no internal marks for Summer Internship. In case, if a student fails, he/ she shall reappear as and when semester supplementary examinations are conducted.

Job – oriented skill courses

The job-oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/ report on the list skills learned. If the student completes job- oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record/report: 20 marks and viva-voce/exam: 30 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job-oriented skill courses.

5. 8. Audit courses: All audit courses will be “Pass/Fail” type with no credit points allotted. The result of the student in the audit course will be notified in the marks memo. A student must

pass all the audit courses registered to be eligible for the award of B. Tech. degree. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects.

List of audit courses will be notified from time to time. An indicative list of courses is as shown below.

a) Professional ethics & Universal Human Values b) Constitution of India c) Life skills d) Environmental science e) Entrepreneurship development f) IPR & Patents g) Gender sensitization for women empowerment h) Game, sports and yoga

MOOCs: It is an online course (Minimum of 12 weeks) to promote advanced knowledge suitable for placement and research.

To award credits, the student should get certificate after they have registered for written exam and successfully passed

(Or)

College will conduct the written examination/Viva-voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

Note: The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.

Major Project (Project - Project work, seminar and internship in industry):

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated by external examiner.

Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be show cased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

5.11 Integrated theory lab:

- The integrated course is in the ratio of 2:1 (total credit:3).
- Attendance shall be counted for both in theory as well as lab. Minimum

- attendance shall be required individually in theory and lab as per institute norms
- c. Student has to attend the internal examination and external examination conducted by the institution as per the regulations.
 - d. Student has to pass individually both the external examinations (Theory for 100 marks and Lab for 50 marks)
 - e. If the student fails in either theory or laboratory, the final result is FAIL only.
 - f. The student has to pass separately both in the external theory examination and external lab examination.

6. Attendance Requirements:

a. It is desirable for a candidate to have 100% attendance in the class in all the courses. However, a candidate shall be permitted to appear for the end semester examination if he/she has a minimum of 75% aggregate attendance in the semester. Student will not be permitted to write Mid examination if the attendance percentage is less than 75 % during the stipulated instruction duration. However, Academic Committee shall review the situation and take appropriate decision.

Note: Special cases for students having extraordinary performance at National and International level will be considered by the Academic Committee.

b. Condonation of shortage of attendance may be considered on Medical grounds maximum up to 10%, if the student provides the medical certificate to the HOD immediately after he / she recovers from the illness. Medical Certificate submitted afterwards shall not be permitted. Shortage of attendance equal to or above 65% and below 75% will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study.***

c. Shortage of attendance may be considered for the students who participate in prestigious sports, co and extra-curricular activities if their attendance is in the minimum prescribed limit.

d. A student will be promoted to the next semester if satisfies attendance and credits requirement.

7. Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements.

For any course, student is considered to be passed upon securing minimum 40% marks in the external examination alone and minimum 50% marks from both internal and external examination put together

8. Promotion Policy:

- a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.
- b) To promote to III year, a student has to secure minimum 40% of total credits from I & II-year courses
- c) To promote to IV year, a student has to secure minimum 40% of total credits from I, II & III-year courses

d) In case of Lateral entry students, to promote to IV year, a student has to secure minimum 40% of total credits from II & III-year courses

9. GAP Year: Gap year concept is introduced after completion of the I/II/III year to give the opportunity to explore entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at Institute level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing Gap year.

10. Supplementary examinations: Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa. In case a student fails in online courses/ industrial lecture(s), he/she may be permitted to register for another course/lecture(s).

11. Examinations and Evaluation

a. General guidelines

- i. All the semester end examinations are conducted for duration of three hours
- ii. External examination shall be conducted for 70 marks consist of five questions of internal choice carrying 14 marks each.
- iii. For laboratory examinations, the evaluation is done by internal examiner and an external examiner.

b. Revaluation

There is a provision for revaluation of theory courses if student fulfils the following norms.

The request for revaluation must be made in the prescribed format duly recommended by the Chief Superintendent of Examinations through Additional Controller along with the prescribed revaluation fee.

12. Grading System:

CGPA

Marks Range (in %)	Letter Grade	Level	Grade Point
≥ 90	O	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Satisfactory	6
<50	F	Fail	0
	AB	Absent	-1
	WH	Withheld	-2
	MP	Malpractice	-3
	CP	Completed	

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average. (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\text{SGPA (Si)} = \Sigma(\text{Ci} \times \text{Gi}) / \Sigma \text{Ci}$$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Computation of CGPA

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\text{CGPA} = \Sigma(\text{Ci} \times \text{Si}) / \Sigma \text{Ci}$$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Conversion of CGPA to Percentage:

$$\text{Equivalent Percentage} = (\text{CGPA} - 0.75) \times 10$$

13. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following three classes:

Regular:

Class Awarded	CGPA to be secured	From the CGPA secured from 160 Credits.
First Class with Distinction	≥ 7.75 with no failures	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

Lateral- entry scheme

Class Awarded	CGPA to be secured	From the CGPA secured from 121 Credits from II Year to IV Year
First Class with Distinction	≥ 7.75 with no failures	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

14. General Instructions

- i. Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers', also.
- ii. The academic regulations should be read as a whole for the purpose of any interpretation.
- iii. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.
- iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institution.

15. Transitory Regulations

- i. The student has to continue the course work along with the regular students of the respective semester in which the student gets re-admission.
- ii. The student has to register for Substitute / Compulsory courses offered in place of courses studied earlier.
- iii. The mode of internal evaluation and end-semester examinations shall be on par with the regular students, i.e., the student has to follow the mode of internal evaluation and the then question paper model for the end-semester examinations along with the regular students of the respective semester in which the student gets re-admission. The marks secured in the internal and end-semester examinations will be pro-rated in accordance with the regulations under which the student was first admitted.
- iv. For the courses studied under earlier regulations but failed, the student has to appear, pass and acquire credits from the supplementary examinations as and when conducted. The question paper model shall remain same as the one in which the student took examination during previous regulations.
- v. The promotion criteria based on attendance as well as credits shall be in accordance with the regulations under which the student was first admitted.
- vi. All other academic requirements shall be in accordance with the regulations under which the student was first admitted.
- vii. The decision of the Principal is final on any other clarification in this regard.
- viii. Transcripts: After successful completion of the entire program of study, a transcript containing performance of all academic years will be issued as a final record. Partial transcript will also be issued up to any point of study to a student on request, after payment of requisite fee.

16. Minimum Instruction Days

The minimum instruction days for each semester shall be 16 weeks

There shall be no branch transfers after the completion of the admission process.

17. Withholding of Results

If the student has not paid the dues, if any, to the Institute or in any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

Note: All other regulations including attendance requirements related to four year B. Tech Regular program will be applicable for B.Tech. Lateral Entry Scheme.

18. Malpractices Rules

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/ Improper conduct	Punishment
1 (a)	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original

		candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant-Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and. a police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical

		examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic committee of the Institute for further action to award suitable punishment.	

19. UGC RECOMMENDED PUNISHMENT FOR RAGGING

- i. Suspension from attending classes and academic privileges
- ii. Withholding/withdrawing scholarships/fellowship and other benefits.
- iii. Debarring from appearing in any test/examination or other evaluation process
- iv. Withholding results
- v. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
- vi. Suspension/expulsion from the hostel
- vii. Cancellation of admission
- viii. Rustication from the institution for period ranging from 1 to 4 semesters.
- ix. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
- x. Fine may extend up to Rs. 2.5 lakh.

**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM**

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**Guidelines B. Tech Minors in Engineering**  
(Applicable from the Academic Year 2020-21 (VR20))

**Award of B. Tech. (Minor):** A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the minor. The department concerned will determine the required courses for award of minor. The subjects in minor programme would be a combination of mostly core and some electives.

Registering for Minor is optional.

**I. OBJECTIVES**

The objectives of initiating the minor certification are:

- (a) To diversify the knowledge of the undergraduates.
- (b) To make the undergraduates more employable.
- (c) To have more educational and professional skills after the completion of his undergraduate courses.
- (d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

**II. Applicability and Enrolment**

- (a) To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
- (b) There shall be no limit on the number of programs offered under Minor. The minor programs in emerging technologies based on expertise in the respective departments may be offered and minor can also be offered in collaboration with the relevant industries/agencies.
- (c) Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
- (d) If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
- (e) The allotment of seat into minor is based on the percentage of marks obtained in the major degree programme. Percentage of marks shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students
- (f) In the event of any tie during the seat allotment for a minor, the concerned major degree department offering minor shall conduct a test/interview on the prerequisite subjects of minor and final decision shall be taken.
- (g) For applicability of minor, both regular B Tech and minor courses shall be successfully completed with specified SGPA/CGPA
- (h) A student shall report the concerned Principal of the college, if he/she is not interested to pursue/continue the minor programme.
- (i) Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted



### **III. Entry level**

- (a) The B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor at their choice in any other department offering minor from III semester onwards.
- (b) Students registering for minor shall select the subjects from other branches. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall select the subjects specified for minor in Civil Engineering and he/she will get major degree of Electrical & Electronics Engineering with minor of Civil Engineering.
- (c) Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. However, students pursuing major degree in a particular Engineering are not allowed to register for minor in the same engineering branch.
- (d) Only those students, who have a CGPA of 7.75 or above, without any backlog, will be permitted to register for a minor.
- (e) An SGPA or CGPA in excess of 7.75 has to be maintained in the subsequent semesters in major as well as minor without any backlogs in order to keep the minor registration active.
- (f) Should both the SGPA and CGPA fall below 7.75 at any point after registering for the minor; the minor registration will cease to be active.
- (g) A student registered for minor in a discipline must register and pass in all subjects with a minimum GPA of 7.75 that constitute requirement for award of minor.
- (h) Separate CGPA shall be shown on semester and final transcripts of regular B. Tech and minor.
- (i) Students shall not be permitted to register for minor after completion of VI semester.
- (j) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for minor.
- (k) The students shall complete minor without supplementary appearance within stipulated period for the completion of regular major B. Tech. programme.
- (l) Minor shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted
- (m) If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of minor
- (n) If a student failed in any registered course of the minor, he/she shall not be eligible to continue the B.Tech. minor. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.
- (o) The subjects completed under minor programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme
- (p) Students completed their degree shall not be permitted to register for minor

### **IV. Structure of Minor in B. Tech**

- (a) The student shall earn at least 20 credits for award of minor from other branch/department/discipline registered for major degree.
- (b) Students can complete minor courses either in the college or in online from platforms like NPTEL/SWAYAM etc.
- (c) The overall attendance in each semester of regular B. Tech courses and minor courses shall be computed separately
- (d) A student shall maintain an overall attendance of 75% in all registered courses of minor to be eligible for attending semester end examinations. However, condonation

for shortage of attendance between 65-75% may be given as per norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee.

- (e) Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations.
- (f) A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue minor programme
- (g) The teaching, examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech. courses
- (h) The students may choose theory or practical courses to fulfil the minimum credit requirement.
- (i) The students may be allowed to take maximum two subjects per semester pertaining to their minor
- (j) The students are permitted to opt for only a single minor course in his/her entire tenure of B.Tech(Engineering)
- (k) The students registered for B. Tech (Hons) shall not be permitted to register for minor
- (l) The student is not permitted to take the electives courses from the parent department fulfil the minimum credit requirement.

#### **V. Credits requirement**

- (a) A Student will be eligible to get minor along with major degree engineering, if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM
- (b) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of minor, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two NPTEL, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.
- (c) The colleges offering minor courses shall be ready teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies
- (d) The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14weeks.
- (e) The teaching and evaluation procedure of minor courses offering in offline mode shall be similar to that of regular B. Tech. courses
- (f) Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment
- (g) The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL.
- (h) After successful completion of all major and minor courses with specified CGPA the Institute will award both major and minors
- (i) If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the minor

#### **VI. Procedure to Applying for the Minor**

- (a) The department offering the minor will announce specialization and courses before the start of the session.
- (b) The interested students shall apply through the HOD of his/her parent department.
- (c) The concerned department will announce the list of the selected students for the minor.
- (d) The whole process should be completed within one week before the start of every session.

- (e) Selected students shall be permitted to register the courses for minor.

## VII. Registering for minor courses

- Each department offering the minor will submit the final list of selected students to the principal.
- The selected students shall submit a joining letter to the Principal through the concerned HOD offering the minor. The student shall inform same to the HOD of his/her parent department.
- Both parent department and department offering minor shall maintain the record of student pursuing the minor.
- With the approval of Principal and suggestion of advisor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the minor.
- Each department shall communicate the minor courses registered by the students to the time table drafting committee and accordingly time table will be drafted. Time table drafting committee shall see that no clash in timetables.
- If the student wishes to withdraw/change the registration of subject/course, he/she shall inform the same to advisor, subject teacher, HODs of minor department and parent department and Principal within two weeks after registration of the course.

## VIII. Procedure for Monitoring the Progress of the Scheme

The students enrolled in the minor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

## IX. Allocation of seats for minor

- The Institute will notify the number of the seats for minor in the concerned department well in advance before the start of the semester.
- Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
- The list of the elective for minor will be offered from the list of running majors in the concerned subjects. Each department of concerned institute will notify the seats for the minor well before the start of each session as per the following Table

| S. No | Name of the course | Sanction seats of major degree programme | Seats offered for minor | Courses offered | Credits for each course |
|-------|--------------------|------------------------------------------|-------------------------|-----------------|-------------------------|
|       |                    |                                          |                         |                 |                         |

## X. Course Fees for registration of subjects in Minor degree

There is no fee for registration of subjects for minor degree programme offered in offline at the respective colleges.

## XI. Examinations

- The examination for the minor courses offered in offline shall be conducted along with regular B. Tech. programme.
- The examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses.
- A separate transcript shall be issued for the minor subjects passed in each semester.
- There is no supplementary examination for the failed subjects in a minor programme.

**VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)  
VISAKHAPATNAM**

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Guidelines for B. Tech Honors - B. Tech (Hons)
(Applicable from the Academic Year 2020-21 (VR20))

Award of B. Tech. (Honors): All the students pursuing regular B. Tech with prerequisite CGPA are eligible to the register Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B. Tech Honors degree. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.

I. OBJECTIVES

The objectives of initiating the B. Tech (Honors) degree certification are:

- a) To encourage the undergraduates towards higher studies and research
- b) To prepare the students to specialize in core Engineering streams
- c) To attain the high-level competence in the specialized area of Under Graduate programme
- d) To learn the best educational and professional skills in the specialized area after the completion of his undergraduate courses.
- e) To provide the opportunity to learn the post graduate level courses in the specified undergraduate programme

II. Applicability and Enrolment

- a) To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
- b) The department offering Honors shall have at least one M. Tech in concerned stream, for B. Tech (Honors) registration.
- c) Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
- d) The allotment of seat into Honors degree is based on the percentage of marks obtained in the major degree programme. Percentage of marks shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students
- e) In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering minor shall conduct a test/interview on the prerequisite subjects of Honors degree and final decision shall be taken.
- f) For applicability of Honors degree, both regular B Tech and Honors degree courses shall be successfully completed with specified SGPA/GCPA
- g) A student shall report the concerned Principal of the college, if he/she is not interested to pursue/continue the Honors degree programme. Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted

III. Entry-level

- (a) The B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for Honors degree at their choice in any same department offering major degree from III semester onwards

- (b) Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BOS committee. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall select subjects in Electrical & Electronics Engineering only and he/she will get major and Honors degree in Electrical & Electronics Engineering
- (c) Only those students, who have a CGPA of 8.0 or above, without any backlog, will be permitted to register for a Honors degree
- (d) An SGPA or CGPA in excess of 8.0 has to be maintained in the subsequent semesters in major as well as Honors degree without any backlogs in order to keep the Honors degree registration active.
- (e) Should both the SGPA and CGPA fall below 8.0 at any point after registering for the Honors; the Honors degree registration will cease to be active.
- (f) A student registered for Honors degree in a discipline must register and pass in all subjects with a minimum GPA of 8.0 that constitute requirement for award of Honors degree.
- (g) Separate SGPA/CGPA shall be shown on semester and final transcripts of regular B. Tech and minor.
- (h) Students shall not be permitted to register for Honors degree after completion of VI semester.
- (i) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Honors degree.
- (j) The students shall complete Honors degree without supplementary appearance within stipulated period as notified by JNTUK for the completion of regular major B. Tech programme.
- (k) Honors degree shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted
- (l) If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses for Honors degree
- (m) If a student failed in any registered course of the Honors, he/she shall not be eligible to continue the B. Tech Honors. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.
- (n) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme
- (o) Students completed their degree shall not be permitted to register for Honors degree

IV. Structure of Honors in B.Tech

- (a) The student shall earn at least 20 credits for award of Honors degree from same branch/department/discipline registered for major degree
- (b) Students can complete Honors degree courses either in the college or online from platforms like NPTEL/SWAYAM etc.
- (c) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses list in the departments, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two NPTEL, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.
- (d) The overall attendance in each semester of regular B. Tech courses and Honors degree courses shall be computed separately
- (e) A student shall maintain an overall attendance of 75% in all registered courses of

Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee

- (f) Student having less than 65% attendance in Honors courses shall not be permitted for semester end examinations.
- (g) A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue Honors programme
- (h) The teaching, examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses
- (i) Students may choose theory or practical courses to fulfil the minimum credit requirement.
- (j) Students shall be allowed to take maximum two subjects per semester pertaining to their Honors degree
- (k) The students registered for minor shall not be permitted to register for B. Tech(Honors)

V. Credits requirement

- (a) A Student will be eligible to get B. Tech (Honors), if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM
- (b) The colleges offering Honors degree courses shall be ready to teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies
- (c) The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14 weeks.
- (d) The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL.
- (e) Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment.
- (f) The teaching and evaluation procedure of Honors courses offering in offline mode shall be similar to that of regular B. Tech. courses
- (g) After successful completion of all major and Honors degree courses with specified CGPA the Institute will award B. Tech(Honors)
- (h) If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the Honors degree

VI. Procedure to Applying for Honors degree

- (a) The department offering the Honors will announce courses required before the start of the session.
- (b) The interested students shall apply for the Honors course to the HOD of the concerned department
- (c) The concerned department will announce the list of the selected students for the minor.
- (d) The whole process should be completed within one week before the start of every session.
- (e) Selected students shall be permitted to register the courses for Honors degree.

VII. Joining in Honor courses in B.Tech

- (a) Each department offering the Honors degree shall submit the final list of selected students to the principal.
- (b) The selected students shall submit a joining letter to the Principal through the concerned HOD.
- (c) The department offering Honors shall maintain the record of student pursuing the

Honors degree

- (d) With the approval of Principal and suggestion of advisor/mentor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the Honor degree.
- (e) Each department shall communicate the Honors courses registered by the students to the time table drafting committee and accordingly time table will be drafting. Time table drafting committee shall see that no clash in timetables.
- (f) If the student wishes to withdraw/change the registration of subject/course, he/she shall inform the same to advisor/mentor, subject teacher, HODs of minor department and parent department and Principal within two weeks after registration of the course.

VIII. Procedure for Monitoring the Progress of the Scheme

The students enrolled in the Honor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

IX. Allocation of seats for Honors degree

- (a) The Institute will notify the number of the seats for Honors degree in each department well in advance before the start of the semester
- (b) Total number of seats offered for Honors degree shall be a maximum of 35% of sanctioned intake of major degree programme.
- (c) Each department of concerned institute will notify the seats for the Honors well before the start of each session as per the following Table

S. No	Name of the course	Sanction seats of major degree programme	Seats offered for Honors	Courses offered	Credits for each course

X. Course Fees for registration of subjects in Major degree

There is no fee for registration of subjects for major degree programme offered in offline at the respective colleges.

XI. Examinations

- (a) The examination for the Honors degree courses offered in offline shall be conducted along with regular B. Tech programme.
- (b) The examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses.
- (c) A separate transcript shall be issued for the minor subjects passed in each semester
- (d) There is no supplementary examination for the failed subjects in a Honors degree programme.

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY: VISAKHAPATNAM

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM STRUCTURE – VR-20

I Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000201100	Mathematics-I	3	1	0	3
2	1005201100	Problem Solving and Programming using C	3	0	0	3
3	1003201101	Engineering Drawing	1	0	4	3
4	1000201102	Technical English Communication	2	0	0	2
5	1000201105	Applied Chemistry	3	0	0	3
6	1000201110	Technical English Communication Lab	0	0	3	1.5
7	1005201110	Problem Solving and Programming using C Lab	0	0	3	1.5
8	1000201113	Applied Chemistry Lab	0	0	3	1.5
9	1000201160	Engineering Exploration	0	0	2	1
10	1000201120	Game, Sports and Yoga	0	0	4	0
Total Credits						19.5

I Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1005201200	Object Oriented Programming through C++	3	0	0	3
2	1005201201	Computer Organization	3	0	0	3
3	1005201202	Web Design	3	0	0	3
4	1000201104	Mathematics-II	3	1	0	3
5	1000201204	Applied Physics	3	0	0	3
6	1005201210	Object Oriented Programming through C++ Lab	0	0	3	1.5
7	1000201212	Applied Physics Lab	0	0	3	1.5
8	1005201211	Web Design Lab	0	0	3	1.5
9	1000201121	Constitution of India	2	0	0	0
Total Credits						19.5

Total Credits (I Year – I & II Sem.) (19.5+19.5= 39)

II Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000202100	Discrete Mathematical Structures	3	1	0	3
2	1005201203	Data Structures	3	0	0	3
3	1005202100	Java Programming	3	0	0	3
4	1005202101	Operating Systems	3	0	0	3
5	1099202100	Managerial Economics & Financial Analysis	3	0	0	3
6	1005201212	Data Structures Lab	0	0	3	1.5
7	1005202110	Java Programming Lab	0	0	3	1.5
8	1005202111	Operating Systems Lab	0	0	3	1.5
9	1012202180	R Programming	0	0	4	2
10	1000202120	Life Skills	2	0	0	0
Total Credits						21.5

II Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000202102	Probability and Statistics	3	0	0	3
2	1005202200	Database Management Systems	3	0	0	3
3	1005202201	Advanced Data Structures	3	0	0	3
4	1012202100	Python Programming	3	0	0	3
5	1012202201	Automata Theory and Compiler Design	3	0	0	3
6	1005202210	Database Management Systems Lab	0	0	3	1.5
7	1005202211	Advanced Data Structures Lab	0	0	3	1.5
8	1012202110	Python Programming Lab	0	0	3	1.5
9	1012202260	EPICS - Engineering Projects in Community Service	0	0	2	1
10	1020202100	Employability Readiness Program	1	0	2	2
11	1000202121	Environmental Science	2	0	0	0
Total Credits						22.5
SUMMER INTERNSHIP						
12	1012202250	Data Preparation and Analysis	4	0	0	4

Total credits (II Year – I & II SEM) (21.5+22.5= 44)

III Year
I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1012203100	Computer Networks	3	0	0	3
2	1005202203	Design and Analysis of Algorithms	3	0	0	3
3	1005202204	Data Warehousing and Data Mining	3	0	0	3
4 (Open Elective-I)	1001202140	Industrial waste and waste water Management	3	0	0	3
	1004203141	Data Communications				
	1000202103	Statistics for Data Science-II				
	1003203140	Green Engineering Systems				
5 (Professional Elective-I)	1005203100	Advanced Web Technologies	3	0	0	3
	1005203131	Computer Graphics				
	1005203136	NoSQL Databases				
	1005203135	Industrial Oriented Python Programming				
	1005203133	UNIX and Shell Programming				
6	1012203110	Computer Networks Lab	0	0	3	1.5
7	1012203111	Data Mining Lab	0	0	3	1.5
8	1012203180	Soft Skills	1	0	2	2
9	1099203120	Entrepreneurship Development-1	2	0	0	0
10	1012203160	Summer Internship	0	0	0	1.5
Total Credits						21.5
11	1012203150	Data Engineering	4	0	0	4

III Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1005202103	Software Engineering	3	0	0	3
2	1012203200	Machine Learning	3	0	0	3
3	1005203200	Cryptography and Network Security	3	0	0	3
4 (Professional Elective-II)	1005203230	Software Project Management	0	0	0	3
	1005203231	Distributed Systems				
	1005203233	Big Data Analytics				
	1019203200	IOT and its applications				
	1012203270	SWAYAM / NPTEL / MOOCS				
5 (Open Elective-II)	1001202240	Environment Pollution and Control	3	0	0	3
	1004203101	Microprocessors and Microcontrollers				
	1019203240	Introduction to Embedded Systems				
	1003202242	Industrial Robotics				
6	1012203210	Case Tools Lab	0	0	3	1.5
7	1054203110	Machine Learning Lab	0	0	3	1.5
8	1012203211	Cryptography and Network Security Lab	0	0	3	1.5
9	1012203280	Kotlin Programming	1	0	2	2
10	1099203220	Professional Ethics and Universal Human Values	2	0	0	0
Total Credits						21.5
INDUSTRIAL/RESEARCH INTERNSHP						
11	1012203250	Data Visualization	4	0	0	4

Total Credits (III Year – I & II SEM) = (21.5+21.5 = 43)

IV Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1 (Professional Elective-III)	1005204132	Software Quality Assurance	3	0	0	3
	1005204130	Soft Computing				
	1004203236	Digital Image Processing				
	1005204133	Digital Forensics				
	1054202200	Artificial Intelligence				
2 (Professional Elective-IV)	1054203200	Deep Learning	3	0	0	3
	1012204130	Quantum Computing				
	1012204131	Block Chain Technologies				
	1012204132	Data Science				
	1012204133	Network Programming				
3 (Professional Elective-V)	1005204134	Social Network and Semantic Web	3	0	0	3
	1012204134	Digital Marketing				
	1012204135	Ad-hoc and Sensor Networks				
	1005204138	Cloud Computing				
	1012204136	Design Patterns				
	1012204170	SWAYAM / NPTEL / MOOCS				
4 (Open Elective-III)	1001204141	Remote Sensing Applications and GIS	3	0	0	3
	1004203237	Information Theory and Coding				
	1054204131	Business Analytics				
	1003204140	Nano Technology				
5 (Open Elective-IV)	1001204140	Disaster Management	3	0	0	3
	1004204140	Speech Processing				
	1054204136	Information Retrieval Systems				
	1003203132	Operations Research				
6	1099203200	Management Science	3	0	0	3
7	1012204180	Android Application Development	1	0	2	2
8	1099204120	IPR & Patents	2	0	0	0
9	1012204160	Industrial/Research Internship	0	0	0	2
Total Credits						22
10	1012204150	Data Acquisition and Productization	4	0	0	4

IV Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1012204260	Main Project	0	0	0	12
SEMESTER LONG INTERNSHIP						
Total Credits						12

TOTAL CREDITS: (IV Year – I & II SEM) (22+12= 34)

GRAND TOTAL CREDITS: (I Y + IIY +III Y + IV Y) = 39+44+43+34 = 160

I Year I Semester

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY: VISAKHAPATNAM

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM STRUCTURE – VR-20

I Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000201100	Mathematics-I	3	1	0	3
2	1005201100	Problem Solving and Programming using C	3	0	0	3
3	1003201101	Engineering Drawing	1	0	4	3
4	1000201102	Technical English Communication	2	0	0	2
5	1000201105	Applied Chemistry	3	0	0	3
6	1000201110	Technical English Communication Lab	0	0	3	1.5
7	1005201110	Problem Solving and Programming using C Lab	0	0	3	1.5
8	1000201113	Applied Chemistry Lab	0	0	3	1.5
9	1000201160	Engineering Exploration	0	0	2	1
10	1000201120	Game, Sports and Yoga	0	0	4	0
Total Credits						19.5

Course Code	MATHEMATICS -I	L	T	P	C
1000201100		3	1	0	3

COURSE OBJECTIVES:

Course Objectives:

1. Utilize mean value theorems to find the characteristics of the function and acquire the knowledge maxima and minima of functions of two variables.
2. To discuss higher order differential equations.
3. To discuss Laplace Transform and its properties.
4. To apply Inverse Laplace transform to different types of functions and to solving initial value problems.
5. To construct partial differential equations by eliminating arbitrary constants and functions and to solve first order partial differential equations.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	Understand the mean value theorems and evaluate maxima and minima of functions of two variables without constraints.
CO2	Understand different analytical methods to solve higher order linear differential equations
CO3	Understand Laplace transform technique to solve initial and boundary value problems arising in engineering stream.
CO4	Understand solution of first order linear partial differential equations

UNIT-1

[10 HOURS]

Mean Value Theorems: Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's Mean value Theorem. Functions of several variables – Partial derivatives – Total derivatives – Chain rule-Jacobian – Functional dependence – Maxima and Minima of functions of two variables without constraints.

UNIT-11

[8 HOURS]

Linear Differential Equations of Higher Order: Non-homogeneous linear differential equations of second and higher order with constant coefficients with non-homogeneous terms of the type e^{ax} , $\sin ax$, $\cos ax$, x^k , method of variation of parameters.

UNIT- III

[10 HOURS]

Laplace Transforms: Introduction - Laplace transforms of standard functions – Shifting Theorems - Transforms of derivatives and integrals - multiplication by t^n - division by t – Unit step/Heaviside's function - Dirac's Delta Function (or Unit Impulse Function) - Laplace Transform of Periodic Function.

UNIT- IV

[10 HOURS]

Inverse Laplace Transforms –Introduction - Properties – Inverse Laplace by using partial fractions and Convolution theorem - solving initial and boundary value problems by using Laplace Transform.

UNIT- V

[10 HOURS]

Partial Differential Equations of first order: Introduction -Solutions of first order linear (Lagrange) equation and nonlinear (standard type $f(p, q) = 0$, $f(z, p, q) = 0$, $f(x, p) = g(y, q)$ & Clairaut's) equations

Text Books:

1. Higher Engineering Mathematics by H.K. Dass, S. Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, Tata McGraw Hill Publishing Co. Ltd.

REFERENCE BOOKS

1. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
 2. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.
 3. A Text book of Engineering Mathematics, N.P. Bali, Laxmi Publications (P) Ltd.
 4. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Edition.
- .

Course Code	PROBLEM SOLVING AND PROGRAMMING USING C	L	T	P	C
1005201100		3	0	0	3

COURSE OBJECTIVES:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Write compile and debug Programs in C language
CO2	Use operators, data types and write programs
CO3	Select the best loop construct for a given problem
CO4	Design and implement C programs

UNIT- I

Introduction to computers: Computer systems, computer Languages, computer number systems.

Introduction to C programming: Background and characteristics of C, Flow Charts, algorithms and pseudo code. Structure of a C Program, Input/output Statements in C, writing C programs, compiling and executing C programs. **[6 Hours]**

UNIT- II

Programming Style: Tokens of C, Keywords, Variables, Constants and rules to form variables and constants, Data Types, Declaration of Variables and initialization, Operators, Operator precedence and associativity. Type conversions

Flow of Control: Selection: Two way selection, multi-way selection

Repetition and Unconditional Control Statements: concept of loop ,pre test and post test loops, initialization and updating loops ,while statement, do-while statement, for statements, nested loops, break ,continue, goto. **[10 Hours]**

UNIT- III
Arrays and Strings:

Arrays: One-Dimensional Arrays, Declaration, Array Initialization, Input and Output of Array Values, Two-Dimensional Arrays.

Strings: String Fundamentals, String Input and Output, String manipulation functions. **[8 Hours]**

UNIT- IV

Modular Programming:

Function and Parameter Declarations: Function definition, types of functions, declaration and definition of user defined functions, its prototypes and parameters, calling a function. Arrays as Function Arguments, Variable Scope, storage class, recursive functions. .

[7Hours]

UNIT- V

Pointers, Structures, Unions and files:

Pointers: Concept of a Pointer, Initialization of pointer variables, pointers as function arguments, address arithmetic, pointers to pointers, Pointers and arrays, Array of Pointers, parameter passing techniques. Dynamic memory allocation.

Structures and Unions: Structures declaration, Initialization of structures, accessing structures, unions.

Files: Declaring, Opening and closing file streams, Reading from and writing to text files.

[10 Hours]

Text Books:

1. Programming in C, ReemaThareja, and Oxford.
2. The C programming Language, Brain W.kernighan, Dennis Ritchie,2e,pearson
3. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. Pub.
Programming with C, Bichkar, Universities Press.

Reference Books:

1. ANSIC Programming garyJ.Bronson. Cengage learning.
2. Let us 'C' by yashwantkanethkar, BPB Publications, 16 edition.

I Year – I Semester

1003201101

ENGINEERING DRAWING

L T P C

1 0 4 3

COURSE OBJECTIVES:

To introduce the use and the application of drawing instruments and to make the students construct the polygons and curves. To introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other. To make the students draw the projections of the plane and solids inclined to one planes. To make the students draw isometric views of simple objects

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the use of drawing instruments to construct the polygons and curves
CO2	Learn the principle of orthographic projections. Draw Orthographic projections of points, lines.
CO3	Draw the various types of planes and solids its views in different Positions
CO4	Draw isometric views of simple objects

UNIT- I

INTRODUCTION TO ENGINEERING DRAWING

[10 Hours]

Polygons– Construction of regular polygons

Curves used in Engineering Practice– Ellipse (General method and oblong Method only), Parabola & Hyperbola (General method only)

Introduction to Scales– Vernier & Diagonal Scales.

UNIT- II

ORTHOGRAPHIC PROJECTIONS

[10 Hours]

Projections of points– Projections of straight line– Line parallel to one plane and perpendicular to other plane– parallel to both the planes.

Projections of straight lines– parallel to one plane and inclined to the other plane.

Straight lines inclined to both the planes.

UNIT- III

PROJECTIONS OF PLANES

[10 Hours]

Regular planes perpendicular/parallel to one plane and inclined to the other reference

Plane inclined to both the reference planes.

UNIT- IV

PROJECTIONS OF SOLIDS

[10 Hours]

Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the plane only

UNIT- V

ISOMETRIC PROJECTIONS

[10 Hours]

Conversion of Isometric Views to Orthographic Views

Conversion of Orthographic Views to Isometric Views.

Text Books:

1. Engineering Drawing, N. D. Bhatt, Chariot Publications.
2. Engineering Drawing, K. L. Narayana & P. Kannaiah, Scitech Publishers
3. Engineering Drawing and Graphics by K Venugopal, New Age international publications .

Reference Books:

1. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers.
2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age.

Course Code	TECHNICAL ENGLISH COMMUNICATION	L	T	P	C
1000201102		2	0	0	2

COURSE OBJECTIVES:

- To introduce students to the specific use of English for Technical Communication.
- To develop the overall English proficiency of students and enable them to function effectively in different professional contexts.
- To strengthen student skills in the areas of reading, writing, listening and speaking and enable them to function effectively in their professional sphere

COURSE OUTCOMES:

CO	At the end of the course, the student will have the ability to:
CO1	Read, understand and interpret material on Environment, Science and Technology, tourism, Energy Sources, Social Awareness
CO2	Analyze the functions of language and grammar in spoken and written forms.
CO3	Write effectively on various domains.
CO4	Prepare and exhibit oral presentation skills by using ICT. (Individual/Team)

UNIT- I

No. of lecture hours: 10

Reading: 1) How to Regain Green Cover 2) Solution to Plastic Pollution

Writing: Functional grammar [articles, prepositions of time, place, direction and movement, verb-tense, subject-verb agreement]

Listening: TED Talk on Water Harvesting (LC) –Answering comprehension-based Qs ~
Listening to improve pronunciation

Speaking: Functional English (LC) ~ Introducing oneself

Activities: Reading Comprehension- Note making while reading 1&2, Letter Writing

UNIT-II

No. of lecture hours: 10

Reading Texts: 1) The Hubble Telescope 2) Genesis of ISRO

Writing: Writing formal letters ~ Functional grammar ~Modals - Paraphrasing

Listening: Listening to a debate on “ Colonizing the Moon” (LC) ~ Note Taking

Speaking: (LC) Making mini presentations on general topics

Activities:

- Reading Comprehension
- Letter Writing-Formal

UNIT-III No. of lecture hours: 10

Reading Texts: 1) Southern Splendour 2) Tourism in India: Role in Conflict and Peace

Writing: Paragraph writing ~ Functional grammar [relative pronouns, comparative adjectives, adverbs]

Listening: (LC) Listening comprehension ~ Listening for global meaning ~ Listening for getting at the nuances and the mood of the speaker

Speaking: (LC) Telephonic Skills ~ participating in an interactive video and teleconferencing
Activities:

Reading Comprehension
Paragraph writing
Essay writing

UNIT-IV

No. of lecture hours: 10

Reading Texts: 1) Wind Energy 2) How pertinent is the nuclear option

Writing: Writing a formal E-mail

Speaking: Group Discussion (LC)

Listening: Listening to an Interview (LC) related to the text ~ listening critically for understanding the attitude/tone of the speaker

Activities: Reading Comprehension, Email Writing

UNIT-V

No. of lecture hours: 10

Reading Texts: 1) The Evolution of Media 2) The Top Ten Developments in Journalism in the 2000s

Writing: Interpret graphic tools [tables, pie & bar charts ~ writing an abstract ~ Leveraging ICT for communication ~ Preparing a PPT(LC)

Speaking: Making short presentations [individual/team] with the aid of PPT

Listening: Listening to Situation/Scene ~ Sub skills: Listening to understand one's viewpoint ~Listening to understand speaker's intention ~Listening for local understanding.

Activity:

Information Transfer

Suggested Books:

- Elango, K et.al 2014. *Mindscapes: English for Technologists and Engineers*, Orient Blackswan, Hyderabad.

Reference Books:

- Balasubramanian M. 1985. *Business Communication*. Vani Educational Books, New Delhi

- Balasubramanian T. 1989. *A Text book of Phonetics for Indian Students*. Orient Longman, New Delhi.
- Krishnaswamy, N and Sriraman, T. 1995. *Current English for Colleges*. Macmillan India Ltd. Madras.
- Mohan Krishna and Meera Banerjee. 1990. *Developing Communication Skills*. Macmillan India Ltd. New Delhi.
- Narayanaswamy V R. 1979. *Strengthen your Writing*. Orient Longman, New Delhi.
- Naterop, Jean, B. and Rod Revell. 1997. *Telephoning in English*. Cambridge University Press, Cambridge

Course Code	APPLIED CHEMISTRY	L	T	P	C
1000201105		3	0	0	3

COURSE OBJECTIVES:

To introduce various polymers and identify their functionalities. Understanding the concepts of batteries & green methodologies for the preparation of advanced materials. Developing ideas in protecting precious metals from corrosive atmospheres.

COURSE OUTCOMES:

COs	At the end of the course, the student will gain the ability in:
CO1	Identification of different polymers and their functionalities
CO2	Determination of structure to many compounds and apply the basic knowledge in construction of cell and its applications
CO3	Analysis of corrosive environments and protection of precious metal
CO4	Adoption of different green methodologies for preparation of advanced materials

UNIT- I**POLYMER CHEMISTRY****[8 Hours]**

Introduction to polymers, Classification of polymers, Types of Polymerizations (Addition, Condensation & copolymerization) with examples, properties of polymers (physical and mechanical).

Plastics - Thermoplastics and Thermosetting plastics, compounding of plastics, Moulding Techniques (Compression & Blow moulding), Preparation, properties and applications of – PVC and Bakelite.

UNIT- II**STRUCTURE AND BONDING MODELS****[10 Hours]**

Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of H₂, C₂, N₂, O₂ and CO, etc. calculation of bond order, shapes of d orbitals, crystal field theory – salient features – Crystal field splitting in octahedral environments, Crystal field stabilization Energy (CFSE) for high spin and low spin octahedral complexes.

UNIT- III**ELECTROCHEMISTRY AND APPLICATIONS****[10 Hours]**

Construction and working of Galvanic cell, Electrode potential, Reference electrodes - Standard hydrogen electrode, Electrochemical series & its applications, pH meter and applications (acid-base titrations), concept of conductivity - conductometric titrations (acid-base titrations)

UNIT- IV

CORROSION

[8 Hours]

Introduction to corrosion, dry corrosion with mechanism, electrochemical theory of corrosion with mechanism.

Types of Electrochemical corrosion (differential aeration corrosion, galvanic corrosion, pitting corrosion & stress corrosion), protection – cathodic protection, corrosion inhibitors, Cathodic & Anodic coatings, Galvanizing & Tinning.

UNIT- V

CHEMISTRY OF ADVANCED ENGINEERING MATERIALS & BIO MOLECULES

[10 Hours]

Nanomaterials: Introduction - Carbon nanotubes: Types, preparation (Electric Arc discharge, Laser ablation and CVD techniques), properties and applications, Fullerenes – structure and applications.

Composites - Fiber reinforced materials – CFRP & GFRP

Biodegradable polymers and its applications

Green Chemistry: 12 Principles only

Nucleic acids: DNA & RNA – Structure & their functions.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publishing Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.
Physics of Semiconductor Devices by S. M. Sze, John Wiley & Sons, New Delhi. (2012)

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
 2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
 3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
 4. Applied Chemistry by H.D. Gesser, Springer Publishers
- Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

Course Code

1000201110

**TECHNICAL ENGLISH
COMMUNICATION LAB**

L T P C

0 0 3 1.5

COURSE OBJECTIVES:

- To introduce students to the specific use of English for Technical Communication.
- To develop the overall English proficiency of students and enable them to function effectively in different professional contexts.
- To strengthen student skills in the areas of reading, writing, listening and speaking and enable them to function effectively in their professional sphere.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	Analyze the functions of language and grammar in spoken and written forms.
CO2	Write effectively on various domains.
CO3	Prepare and exhibit oral presentation skills by using ICT.(Individual/Team)

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Just A Minute –Tell about oneself	Speaking
2	Note Taking	Listening & Writing
3	Interactions	Listening & Speaking
4	Mini Presentation	Speaking
5	Letters and Sounds- Some pronouncing Patterns	Speaking
6	Telephonic Skills	Speaking & Listening
7	Group Discussion	Team work, leadership Speaking
8	Mock-Interview	Speaking
9	Impromptu individual presentations	Speaking
10	Information Transfer	Writing

Text Books:Speak Well-Maruthi Publications

Reference Books:Interact –Orient Blackswan

Course Code	PROBLEM SOLVING AND PROGRAMMING USING C LAB	L	T	P	C
1005201110		0	0	3	1.5

COURSE OBJECTIVES:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Write compile and debug Programs in C language
CO2	Use operators, data types and write programs
CO3	Select the best loop construct for a given problem
CO4	Design and implement C programs

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	Exercise – 1 a) Write a C program to compute perimeter and area of rectangle b) Write a C program to calculate distance between points c) Write a C Program to Simulate 3 Laws of Motion	Input/Output
2.	Exercise – 2 a) Write a C Program to convert Celsius to Fahrenheit and vice versa b) Write a C program to find maximum of three numbers using conditional operator.	Input/Output
3.	Exercise – 3 a) Write a C Program to find Whether the Given Year is a Leap Year or not. b) Write a C Program to find grade of student. c) Write a menu driven program to compute area of different geometrical shapes	Control Statements
4.	Exercises –4 a) Write a C Program to Find Whether the Given Number is i)Strong number ii)perfect number b) Write a C Program to print the following between 1 to n i)Prime Number ii) Armstrong Number	Loops and Control Statements
5.	Exercise -5 Demonstration of arrays& Strings a) Write a C program to perform Linear Search	Arrays and Strings

	b) Write a C program to perform transpose of two matrices c) Write a C program to perform multiplication of two matrices d) Implementation of string manipulation operations with and without library function. i)copy ii) concatenate iii)length iv)compare	
6.	Exercise -6 a) Write a C program to find cube of any number using function. b) Write a c program to find area and volume of geometric shapes using functions. c) Write a C program to check whether a number is even or odd using functions.	Functions
7.	Exercise -7 a) Write a C Program illustrating Fibonacci, Factorial using recursion b) Write a C program to find power of any number using recursion. c) Write a C program to find GCD and LCM using recursion	Recursive Functions
8.	Exercise -8 a) Write a C Program to Access Elements of an Array Using Pointer b) Write a C Program to find the sum of numbers with arrays and pointers. c) Write a c program to illustrate parameter passing techniques	Pointers
9.	Exercise -9 a) Write a C Program to Store Information of a student Using Structures b) Write a C program to create memory for int, char and float variable at run time.	Structures
10.	Exercise -10 a) Write a program in C to copy a file in another name b) Write a C program to append multiple lines at the end of file	Files

Text Books:

1. Programming in C, ReemaThareja, and Oxford.
2. The C programming Language, Brain W.kernighan, Dennis Ritchie,2e,pearson
3. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. Pub.
Programming with C, Bichkar, Universities Press.

Reference Books:

1. ANSIC Programming garyJ.Bronson. Cengage learning.
2. Let us 'C' by yashwantkanethkar, BPB Publications, 16 edition.

I Year – I Semester

1000201113

**APPLIED CHEMISTRY -
LABORATORY**

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

To acquaint the students with the basic phenomenon/concepts of titrations and element analysis in Chemistry. Design the synthetic methods to prepare polymers and nano materials.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Analyze & generate experimental skills
CO2	Enhance the thinking capabilities pertaining modern trends in engineering & technology
CO3	Select and use a suitable instrumental technique for the quantitative estimation and analyze the data obtained
CO4	Learn safety rules during the practice of laboratory investigation

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Total Hardness	Determination of Hardness of a ground water sample.
2	Total alkalinity	Determination of alkalinity of Water.
3	Complex metric Titration	Determination Copper using standard EDT Absolution.
4	Precipitation Titration	Determination of Zinc (II) by ferrocyanidemethod.
5	Iron permanganate redox titration	Determination of Iron (II) by using standard KMnO_4 solution
6	pH metry titration	Determination of the Concentration of HCl using Sodium Hydroxide (by pH - metry method).
7	Conduct metric Titration	Determination of the Concentration of strong acid vs strong base (by conduct metric method)
8	Iron dichromate redox titration	Determination of Iron (II) by using standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution.

9	Bakelite – A Thermosetting polymer	Preparation of a polymer (phenol-formaldehyde resin).
10	Nanomaterial Synthesis	Preparation of Nano materials (Demonstration only)
11	Electrochemical Cell	Construction of Galvanic cell (Virtual lab).
12	Acid – Base titration	Determination of strength of an acid in Pb-Acid battery.

Text Books:

1. Arthur Vogel and G. Svehla, Qualitative Inorganic Analysis, Pearson Education India.
2. Thompson & Atteshlis, Advanced Practical Chemistry & Resource Pack, John Murray Publications.

Reference Books:

1. Hill & Holman, Chemistry in Context Laboratory, Nelson Publications.

Course Code	ENGINEERING EXPLORATION	L	T	P	C
1000201160		0	0	2	1

COURSE OBJECTIVES:

To understand the importance of multi-disciplinary Engineering knowledge in the current world, for making any project. To learn Engineering design process for creating any new product/system. To learn the fundamental practical knowledge for starting any inter-disciplinary project.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Realize the purpose/Role of Engineer for solving social problems
CO2	Learn to Design a component/system in an engineering way
CO3	Learn to use mechanisms, Arduino, sensors, motors.
CO4	Integrating different systems (mechanical/Electrical/computer) to work as a unit

UNIT- I**INTRODUCTION TO ENGINEERING AND ENGINEERING STUDY [6 Hours]**

Introduction to Engineering, Difference between science and engineering, scientist and engineer, needs and wants various disciplines of engineering, some misconceptions of engineering, Role of engineers in solving social problems, Graduate Attributes.

Activity theme: Activities aimed to understand Engineering

Activities:

1. Identifying Various Engineering disciplines involved in projects/systems
2. Listing down various social problems in the world & Finding how engineering can solve these social problems.

UNIT- II**ENGINEERING DESIGN [12 Hours]**

Engineering Design Process, Multidisciplinary facet of design, Generation of multiple solution, Introduction to Mechatronics systems, Motor and Battery Sizing concepts, Introduction to PCB design.

Activity theme: Activities based on the designing & making of models

Activities:

1. Making of a Popsicle sticks prototype bridge
2. Conversion of AC to DC using bridge rectifier
3. Creation of Mobile App using MIT App Inventor
4. Creating a Full adder circuit using Logic gates with IC's

UNIT- III

MECHANISMS

[6 Hours]

Basic Components of a Mechanism, Degrees of Freedom (Mobility of a Mechanism), 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism.

Activity theme: Creating a model which illustrate any mechanism

Activities:

1. Determining the number of Degrees of freedom for a given mechanism
2. Assembly of scissors mechanism

UNIT- IV

PLATFORM BASED DEVELOPMENT

[8 Hours]

Introduction to platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers and actuators and its interfacing with Arduino.

Activity theme: To Program Arduino to control lights, Motors, Sensors etc.

Activities:

1. Blinking LEDs using Arduino interface
2. Identifying the objects with Infrared sensor
3. Usage of different sensors using Arduino Interface

UNIT- V

DATA ACQUISITION AND ANALYSIS

[8 Hours]

Types of Data, Descriptive Statistics techniques as applicable to different types of data, Types of graphs as applicable to different types of data, Usage of Microsoft Excel tool for descriptive statistics, Data Acquisition using Sensors interfaced with Arduino, exporting acquired data to Microsoft Excel and analysis using visual representation.

Activity theme: Acquiring data from sensors using Arduino

Activities:

1. Data analysis of Ultrasonic sensor with Arduino as interface
2. Data analysis of DHT sensor with Arduino as interface

I Year II Semester

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY: VISAKHAPATNAM

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM STRUCTURE – VR-20

I Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1005201200	Object Oriented Programming through C++	3	0	0	3
2	1005201201	Computer Organization	3	0	0	3
3	1005201202	Web Design	3	0	0	3
4	1000201104	Mathematics-II	3	1	0	3
5	1000201204	Applied Physics	3	0	0	3
6	1005201210	Object Oriented Programming through C++ Lab	0	0	3	1.5
7	1000201212	Applied Physics Lab	0	0	3	1.5
8	1005201211	Web Design Lab	0	0	3	1.5
9	1000201121	Constitution of India	2	0	0	0
Total Credits						19.5

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH C++	L	T	P	C
1005201200		3	0	0	3

COURSE OBJECTIVES:

3. To understand how C++ improves C with object-oriented features
4. To learn the syntax and semantics of the C++ programming language.
5. To learn how containment and inheritance promote code reuse in C++.
6. To learn how inheritance and virtual functions implement dynamic binding with polymorphism.
7. To learn how to design and implement generic classes with C++ templates

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Articulate the principles of object-oriented programming and Outline the essential features and elements of the C++ programming language.
CO2	Apply the concepts of class, method, constructor, instance, data abstraction, function abstraction, inheritance, overriding, overloading, and polymorphism.
CO3	Apply virtual and pure virtual function in complex programming situations
CO4	To use template classes and the STL library in C++ and to incorporate exception handling in object oriented concepts

UNIT- I

INTRODUCTION TO C++

Difference between C and C++- Evolution of C++- The Object Oriented Technology- Disadvantage of Conventional Programming- Key Concepts of Object Oriented Programming- Advantage of OOP- Object Oriented Language. **[6 Hours]**

UNIT- II

CLASSES AND OBJECTS & CONSTRUCTORS AND DESTRUCTOR

Classes in C++ - Declaring Objects- Access Specifiers and their Scope- Defining Member Function Overloading Member Function- Nested class. Introduction to Constructors and Destructor- Characteristics of Constructor and Destructor-Types of Constructor - Anonymous Objects. **[8 Hours]**

UNIT- III

OPERATOR OVERLOADING AND TYPE CONVERSION & INHERITANCE

The Keyword Operator- Overloading Unary Operator- Operator Return Type- Rules for Overloading Operators, Overloading Assignment Operator (=). Inheritance, Types of Inheritance. Virtual Base class, object as class member, abstract classes. [8Hours]

UNIT- IV

POINTERS & BINDING POLYMORPHISMS AND VIRTUAL FUNCTIONS

Pointer, Features of Pointers- Pointer Declaration- Pointer to Class- Pointer Object- this Pointer- Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction- Binding in C++ - Virtual Functions- Rules for Virtual Function- Virtual Destructor. [8Hours]

UNIT- V

GENERIC PROGRAMMING WITH TEMPLATES & EXCEPTION HANDLING

Generic Programming with Templates, Need for Templates- Definition of class Templates- Normal Function Templates- Overloading of Template Function-Bubble Sort Using Function Templates. Introduction to Standard Template Library: list-set-vector-map-deque. Introduction to Exception Handling: keywords try, throw and catch, multiple catch statements specifying exceptions. [10 Hours]

Text Books:

1. Programming in C++, Ashok N Kamathane, Pearson 2nd Edition.
2. The Complete Reference C++, Herbert Schildt, TMH.

Reference Books:

4. Object Oriented Programming C++, Joyce Farrell, Cengage.
5. C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning.
6. Computer Programming with C++,kunal Pimparkhede, cambridge

Course Code	COMPUTER ORGANIZATION	L	T	P	C
1005201201		3	0	0	3

COURSE OBJECTIVES:

To make students gain knowledge of the basic organization, design, programming of a simple digital computer and to provide an intuition of computer arithmetic, instruction set design, micro programmed control unit, pipelining, vector processing, memory organization and I/O systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Implement computer arithmetic, like addition, subtraction, division and multiplication.
CO2	Design and analyze combinational and sequential circuits.
CO3	Understand the instruction cycle and the Interrupt cycle.
CO4	Understand micro program and implement it

UNIT- I

Digital Components and Data Representation: Number Systems, Conversions, BCD, Gray Code, Excess-3 Code, Parity and Hamming Code

Boolean algebra and minimization: Boolean expressions and their minimization using algebraic identities; Karnaugh map representation and minimization. **[10 Hours]**

UNIT- II

Combinatorial Circuits: Design Procedure, Adder, Subtractor, BCD Adder, Multiplexers, Demultiplexers, Encoders and Decoders.

Sequential Switching Circuits: Latches, Flip-Flops, Introduction to Register and Counter. **[8 Hours]**

UNIT- III

Computer Arithmetic: Data representation, Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt. **[10Hours]**

UNIT- IV

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit. **[10 Hours]**

UNIT- V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory. Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access. **[10 Hours]**

Text Books:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer System Architecture, 3rd edition, M. Morris Mano, PHI
3. Microprocessor and Interfacing –Douglas V. Hall, 3rd edition, TMH

Reference Books:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer System Architecture, 3rd edition, M. Morris Mano, PHI
3. Microprocessor and Interfacing –Douglas V. Hall, 3rd edition, TMH

Course Code	WEB DESIGN	L	T	P	C
1005201202		3	0	0	3

COURSE OBJECTIVES:

1. To understand computer programming and application software, package/ suites.
2. Design static web application development and Students will gain the skills and front designs.
3. Able to get project based experience needed for entry into web application and development careers.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the various applications and computer programming languages purpose.
CO2	Describe the basic concepts of client server application and WWW
CO3	Describe the basic concepts of HTML & CSS to design web pages and web site
CO4	Analyze a given problem and apply requisite appropriate tools for designing interactive web applications

UNIT- I
INTRODUCTION
[8 Hours]

Types of computer applications (Console, Window, web based mobile and cloud applications).Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards. About Client and server process.

Introduction to HTML: History of HTML, What are HTML Tags and Attributes? HTML Tag vs. Element, HTML Attributes. Basic Syntax, Standard HTML Document Structure

UNIT- II
HTML Tags:
[10 Hours]

Basic Text Markup, Text formatting tags, Heading types, font tag, Images, image map, Hypertext Links, navigating web pages. What is Lists and various types of list, design the Tables using table tag.

UNIT- III
USER INTERACTIVE WEB PAGE
[10 Hours]

Form tag, user interactive components, Text box, lable, text area, check box, radio button, drop down box, submit and reset. **Frames:** Importance of frames, divide the web browser window into different sections.Introduction to HTML5.

UNIT- IV

Cascading Style Sheets:

[8 Hours]

Creating Style Sheet ,CSS Properties, Types of CSS, CSS Styling(Background, Text Format, Controlling Fonts) Working with block elements and objects, Working with Lists and Tables,CSS Id and Class.

UNIT- V

Scripting Languages:

[10 Hours]

Introduction to Client side and server side scripting languages.

Java Script: Variables, arrays, decision control and loop statements, Functions.

Introduction to PHP script and working with get and post methods.

Text Books:

3. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
4. Web Technologies, Uttam K Roy, Oxford
5. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning

Course Code	MATHEMATICS - II	L	T	P	C
1000201104		3	1	0	3

COURSE OBJECTIVES:

1. To familiarize the students with numerical methods of solving the non-linear equations, Interpolation, Numerical differentiation and integration.
2. Course will illuminate the student in the standard concepts of Linear algebra.
3. Methods to solving system of linear equations and compute Eigen values & Eigen vectors of a real matrix.
4. To apply mathematical statements, ideas and results, with the correct use of mathematical definitions.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	<i>Compute</i> approximate roots of an equation by using different numerical methods.
CO2	<i>Explain</i> difference operators and find the relation among operators and apply forward and backward formulas for compute interpolating polynomial.
CO3	<i>Apply</i> different numerical methods to solve integrations and ordinary differential equations.
CO4	<i>Understand</i> to solve the system of Linear equations by direct and iteration methods, and compute eigen values and eigen vectors of a matrix and study the nature of Quadratic form.

UNIT- I

Numerical Solution of Algebraic and Transcendental Equations:

[8 Hours]

Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

UNIT- II

Interpolation:

[8 Hours]

Introduction– Forward Difference, Backward difference, Central difference operators – Newton's formulae for interpolation – Gauss' Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT- III

Numerical Integrations & Differential Equations:

[8 Hours]

Numerical Integration: – Trapezoidal rule – Simpson's $1/3^{\text{rd}}$ Rule –Simpson's $3/8^{\text{th}}$ Rule.

Numerical solution of Ordinary Differential equations: Solution by Taylor's series method - Euler's method - Modified Euler's method- Runge-Kutta Method of 4^{th} order.

UNIT- IV

Linear system of equations:

[8 Hours]

Introduction-Rank-Echelon Form- Normal Form - System of Linear equations - Homogeneous and Non-Homogeneous , Consistency of system of Linear equations - Gauss elimination - Gauss Seidel method.

UNIT- V

Eigen values, Eigen vectors:

[10 Hours]

Introduction - Eigen values - Eigen vectors - Properties - Cayley Hamilton theorem (without proof) - Inverse and power of a matrix by using Cayley Hamilton theorem, Reduction of Quadratic form to canonical form by using orthogonal reduction – Rank, index, signature and Nature of quadratic form.

TEXT BOOKS

1. Higher Engineering Mathematics by H.K. Dass, S. Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, Tata McGraw Hill Publishing Co. Ltd.

REFERENCE BOOKS

1. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
2. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.
3. A Text book of Engineering Mathematics, N.P. Bali, Laxmi Publications (P) Ltd.
4. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Edition.

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

I Year – I Semester

1000201204

APPLIED PHYSICS

L T P C

3 0 0 3

COURSE OBJECTIVES:

To introduce the basic concepts of physical optics phenomenon such as interference, diffraction and polarization. Understanding of the concepts found in Lasers, fiber optics, semiconductor physics and provide an insight into semiconductor devices.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Describe the wave phenomena and formation of Newton's rings.
CO2	Make use of the concepts of pumping and total internal reflection to set up lasers and optical fibers.
CO3	Apply basic knowledge of energy bands in crystalline solids to understand semiconductor physics.
CO4	Identify the importance of semiconductor physics for construction and working of diode, transistors and logic gates.

UNIT- I

INTERFERENCE

[8 Hours]

Introduction-Principle of Superposition – Interference-Conditions for sustained interference– Coherent Sources – Interference in thin films (reflection geometry) – Newton's rings – Applications of interference.

UNIT- II

DIFFRACTION & POLARIZATION

[10 Hours]

Introduction – Difference between interference and diffraction – Difference between Fresnel and Fraunhofer diffraction - Fraunhofer diffraction at single slit- cases – Diffraction grating and grating equation.

Introduction to polarization-Double refraction – Types of Polarization -Quarter wave plate - Half Wave plate.

UNIT- III

LASERS & FIBER OPTICS

[10 Hours]

Introduction-Characteristics of laser light – stimulated absorption, spontaneous and stimulated emission of radiation – population inversion (2-level, 3-level and 4-level schemes) - Einstein coefficients and significance– basic components of laser - Ruby laser – He- Ne laser and applications of lasers.

Introduction and principle of optical fiber – acceptance angle - numerical aperture - Applications of optical fibers.

UNIT- IV

SEMICONDUCTOR PHYSICS& DEVICES

[12 Hours]

Introduction - bond formation in intrinsic semiconductors and extrinsic semiconductors (P-type and N-type) – intrinsic electrical conductivity – Drift & Diffusion –Einstein's equation – Hall effect in semiconductors – Applications of Hall effect.

Introduction to Diodes: p-n junction diode – Volt- ampere characteristics of p-n junction diode – Zener diode – Volt- ampere characteristics of Zener diode – Zener diode as voltage regulator- Solar Cell (qualitative).

UNIT- V

INTRODUCTION TO DIGITAL ELECTRONICS

[12 Hours]

Logic gates (OR gate, AND gate, NOT gate, NAND gate, NOR gate, XOR gate), Two level implementations: And Or Inverter (AOI), Or And Inverter (OAI), Demorgan's theorems, Boolean Expressions with Truth Tables, Product of literals (Min term), Sum of literals (Max term), Sum of products, Product of sums, Laws of Boolean algebra, Half adder and Full adder circuits with truth tables.

Text Books:

6. L.M. Pedrotti, Introduction to Optics, Prentice-Hall International, Inc. (1993)
7. Arthur Beiser, Concepts of Modern Physics, McGraw-Hill Science (2003)
8. Resnick , Halliday, Krane, Physics Vol 1& 2 (5ed), Wiley, Fifth edition (2007)
9. A.P. Malvino, D.P. Leach, Digital Principles and Applications, Tata McGraw Hill Education Pvt. Ltd. (1995)
10. A. J. Dekker, Solid State Physics, Macmillan India Pvt. Ltd., (2011)
11. C. Kittel, Introduction to Solid State Physics, Wiley india Pvt. Ltd, (2012)
12. S. M. Sze, Physics of Semiconductor Devices, 3rd edition, John Wiley & Sons, (2007)
13. M. A. Wahab, Solid State Physics: Structure And Properties Of Materials, Narosa Publishing House Pvt. Ltd. (2005)
14. Joseph Lindmayer, Charles Y. Wrigly, Fundamentals of Semiconductor Devices, Litton Educational Publishing Inc. (1966)
15. Physics of Semiconductor Devices by S.M.Sze, John Wily & Sons, New Delhi. (2012)

Reference Books:

3. Dr. M. N. Avadhanulu and Dr. P. G. KshiraSagar, A Text Book of Engineering Physics, S.Chand& Company Ltd., (2014).
4. David J. Griffiths · Darrell F. Schroeter, Introduction to Quantum Mechanics, Cambridge University Press; 3 edition, (2018).
5. David. J. Giffiths, Introduction to Electrodynamics, Pearson Education India Learning Private Limited; 4 edition (2015).
6. A.K. Sharma, Semiconductor Electronics ,New Age International (P) Limited Publisher, New Delhi. (2011)

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH C++ LAB	L	T	P	C
1005201210		0	0	3	1.5

COURSE OBJECTIVES:

1. To strengthen problem solving ability by using the characteristics of an object-oriented approach.
2. To design applications using object oriented features
3. To handle Exceptions in programs.
4. To teach the student to implement object oriented concepts

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Create simple programs using classes and objects in c++ and implement object oriented programs in c++
CO2	Implement object oriented programs using templates and exception handling mechanisms
CO3	Implement programs using STL

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	Exercise – 1 (Basics) a) Write a Simple Program on printing “Hello World” and “Hello Name” where name is the input from the user b) Write a C++ program to find both the largest and smallest number in a list of integers c) Write a C++ program to find the sum of individual digits of a positive integer	Input/output
2.	Exercise – 2 a) Write a program to implement call by value and call by reference using reference variable. b) Write a program to illustrate scope resolution, new and delete Operators.	Parameter passing techniques, Dynamic Memory Allocation
3.	Exercise – 3 a) Write a program illustrating Inline Functions b) Write a program illustrates function overloading. Write 2 overloading functions for power. c) Write a program illustrates the use of default arguments for simple interest function.	Functions
4.	Exercises –4 a) Write a program for illustrating Access Specifiers public, private, protected b) Write a program implementing Friend Function	Access Specifiers

	c) Write a program to illustrate this pointer	
5.	Exercise -5 a) Write a program to Overload Unary, and Binary Operators as Member Function, and Non Member Function. b) Write a c ++ program to implement the overloading assignment = operator	Operator Overloading
6.	Exercise -6 a) Write C++ Programs and incorporating various forms of Inheritance <ul style="list-style-type: none"> i) Single Inheritance ii) Hierarchical Inheritance iii) Multiple Inheritances iv) Multi-level inheritance v) Hybrid inheritance b) Write a Program in C++ to illustrate the order of execution of constructors and destructors in inheritance	Inheritance
7.	Exercise -7 a) Write a program to illustrate runtime polymorphism b) Write a program illustrates pure virtual function and calculate the area of different shapes by using abstract class.	Polymorphism
8.	Exercise -8 a) Write a C++ Program to illustrate template class b) Write a Program to illustrate class templates with multiple parameters c) Write a Program to illustrate member function templates	Templates
9.	Exercise -9 a) Write a Program to implement List and List Operations. b) Write a Program to implement Vector and Vector Operations. c) Write a Program to implement Deque and Deque Operations. d) Write a Program to implement Map and Map Operations. e) Write a Program to implement set and set Operations.	STL
10.	Exercise -10 a) Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly. b) Write a Program to Demonstrate the Catching of All Exceptions.	Exception Handling

Text Books:

1. The Complete Reference C++, Herbert Schildt, TMH.
2. Programming in C++, Ashok N Kamathane, Pearson 2nd Edition.

Reference Books:

1. Object Oriented Programming C++, Joyce Farrell, Cengage.
2. C++ Programming: from problem analysis to program design, DS Malik, Cengage Learning.
3. Computer Programming with C++, kunalPimparkhede, cambridge

I Year – I Semester**APPLIED PHYSICS LAB**

1000201212

L T P C**0 0 3 1.5****COURSE OBJECTIVES:**

To study the interference, diffraction patterns and characteristics of PN, Zener, thermistor, laser, optical fiber, solar cells and semiconductors. Apply the analytical techniques and graphical analysis to the experimental data.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Demonstrate the formation Newton's rings, diffraction pattern using grating
CO2	Analyze the voltage vs. current characteristics of PN, Zener diode and solar cell
CO3	Study the characteristics of Laser, optical fiber and thermistor
CO4	Identify the type of semiconductor and estimation of carrier concentration

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Newton's rings	Determination of radius of curvature of the lens
2	Interference by wedge shaped film using thin wire	Determination of thickness of a thin wire
3	diffraction by grating	Determination of wavelength of light
4	Laser light diffraction by grating	Determination of wavelength of laser light
5	Laser beam divergence	Determination of laser beam divergence and spot size
6	Numerical aperture of optical fiber	Determination of numerical Aperture of optical fiber
7	Bending losses of Optical fibers	Determination of bending losses of optical fiber
8	Hall effect	Identification of semiconductor type and determination of Hall coefficient and carrier concentration

9	Thermistor characteristics	Determination of temperature coefficient of given thermistor
10	pn junction diode	Study of V-I characteristics of pn junction diode
11	Zener diode	Determination of breakdown voltage of Zener diode
12	solar cell	Study of V-I characteristics of solar cell

Text Books:

1. C.L. Arora, Practical physics, S. Chand Publication
2. B.L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House

Reference Books:

1. P.K. Mittal, N. H. Ayachit, Engineering Physics: With Laboratory Manual, Wiley India.

Course Code	WEB DESIGN LAB	L	T	P	C
1005201211		0	0	3	1.5

COURSE OBJECTIVES:

1. To understand computer programming and application software, package/ suites.
2. Design static web application development and Students will gain the skills and front designs.
3. Able to get project based experience needed for entry into web application and development careers.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the usage and designing of web pages using HTML & CSS
CO2	Able to design the user interactive pages and web page layouts
CO3	Analyze a given problem and apply requisite appropriate tools for designing interactive web applications

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	Exercise – 1 Design Web page to illustrate the following <ul style="list-style-type: none"> • Title of web page • Heading styles • Various Text formatting tags 	Web Page Design
2.	Exercise – 2 Design Web page to illustrate the following <ul style="list-style-type: none"> • Apply font tag to the text • Upload and resize the image • Implement Image maps 	Web Page Design
3.	Exercise – 3 Design Web page to illustrate the following <ul style="list-style-type: none"> • Various List types • Display the class time table using table tag 	Web Page Design
4.	Exercise – 4 Design Web page to illustrate the following <ul style="list-style-type: none"> • Web page navigation (self and new page) • Implement image as web page navigation 	Web Page Design
5.	Exercise – 5	CSS

	Implement the various CSS <ul style="list-style-type: none"> • Inline CSS • Internal CSS • External CSS 	
6.	Exercise – 6 Design the Login and Registration forms and apply CSS	Web Page Design
7.	Exercise – 7 Java script to implement decision control and loop statements	Web Page Design
8.	Exercise – 8 Java script to implement functions concepts	Scripting
9.	Exercise – 9 Login form validation using java script	Validation
10.	Exercise – 10 Working with get and post method mechanism to interact server using PHP script	Web Page Design

Text Books:

1. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrell, Gosselin, Zak, Karparhi, MacIntyre, Morrissey, Cengage

Reference Books:

1. Web Technologies, HTML< JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning

Course Code	CONSTITUTION OF INDIA	L	T	P	C
1000201121	(Audit Course)	2	0	0	0

COURSE OBJECTIVES:

To provide basic information about Indian constitution. To identify individual role and ethical responsibility towards society. Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the importance of constitution, fundamental rights and duties
CO2	Understand the structure of executive, legislature and judiciary
CO3	Understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
CO4	Understand the central and state relation financial and administrative.

UNIT- I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties

LEARNINGOUTCOMES: After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT- II

.Union Government and its Administration Structure of the Indian Union. President: Role, power and position, PM and Council of ministers, ,LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High course

UNIT- III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariate

UNIT- IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role - CEO of Municipal Corporation PachayatiRaj: Functions ZilaPanchayat, CEO ZilaPanchayat

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Evaluate ZillaPanchayat block level organisation

UNIT- IV

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission;

LEARNING OUTCOMES:-After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission

Evaluate various commissions of viz SC/ST/OBC and women

Text Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E Resources

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details

www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

II Year- I Semester

II Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000202100	Discrete Mathematical Structures	3	1	0	3
2	1005201203	Data Structures	3	0	0	3
3	1005202100	Java Programming	3	0	0	3
4	1005202101	Operating Systems	3	0	0	3
5	1099202100	Managerial Economics & Financial Analysis	3	0	0	3
6	1005201212	Data Structures Lab	0	0	3	1.5
7	1005202110	Java Programming Lab	0	0	3	1.5
8	1005202111	Operating Systems Lab	0	0	3	1.5
9	1012202180	R Programming	0	0	4	2
10	1000202120	Life Skills	2	0	0	0
Total Credits						21.5

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code 1000202100	DISCRETE MATHEMATICAL STRUCTURES (Common for CSE, IT and AI&DS)	3	1	0	3

COURSE OBJECTIVES:

1. To introduce the algorithmic approach to the solution of problems, which is fundamental in discrete mathematics and this approach reinforces the close ties between this discipline and the area of computer science.
2. To introduce basic logical connectives and inference theory.
3. To Familiarize closed form solution of linear recurrence relations by various methods.
4. To perform the operations associated with sets, functions and relations.
5. To bring awareness of basic concepts of graphs and explaining related algorithms.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Develop reasoning skills using Mathematical Logic concepts.
CO2	Evaluate the solutions for various problems using recurrence relations.
CO3	Construct Hasse diagrams and Understand the concept of Algebraic Structures.
CO4	Apply the concepts of graph theory for a given problem.

UNIT- I

MATHEMATICAL LOGIC

[12 HOURS]

Propositional Logic: Connectives- negation, conjunction, disjunction, conditional and bi-conditional, well-formed formulae, tautologies, equivalence of formulae, tautological implications, Disjunctive and Conjunctive normal forms, Rules of inference and examples, Consistency of premises.

Predicative Logic.: Statement Functions, Variables and Quantifiers, Free and Bounded variables, Inference theory for predicative logic.

UNIT- II

RECURRENCE RELATIONS

[8 HOURS]

Recurrence relations: Recurrence relations, solving homogeneous linear recurrence relations by characteristic roots method, solving non-homogeneous linear recurrence relations.

UNIT- III

SETS, RELATIONS AND ALGEBRAIC STRUCTURES

[12 Hours]

Sets: Sets, Operations on Sets, Principles of Inclusion–Exclusion, Pigeonhole Principle and its Application

Relations: Definition, representation, types of relations: equivalence relation, equivalence class, partial order, Hasse Diagram and total order relations.

Functions: Definition, types of functions: surjective, injective and bijective.

Algebraic Structures: Binary operations, Algebraic structures, Group, Abelian Group, Subgroups, Lagrange's theorem on finite groups.

UNIT- IV

GRAPH THEORY

[10 HOURS]

Graph theory: Definitions, finite and infinite graphs, incidence and degree, isolated and pendant vertices, isomorphism, sub graphs, connected and disconnected graphs, simple graph, complete graph, bipartite graph, complete bipartite graph, planar graph, Isomorphic Graphs, Euler formula (without proof) and Graph colouring, Walk, path and circuit, Euler graph, Hamiltonian Graph.

UNIT- V

TREES

[10 HOURS]

Trees: Some properties of trees, rooted and binary trees, spanning trees, BFS & DFS Algorithms, Minimal spanning trees, Kruskal's algorithm.

TEXTBOOKS:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
3. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for computer scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

REFERENCE BOOKS:

1. S. Santha and E. V. Prasad Mathematical Foundation for Computer Science, Cengage, 2017.
2. Discrete Mathematical Structures, Bernard Kolman, Robert C. Bus by, Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
4. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw.

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005201203	Data Structures	3	0	0	3

COURSE OBJECTIVES:

1. Basics of data structures including their fundamentals building blocks: arrays and linked list.
2. To solve problems using linear data structures such as linear lists, stacks, queues.
3. To solve problems using searching and sorting techniques.
4. To be familiar with non-linear data structures such as trees.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Apply the C language Concepts: Pointers, Structures, Unions and recursion to solve the problems
CO2	Implement Standard Data Structures like Stack, Queue, List, Trees and Graphs
CO3	Choose appropriate data structure while building new application
CO4	Explain the need for data structuring techniques

UNIT- I

ARRAYS AND LINKED LISTS

The Abstract Data Type (ADT), Dynamic allocation of Arrays, Representation of multidimensional Arrays. Single Linked List, Polynomials, Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Sparse Matrices, Sparse Matrix Representation, Doubly Linked Lists. **[8 Hours]**

UNIT-II

STACKS AND QUEUES

The Stack, Stacks using Dynamic Arrays, Recursion, Linked Stacks, The Queue, Linked Queues, Circular Queues using Dynamic Arrays, De-queue. Application of stacks and queues, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix, Towers Of Hanoi Problem. **[8 Hours]**

UNIT-III

SEARCHING AND SORTING

Searching: Linear Search, Binary Search.

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort **[8 Hours]**

UNIT-IV

TREES:

Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Trees, Binary Tree Representations, Binary Tree Traversals: Inorder Traversal, Preorder Traversal, Postorder Traversal, Binary Search Trees: Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree .

[10 Hours]

UNIT-V

GRAPHS:

The Graph Abstract Data Type, Introduction, Definition, Graph Representation, Elementary Graph Operation- Depth First Search, Breadth First Search, Connected Components, Spanning Trees, Biconnected Components, Minimum Cost Spanning Trees- Kruskal's Algorithm, Prim's Algorithm, Shortest Paths and Transitive Closure, Single Source/All Destination, All-Pairs Shortest Path.

[10 Hours]

Text Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, S.Sahni, Andrews Freed, University Press (India). Second Edition.
2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.

Reference Books:

1. Classic Data Structures, Debasis Samanta, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition

E-Books:

1. <https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf>
2. <https://vardhaman.org/wp-content/uploads/2018/12/Data%20Structures.pdf>
3. <https://www.ncertbooks.guru/data-structures/>

NPTEL/MOOC:<https://nptel.ac.in/courses/106/102/106102064/>

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005202100	Java Programming	3	0	0	3

COURSE OBJECTIVES:

1. Implementing program for user interface and application development using core java principles.
2. Comprehension of java programming constructs, control structures in java.
3. Implementing object-oriented constructs such as various class hierarchies, interfaces and exception handling.
4. Understanding of thread concepts and I/O in java.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Use the Java programming language for various programming technologies.
CO2	Develop software in the Java programming language.
CO3	Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
CO4	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.

UNIT- I

INTRODUCTION TO OOPS

Introduction to object-oriented programming -principles of object-oriented languages - procedural languages Vs. OOPs -applications of OOPs -java features - JVM -program structures -Variables -primitive data types –identifiers -naming conventions –keywords –literals – operators –binary -unary and ternary –expression -precedence rules and associativity -primitive type conversion and casting, flow of control.

[6 Hours]

UNIT-II

PROGRAMMING CONSTRUCTS

Arrays-one dimensional and multidimensional -command line arguments. Introducing classes – class fundamentals –methods -objects -constructors –this keyword –garbage collection-Nested Classes – Polymorphism.

[8 Hours]

UNIT-III

INHERITANCE, INTERFACE AND EXCEPTIONS

Types of inheritance-Super and Final -Interface-Abstract Classes- Interface vs Abstract classes - Packages-Creating Packages -access protection - Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions. **[8 Hours]**

UNIT-IV

MULTITHREADING AND I/O

Threads -Thread Life Cycle-Thread priority –multithreading –Synchronization -suspending and resuming threads -communication between threads. Java I/O streaming –filter and pipe streams. **[8 Hours]**

UNIT-V

COLLECTION FRAMEWORKS

Collection Framework in Java –Introduction to Java Collections, Overview of Java Collection frame work, Generics, commonly used Collection classes–Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calendar and Properties. **[10 Hours]**

Text Books:

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

Reference Books:

1. Head First Java, Author – Kathy Sierra & Bert Bates, Latest Edition – 2nd Edition, Publisher – Shroff/O'Reilly
2. Effective Java, Author – Joshua Bloch, Latest Edition – 3rd Edition, Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016 by R. Nageswara Rao

E-Books:

<https://docs.oracle.com/en/java/>

NPTEL/MOOC:

<https://nptel.ac.in/courses/106/105/106105191/>

https://onlinecourses.nptel.ac.in/noc20_cs85/preview

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005202101	Operating Systems	3	0	0	3

COURSE OBJECTIVES:

1. Study the basic concepts and functions of operating systems.
2. Understand the structure and functions of OS.
3. Learn about Processes, Threads and Scheduling algorithms.
4. Understand the principles of concurrency and Deadlocks.
5. Learn various memory management schemes.
6. Study I/O management and File systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Summarize various concepts of Operating Systems
CO2	Implement and Apply Process Scheduling Algorithms
CO3	Illustrate concepts of Paging, Segmentation and Apply Concurrency, Deadlock Mechanisms in real world
CO4	Analyze the concepts of file systems in operating systems

UNIT- I

INTRODUCTION TO OPERATING SYSTEM CONCEPT

Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types. **[8 Hours]**

UNIT-II

PROCESS MANAGEMENT

Process concept, The process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Inter process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms. **[8 Hours]**

UNIT-III

MEMORY MANAGEMENT

Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation.

VIRTUAL MEMORY MANAGEMENT

Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing **[10 Hours]**

UNIT-IV

CONCURRENCY

Process Synchronization, The Critical- Section Problem, SynchronizationHardware, Semaphores, Classic Problems of Synchronization, Monitors, SynchronizationExamples.

[8 Hours]

UNIT-V

FILE SYSTEM INTERFACE

The concept of a file, Access Methods, Directory structure, File system mounting, files sharing, protection. File System implementation- File system structure, allocation methods, free-space management Mass-storage structure overview of Mass-storage structure, Disk scheduling, Device drivers. Introduction to Dockers.

[10 Hours]

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley,2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education”, 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhare, Second Edition, TataMc Graw-Hill Education, 2007.

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code 1099202100	Managerial Economics & Financial Analysis (MEFA)	3	0	0	3

Course Overview: The present course is designed in such a way that it gives an overview of concepts of Economics. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Financial Analysis gives clear idea about concepts, conventions and accounting procedures along with introducing students to fundamentals financial statements. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning.

Course Objectives:

1. Understand the concepts of managerial economics and the market dynamics namely Demand, Elasticity of demand and pricing in different market structures.
2. Acquire the knowledge about production theories and cost analysis besides dealing with the production and factors of production.
3. Analyze the different market structures and understand various pricing methods which are adopted in attracting the customers under different markets.
4. To provide the basic knowledge on financial accounting
5. To understanding Capital budgeting decisions.

Course Outcomes:

Cos	Course outcome
CO1	Analyze the Demand, Price and Cost.
CO2	Identify the Nature of different markets
CO3	Understand Various Business Forms
CO4	Evaluate investment project proposals

Unit-I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand, Demand schedule, Demand curve - Law of Demand and its Exceptions- Elasticity of Demand & Its types - Demand forecasting and Methods of forecasting.

Unit-II

Production and Cost Analysis: Concept of Production function- Cobb-Douglas Production function – Leontief production function, Production Function with One variable Input, Two Variable Inputs and Concept of Returns to scale -economies of scale, Different cost concepts – Cost –Volume-Profit (CVP) analysis (simple problems)

Unit-III

Part-I: Introduction to Market Structures and pricing methods: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly- Features – Price and Output Determination, Significance of Pricing and various methods of pricing with contemporary examples

Part-II: Introduction to Business: Features, Merits and Demerits - Sole Trader, Partnership, Joint Stock Company – Public Enterprises – Business Cycles: Meaning and Features – Phases of Business Cycle.

Unit-IV

Introduction to Financial Accounting: Systems of Book-keeping, Golden rules of Accounting, Accounting Principles, Accounting Cycle- Journal, Ledger, Trail Balance, Preparation of Trading-Account, P&L Account and Balance Sheet (Simple Problems)

Unit-V

Capital and Capital Budgeting Decisions: Introduction to Capital, Classification of Capital, Time value of money. Types of Capital Budgeting Decisions: Traditional Methods (Payback period, Accounting rate of return) and Modern methods (Net Present Value method, Internal Rate of Return Method and Profitability Index Method) (Simple Problems)

Text Books:

1. M.Kasi Reddy & Saraswathi, “Managerial Economics and Financial Analysis”, PHI Publications, New Delhi, 10th Revised Edition, 2012.
2. Varshney & Maheswari, “Managerial Economics”, Sulthan Chand Publishers, 1st Revised Edition, 2009.
3. S.N. Maheshwari & S.K. Maheshwari, “Financial Accounting”, Vikas Publication House Pvt.Ltd, 4th Edition, 2012.

Reference Books:

1. D.N. Dwivedi, “Managerial Economics”, Vikas Publication House Pvt.Ltd, 2nd Edition, 2012.
2. R.Narayana Swamy, “Financial Accounting- A managerial Perspective”, Pearson publications, 1st Indian Reprint Edition, 2012.
3. J.V.Prabhakar Rao & P.V.Rao, “Managerial Economics & Financial Analysis”, Maruthi Publishers, 1st Revised Edition, 2011

NPTEL/SWAYAMMOOCS:

1. https://onlinecourses.swayam2.ac.in/imb19_mg08/preview
2. <https://www.coursera.org/learn/strategic-management>

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code 1005201212	Data Structures Lab	0	0	3	1.5

COURSE OBJECTIVES:

1. To develop skills to design and analyze simple linear and non-linear data structures
2. To Strengthen the ability to identify and apply the suitable data structure for the given real-world problem
3. To gain knowledge in practical applications of data structures

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Implement the programs on arrays and linked lists
CO2	Implement Standard Data Structures like Stacks and Queue
CO3	Analyze the time and space efficiency of the data structure be capable to identity the appropriate data structure for given problem
CO4	Have practical knowledge on the application of data structures

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	Exercise – 1 a) Write a program to implement dynamic arrays b) Write a program to implement sparse matrices using arrays	Arrays
2	Exercise – 2 Write a program to implement a Single Linked List and its operations.	Single Linked List
3.	Exercise – 3 Write a program to implement a Doubly Linked List and its operations.	Doubly Linked List
4.	Exercise – 4 Write a program to implement the following using arrays and linked list	Linear Data Structures

	a) Stack b) Queue	
5.	Exercise – 5 Write a program to do the following a) Infix to postfix conversion. b) Evaluation of postfix expression.	Applications of Stack
6.	Exercise – 6 Write a program to implement: a) Linear Search b) Binary Search	Searching Strategies
7.	Exercise – 7 Develop a Program to find number of comparisons and swapping for a given list of numbers a) Bubble Sort b) Selection Sort	In-Place Sorting techniques
8.	Exercise – 8 Write a program for the following a) Merge Sort b) Quick Sort	Divide and Conquer
9.	Exercise – 9 a) Write a program that use non-recursive functions to traverse the given binary tree in i. Pre-order ii. In-order iii. Post-order. b) Implementation of Binary Search trees.	Trees
10.	Exercise – 10 Write a program for the following modules a) To implement Prim's algorithm to generate a min-cost spanning tree. b) To implement Kruskal's algorithm to generate a min-cost spanning tree. c) To implement Dijkstra's algorithm to find shortest path in the graph. d) Implement Depth First Search	Graphs

Text Books:

1. Fundamentals of Data structures in C, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press, Pvt. Ltd.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition

Reference Books:

1. Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition.

II Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005202110	Java Programming Lab	0	0	3	1.5

COURSE OBJECTIVES:

1. Implementing program for user interface and application development using core java principles.
2. Comprehension of java programming constructs, control structures in java.
3. Implementing object-oriented constructs such as various class hierarchies, interfaces and exception handling.
4. Understanding of thread concepts and I/O in java
5. To understand computer programming and application software, package/ suites.

CO's	At the end of the course, the student will have the ability to:
CO1	Use the Java programming language for various programming technologies.
CO2	Develop software in the Java programming language.
CO3	Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
CO4	Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	Exercise – 1 (Basics) a) Write a JAVA program to display default value of all primitive data type of JAVA b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root. c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers. d) Write a case study on public static void main (250 words)	Basic Programming

2.	Exercise – 2 a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort. c) Write a JAVA program to sort for an element in a given list of elements using merge sort. d) Write a JAVA program using String Buffer to delete, remove character.	Sorting
3.	Exercise – 3 a) Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method. b) Write a JAVA program to implement constructor	Constructor
4.	Exercises –4 a) Write a JAVA program to implement constructor overloading. b) Write a JAVA program implements method overloading.	Constructor Overloading
5.	Exercise -5 a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi-level Inheritance c) Write a java program for abstract class to find areas of different shapes	Inheritance
6.	Exercise -6 a) Write a JAVA program give example for “super” keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?	Programming using “super” Keyword
7.	Exercise -7 a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses	Exception Handling
8.	Exercise -8 a) Write a JAVA program that implements Runtime polymorphism b) Write a Case study on run time polymorphism, inheritance that implements in above problem	Runtime Polymorphism

9.	Exercise -9 a) Write a JAVA program for creation of Illustrating throw b) Write a JAVA program for creation of Illustrating finally c) Write a JAVA program for creation of Java Built-in Exceptions d) Write a JAVA program for creation of User Defined Exception. e) Write a Program to implement set and set Operations.	Exceptions
10.	Exercise -10 a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning” every 1 sec, the second thread displays “Hello” every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable) b) Write a program illustrating is Alive and join c) Write a Program illustrating Daemon Threads.	Threads
11.	Exercise -11 a) Write a JAVA program for Producer Consumer Problem b) Write a case study on thread Synchronization after solving the above producer consumer problem	Synchronization
12.	Exercise -12 a) Write a JAVA program illustrates class path b) Write a case study on including in class path in your os environment of your package. c) Write a JAVA program that import and use the defined your package in the previous Problem	Package
13.	Exercise -13 a) What is the difference between List and Set? Implement a Program to show the differences. b) What is the difference between HashSet and TreeSet? Implement a Program to show the differences. c) What is the difference between Set and Map? Implement a Program to show the differences.	Set and Map

Text Books:

1. The complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
3. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson.

Reference Books:

1. Head First Java, Author – Kathy Sierra & Bert Bates, Latest Edition – 2nd Edition, Publisher – Shroff/O'Reilly
2. Effective Java, Author – Joshua Bloch, Latest Edition – 3rd Edition, Publisher – Addison Wesley
3. Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 Paperback – 1 January 2016 by R. Nageswara Rao

II Year – I Semester	Operating Systems Lab	L	T	P	C
Course Code: 1005202111		0	0	3	1.5

COURSE OBJECTIVES:

1. To provide an understanding of the design aspects of operating system.
2. To provide practical knowledge on the different concepts of operating systems.
3. To familiarize students with the Linux environment.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Stimulate CPU scheduling algorithms in operating system.
CO2	Evaluate memory management techniques in operating system.
CO3	Implement page replacement algorithms in operating system
CO4	Implement file allocation strategies used in operating system.

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	Exercise -1 Study of Unix/Linux general purpose utility command list man,who,cad, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.	Unix/Linux Commands
2.	Exercise – 2 Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority	CPU Scheduling
3.	Exercise – 3	Multi

	Simulate MVT and MFT	Programming
4.	Exercise – 4 Simulate Bankers Algorithm for Dead Lock Avoidance	Dead Lock Avoidance
5.	Exercises –5 Simulate Bankers Algorithm for Dead Lock Prevention	Dead Lock Prevention
6.	Exercise -6 Simulate all page replacement algorithms. FIFO b) LRU c) LFU	Page Replacement
7.	Exercise -7 Simulate all File allocation strategies a) Sequenced b) Indexed c) Linked	File Allocation
8.	Exercise -8 C program to emulate the UNIX ls -l command.	ls -l command
9.	Exercise -9 C program that illustrates how to execute two commands concurrently with a command pipe.	Command Pipe
10.	Exercise -10 C program that illustrates two processes communicating using shared memory	Shared Memory

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education", 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhare, Second Edition, TataMc Graw-Hill Education, 2007.

II Year – I Semester	R-Programming (Skill Oriented Course)	L	T	P	C
Course Code: 1012202180		0	0	4	2

Course Description:

R is rapidly becoming the leading language in data science and statistics. Today, R is the tool of choice for data science professionals in every industry and field. This Statistics with R programming course will help you master the Programming with R in five Sections. It covers the basic syntax, making you ready to undertake your own first data analysis using R. Starting from variables and basic operations, you will eventually learn how to handle data structures such as vectors, matrices, data frames and lists. In the final section, you will dive deeper into the graphical capabilities of R, and create your own stunning data visualizations and data perform various analysis of Regression models in Linear and Non-Linear.

Course outcomes:

CO'S	Course outcome
CO1	Understand the R workspace and Programming with R
CO2	Access online resources for R and import new function packages into the R workspace
CO3	Apply math functions to calculate probability and statistical distributions and knowledge on Graphics in data visualization.
CO4	Understand and use linear, non-linear regression models, and classification techniques for data analysis

LIST OF EXPERIMENTS

i. Study of data analysis using MS-Excel (Prerequisite)

1. Study of basic Syntaxes in R

2. Implementation of vector data objects operations

3. Implementation of matrix, array and factors and perform va in R

4. Implementation and use of data frames in R

5. Create Sample (Dummy) Data in R and perform data manipulation with R

6. Study and implementation of various control structures in R
7. Data Manipulation with dplyr package
8. Data Manipulation with data.table package
9. Study and implementation of Data Visualization with ggplot2
10. Study and implementation data transpose operations in R

Text Books:

1. The Art of R Programming, Norman Matloff, Cengage Learning
2. R for Everyone, Lander, Pearson

Reference Books:

1. R Cookbook, Paul Teetor, O'Reilly.
2. R in Action, Rob Kabacoff, Manning

II Year – I Semester	LIFE SKILLS (Audit Course)	L	T	P	C
Course Code 1000202120		2	0	0	0

COURSE OBJECTIVE:

The students will be able to build self-confidence, encourage critical thinking, foster independence and help people to communicate more effectively.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Build Self Confidence and Interpersonal and Intrapersonal relationships.
CO2	Practice Emotional Competency while communicating with others
CO3	Gain Intellectual Competency by practicing ethics and morals

UNIT1: LIFE SKILLS: Positive Attitude and Positive Work Ethics, Time Management, Goal Setting: Short term, Long Term. (Activity has to be conducted)

UNIT2: EMOTIONAL INTELLIGENCE: Self Awareness through Johari Window and SWOT analysis (Activity has to be conducted)

UNIT3: PROBLEM SOLVING SKILLS: Critical Thinking and Brain Storming, Creative Thinking, Conflict Management. (Activity has to be conducted)

UNIT4: PUBLIC SPEAKING: Body Language, presentation skills, impromptu presentation, interviewing others. (Activity has to be conducted)

UNIT 5: NPTEL Course/ Coursera /Any relevant Certificate Course has to be done

Assessment: In order to clear internal assessment, the student has to submit Project Report and give Presentation on all the activities he/she has done during the course. The student has to do a certificate course also. (Presentation, Project Report and Certificate in total will be the criteria for the assessment)

References:

- Barun K. Mitra; (2011), “Personality Development & Soft Skills”, First Edition; Oxford Publishers.
- Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
- Larry James (2016); “The First Book of Life Skills”; First Edition; Embassy Books.
- Shalini Verma (2014); “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company
- John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc.

II Year- II Semester

II Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1000202102	Probability and Statistics	3	0	0	3
2	1005202200	Database Management Systems	3	0	0	3
3	1005202201	Advanced Data Structures	3	0	0	3
4	1012202100	Python Programming	3	0	0	3
5	1012202201	Automata Theory and Compiler Design	3	0	0	3
6	1005202210	Database Management Systems Lab	0	0	3	1.5
7	1005202211	Advanced Data Structures Lab	0	0	3	1.5
8	1012202110	Python Programming Lab	0	0	3	1.5
9	1012202260	EPICS - Engineering Projects in Community Service	0	0	2	1
10	1020202100	Employability Readiness Program	1	0	2	2
11	1000202121	Environmental Science	2	0	0	0
Total Credits						22.5
MANDATORY SUMMER INTERNSHIP						
12	1012202250	Data Preparation and Analysis	4	0	0	4

II Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code 1000202102	PROBABILITY AND STATISTICS (Common for ECM, CSE & IT)	3	0	0	3

COURSE OBJECTIVES:

1. To explain fundamental concepts of probability theory and random variables.
2. To develop an understanding of the role of discrete and continuous probability distributions in science and engineering.
3. The basic ideas of statistical methods of studying data samples.
4. To impart statistical methods in various applications Engineering

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the notion of random variable and evaluate the expected value and probability of random variables.
CO2	Apply Binomial, Poisson, Normal, gamma and Weibull distributions for real data to compute probabilities, theoretical frequencies.
CO3	Evaluate the confidence levels and maximum error for large and small samples, Apply the concept of hypothesis testing for large and small samples in real life situations to draw the inferences and estimate the goodness of fit.
CO4	Examine correlation for the bi-variate data and fit the different curves using principle of least squares and to predict the regression analysis.

UNIT- I

RANDOM VARIABLES:

[8 Hours]

Review on Probability, Random experiment, sample space, events, Random variable, Discrete and Continuous variables, mathematical expectation and properties of Moment generating Functions (Without proof).

UNIT- II

DISTRIBUTIONS:

[10 Hours]

Binomial, Poisson distributions (MGF, Mean and Variance without proofs), Normal distribution (MGF, area and symmetric properties without proofs) -related properties, Gamma and Weibull distributions.

UNIT- III

SAMPLING DISTRIBUTIONS:

[10 Hours]

Introduction, Population and samples, Sampling distribution of mean for large and small samples (with known variance), proportion - Point and interval estimators for means and proportions (for large and small samples), Maximum error.

UNIT- IV

TESTING OF HYPOTHESIS

[14 Hours]

Introduction, Null and alternative hypothesis, Type I and Type II errors, one tail, two-tail tests, Level of Significance. Tests concerning means, proportions and their differences using Z-test. Student's t-test, F-test and χ^2 test of goodness of fit and independence of attributes.

UNIT- V

CORRELATION & CURVE FITTING

[10 Hours]

Introduction, simple correlation, regression, fitting of straight-line, second-degree curves, exponential and power curves by method of least squares.

TEXTBOOKS:

1. Probability & Statistics for Engineers, Miller & John E. Freund, Prentice Hall of India.
2. Probability & statistics for Engineers and Scientists; R.E. Walpole, S.L. Myers Pearson

REFERENCE BOOKS:

1. Fundamentals of Applied Statistics; S.C. Gupta & V.K. Kapoor S. Chand & Sons, Cengage.

II Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005202200	Database Management Systems	3	0	0	3

COURSE OBJECTIVES:

1. Provide students with theoretical knowledge and practical skills in the use of database and database management systems in information technology applications.
2. The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Describe ER model and normalization for database design.
CO2	Create, maintain and manipulate a relational database using SQL.
CO3	Design and build database system for a given real world problem.
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions.

UNIT- I

Introduction to Database Systems, File System Vs DBMS, Advantages of DBMS, Structure of DBMS, Levels of Data Abstraction (Data Independence), Database Users and Administrators, Different Data Models.

E-R Model: Overview of Database Design, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model **[8 Hours]**

UNIT-II

Introduction to the Relational Model, Relational model constraints over relations. Relational Algebra and calculus **[8 Hours]**

UNIT-III

SQL Queries: The Form of Basic SQL Query, Union, Intersect and Except-Nested Queries- Aggregative Operators- Group By and Having Clauses-Null Values-Outer Joins.

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF),De-normalization.

[8 Hours]

UNIT-IV

Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing. **[8 Hours]**

UNIT-V

Query processing, Transaction Management, Concurrency Control and Crash recovery Transactions: Acid Properties of Transaction - Transaction States - Schedule: Serial Schedule Concurrent Schedules - Anomalies Associated With Concurrent Schedules (RW WR - and WW Conflicts) -Serializability – Conflict Serializability - and View Serializability. Introduction to Lock Management-Lock Based Concurrency Control: 2pl-Strict 2pl Concurrency without Locking, Timestamp-Based Concurrency Control – Optimistic Concurrency Control. Introduction to ARIES - The Log - The Write-Ahead Log Protocol Check Pointing. **[8 Hours]**

Text Books:

1. Database System Concepts. 6/e Silberschatz, Korth, TMH
2. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA
2. The Database book principles & practice using Oracle/MySQLNarainGehani, University Press.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

II Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005202201	Advanced Data Structures	3	0	0	3

COURSE OBJECTIVES:

1. To be familiar with hashing and various overflow handling techniques
2. To emphasize the importance of dictionaries and Hashing for the faster retrieval
3. Develop effective digital search using tries
4. To implement M-way trees like B- Trees and B+ trees

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Implement Hashing and its collision resolution mechanisms.
CO2	Implement heaps, queues, binomial queues and their operations
CO3	Implement variants of Binary Search Trees like AVL, Red-Black Tree and Multiway search Trees
CO4	Illustration of tries which share some properties of table look up, various issues related to the design of file structures

UNIT- I
HASHING:

Dictionary ADT, Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic Hashing. **[8 Hours]**

UNIT-II
PRIORITY QUEUES:

Priority Queue ADT, Model, Simple Implementation, Binary Heap, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Heap Sort, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation- Implementation of Binomial Queues. **[8 Hours]**

UNIT-III
EFFICIENT BINARY SEARCH TREES:

Binary Search Tree, AVL Tree, Insertion into a AVL Tree, Deletion from a AVL Tree, Red-Black Trees, Definition, Representation of a Red- Black Tree, searching a Red-Black Tree, Inserting into a Red Black Tree, Deletion from a Red Black Tree. **[10 Hours]**

UNIT-IV
MULTIWAY SEARCH TREES:

M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree. **[8 Hours]**

UNIT-V

DIGITAL SEARCH STRUCTURES:

Digital Search Trees, Definition- Search, Insert and Delete- Binary tries and Patricia, Binary Tries, Compressed Binary Tries- Patricia, Multiway Tries- Definitions- Searching a Trie- Sampling Strategies- Insertion into a Trie- Deletion from a Trie- Keys with Different Length- Height of a Trie- Space Required and Alternative Node Structure- Prefix Search and Applications- Compressed Tries- Compressed Tries With Skip Fields- Compressed Tries With Labelled Edges- Space Required by a Compressed Tries. **[10 Hours]**

Text Books:

1. Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
2. Fundamentals of DATA STRUCTURES in C: 2nded, , Horowitz , Sahani, Anderson-freed, Universities Press
3. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson

Reference Books:

1. Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition
4. File Structures :An Object oriented approach with C++, 3rded, Michel J Folk, Greg Riccardi, Bill Zoellick
5. C and Data Structures: A Snap Shot oriented Treatise with Live examples from Science and Engineering, NB Venkateswarlu& EV Prasad, S Chand, 2010.

E-Books:

1. <https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf>
2. <https://vardhaman.org/wp-content/uploads/2018/12/Data%20Structures.pdf>
3. <https://www.ncertbooks.guru/data-structures/>
4. <http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures>
5. <http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms>
6. <http://lcm.csa.iisc.ernet.in/dsa/dsa.html>
7. http://utubersity.com/?page_id=878

NPTEL/MOOC:

<https://nptel.ac.in/courses/106/102/106102064/>

II Year – II Semester	Python Programming	L	T	P	C
Course Code: 1012202100		3	0	0	3

COURSE DESCRIPTION:

This course introduces computer programming using the Python programming language. This Python Programming course will help you master the Programming with Python by introducing the Object Oriented programming concepts, creation of Data Structures, Implementation of Functions, and Visualization libraries using the Python programming language. Lastly you will get into design, code, test, and debug Python programming Language Scripts.

COURSE OUTCOMES:

CO	Course outcomes
CO1	Install Python IDE and run basic Python scripts.
CO2	Understand the operators, functions, key Concepts of Object Oriented Programming in python.
CO3	Access Python from various online resources and import packages to the current working environment.
CO4	Understand file handling operations and implement ML/DS Libraries using in Python.

UNIT-I

Introduction: History of Python, Need of Python Programming, Applications, Basics of Python Programming, Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations..

Outcome:

- Understanding the Python IDE.
- Learn the basics building blocks of python.
- Write the basic programs in python

Activity: Install Python on PCs or through Mobile applications run basic Python Scripts for a given data.

UNIT-II

Control Flow- if, if-elif-else, for, while, break, continue, pass

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

Outcome

- Usage of different operators in conditional statements and flow of program.
- Understanding the sequences and dictionaries.

Activity

Identify Operators and types in Python. Implement Data Structure concepts by writing python Scripts.

UNIT-III

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules- Creating modules, import statement, from import statement, name spacing, Python packages-Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Outcome:

- Understanding Functions implementation in Python.
- Learn the scope or life time of variables in a function.
- Usage of import statement in modules.
- Create a package, import and install PIP package in python.

Activity/Event

Using Functions develop simple scripts in Python Programming.

UNIT-IV

Object Oriented Programming in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, and Data hiding.

Error and Exceptions: Difference between an Error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

Outcome:

- Implement the OOP concepts using python
- Understand the Exception handling in python.

Activity/Event

Implement OOP concepts in Writing Python Scripts

UNIT-V

Regular Expressions: Simple Meta characters, Character classes.

File handling: Python File(doc and csv) Operation Reading config files in python, Writing log files in python, Understanding read functions, Understanding write functions, Manipulating file pointer using seek, Programming using file operation.

Introduction to ML/DS Libraries: Introduction to NumPy, Pandas and Matplotlib

Brief Tour of the Standard Library:

Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Multithreading.

Outcome:

- Perform various Regular operation
- Perform various File handling operation
- Understand standard Libraries and GUI visualization in Python.

Activity/Event

Write various test cases and implement specific test for a given case study.

Text Books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

Reference Books:

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W. Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage
4. <http://nptel.ac.in/courses/117106113/34>
5. <https://www.python.org/>

II Year – II Semester	Automata Theory and Compiler Design	L	T	P	C
Course Code: 1012202201		3	0	0	3

COURSE OVERVIEW:

This course covers the main design practices and principles for the development of programming languages. This course covers the basic of finite automata and regular expressions. It also covers the analysis and synthesis phases of a language processor: lexical analysis, syntax analysis (top-down and bottom-up techniques), semantic analysis, runtime environments, error handling, intermediate code, code optimization, and final code generation.

COURSE OBJECTIVES:

1. Describes how a programming language works
2. How input is converted into output from the machine hardware level and various phases of compiler
3. Understanding the Language Semantics
4. Understanding the relation between the source code and generated machine code.

COURSE OUTCOMES:

CO's	Course outcome
CO1	Apply the basic concepts of Languages, operations of Languages, NFA, DFA and its conversions.
CO2	Identify the similarities and differences among various parsing techniques and will be able to solve problems related to Shift reduce parsing, compute FIRST and FOLLOW sets, LR(0), LR(1) and LALR sets of items and parse table for a given grammar
CO3	Demonstrate the ability to write syntax directed translations of simple statements and understand the working of procedure calls and use various storage allocation schemes for the better utilization of run time memory.
CO4	Apply various schemes for optimized code and will be able to write 3 addresses code and identify the basic blocks, draw flow graphs and represent directed Acyclic graphs for the identified basic blocks and also be able to write the target optimized code (assembly code) for the given three address code.

UNIT- I

Formal Language and Regular Expressions: Languages, operations on languages, regular expressions (re), Languages associated with (re), operations on (re), identity rules for (re), Finite Automata: DFA, NFA, Conversion of regular expression to NFA, NFA to DFA, Applications of Finite Automata to lexical analysis.

[8 Hours]

UNIT-II

Context Free grammars and parsing: Context free Grammars, Leftmost Derivations, Rightmost Derivations, Parse Trees, Ambiguity Grammars, Top-Down Parsing, Recursive Descent Parsers: LL (1) Parsers. Rightmost Parsers: Shift Reduce Parser, LR (0) Parser, SLR (1) Parser, LR (1) & LALR (1) Parsers, Ambiguous Grammars. **[8 Hours]**

UNIT-III

Syntax Directed Translation: Definitions, construction of Syntax Trees, S-attributed and L-attributed grammars, Intermediate code generation, abstract syntax tree, translation of simple statements and control flow statements.

Semantic Analysis: Semantic Errors, Chomsky hierarchy of languages and recognizers, Type checking, type conversions. **[10 Hours]**

UNIT-IV

Storage Organization: Storage Organization Issues, Storage Allocation Strategies, Scope, Access to Nonlocal Names, Parameter Passing, Dynamics Storage Allocation Techniques.

Code Optimization: Issues in the design of code optimization, Principal sources of optimization, optimization of basic blocks, Loop optimization, and peephole optimization. **[10 Hours]**

UNIT-V

Code Generation: Issues in the design of code Generation, Machine Dependent Code Generation, object code forms, Register allocation and assignment, DAG representation of basic Blocks, Generating code from DAGs. **[10 Hours]**

Text Books:

1. A Text Book on Automata Theory, Nasir S.F.B, P.K. Srimani, Cambridge university Press
2. Introduction to Automata Theory, Formal languages and computation, Shamalendukandar,
3. Compilers Principles, Techniques and Tools, Aho, Ullman, Ravi Sethi, PEA
4. Introduction to theory of computation, 2nd ed, Michel sipser, CENGAGE
5. Principles of Compiler Design, A.V. Aho .J. D. Ullman; PEA

Reference Books:

1. Theory of Computer Science, Automata languages and computation, 2/e, Mishra, Chandra Shekaran, PHI
2. Theory of Computation ,aproblem solving approach, kavi Mahesh, WileyIntroduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.MotwaniAnd J.D.Ullman, 3rd Edition, Pearson, 2008.

II Year – II Semester	Database Management Systems Lab	L	T	P	C
Course Code: 1005202210		0	0	3	1.5

COURSE OBJECTIVES:

1. To provide a sound introduction to the discipline of database management as a subject in its own right, rather than as a compendium of techniques and product-specific tools.
2. To familiarize the participant with the nuances of database environments towards information oriented data-processing oriented framework.
3. To give a good formal foundation on the relational model of data
4. To present SQL and procedural interfaces to SQL comprehensively
5. To give an introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand, appreciate and effectively explain the underlying concepts of database technologies
CO2	Design and implement a database schema for a given problem-domain
CO3	Normalize a database
CO4	Populate and query a database using SQL DML/DDL commands.

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	Exercise – 1 Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.	Creating Tables
2.	Exercise – 2 Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.	Queries

3.	Exercise – 3 Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.	Queries
4.	Exercise – 4 Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)	Queries using conversion functions
5.	Exercise – 5 Creation of a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found).	PL/SQL Programs
6.	Exercise – 6 Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.	Commit and Rollback
7.	Exercise – 7 Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.	Programs using Case
8.	Exercise – 8 Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.	Programs using Loops
9.	Exercise – 9 Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.	Procedures
10.	Exercise – 10 Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.	Stored Functions
11.	Exercise – 11 Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.	Package

12.	Exercise – 12 Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.	Cursors
13.	Exercise – 13 Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.	Triggers
14.	Exercise – 14 For a given set of relation tables perform the following: a. Creating Views b. Dropping Views c. Selecting from a View	Views

Text Books:

1. Database System Concepts. 6/e Silberschatz, Korth, TMH
2. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA
2. The Database book principles & practice using Oracle/MySql Narain Gehani, University Press.
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

II Year – II Semester	Advanced Data Structures Lab	L	T	P	C
Course Code: 1005202211		0	0	3	1.5

COURSE OBJECTIVES:

1. Describe and implement a variety of advanced data structures (hash tables, priority queues, balanced search trees, graphs).
2. Analyse the space and time complexity of the algorithms studied in the course.
3. Identify different solutions for a given problem; analyse advantages and disadvantages to different solutions

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To understand graph representations, Minimum Spanning Trees and traversals
CO2	Understand dictionaries, hashing mechanism which supports faster retrieval.
CO3	Implement heaps, queues and their operations, B Trees and B+ Trees
CO4	Illustration of tries which share some properties of table look up, various issues related to the design of file structures

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1.	a) Implementation of Static Hashing (Use Linear probing for collision resolution) b) Implement Huffman coding.	Hashing
2.	Write a program to implement AVL tree operations	Balanced BST
3.	Write a program to implement Red- Black tree operations	Balanced BST
4.	Write a program to implement Binomial queues	Binomial Queue
5.	Write a program to implement Heap Sort	Heap Sort
6.	Write a program to implement B- Tree	B-Tree
7.	Write a program to implement B+ Trees	B+ Tree
8.	Construct Tries for the implementation of English Dictionary and Perform Searching of a word in dictionary.	Tries

Text Books:

1. Fundamentals of Data structures in C, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press, Pvt. Ltd.
2. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition

Reference Books:

1. Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition.

II Year – II Semester	Python Programming Lab	L	T	P	C
Course Code: 1012202110		0	0	3	1.5

COURSE OBJECTIVES:

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

LIST OF EXPERIMENTS**Exercise 1- Basics**

- a) Running instructions in Interactive interpreter and a Python Script
- b) Write a program to purposefully raise Indentation Error and Correct it.

Exercise 2- Operations

- a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
- b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise 3- Control Flow

- a) Write a Program for checking whether the given number is a even number or not.
- b) Using a for loop, write a program that prints out the decimal equivalents of $1/2$, $1/3$, $1/4$, . . . , $1/10$
- c) Write a program using a for loop that loops over a sequence. What is sequence?
- d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

- a) Find the sum of all the primes below two million.
Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:
1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...
- b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 - DS

- a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure. Eg: hello -> {"h":1,"e":1,"l":2,"o":1}
- b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

- a) Write a program combine lists that combines these lists into a dictionary.
- b) Write a program to count frequency of characters in a given file.

Exercise -7 Functions

- a) Write a function ball collide that takes two balls as parameters and computes if they are colliding.

Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius

If (distance between two balls centers) \leq (sum of their radii) then (they are colliding)

b) Find mean, median, mode for the given set of numbers in a list.

Exercise - 8 Functions - Continued

a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.

b) Write a function dups to find all duplicates in the list.

c) Write a function unique to find all the unique elements of a list.

Exercise - 9 - Functions - Problem Solving

a) Write a function cumulative product to compute cumulative product of a list of numbers.

b) Write a function reverse to reverse a list. Without using the reverse function.

c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise 10 - Multi-D Lists

a) Write a program that define and print a matrix.

b) Write a program to perform addition of two square matrices.

c) Write a program to perform multiplication of two square matrices.

Exercise - 11 - Modules

a) Using PIP install packages requests, flask and explore them.

b) Write a script that imports requests and fetch content from the page. Eg.(Wiki).

c) Write a simple script that serves a simple HTTP Response and a simple HTML Page.

Write various test cases and implement specific test for a given case study.

Exercise - 12 OOP

a) Class variables and instance variable and illustration of the self-variable

i) Robot.

ii) ATM Machine.

Exercise - 13 Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 14 File access

a) Create a CSV file (roll no, subject1, subject2, subject 3) with 100 rows. All the marks randomly generated having range (0-100), roll no are having range (1-100)

b) Read the above CSV file having(roll no,subject1, subject2,subject 3) and create new CSV (roll no,subject1, subject2,subject 3, average marks)

Exercise – 15 Introduction to ML/DS Libraries

a) Write a program to represent 2 – dimensional matrix using NUMPY and perform basic operations like addition, multiplication, transpose.

b) Develop a student dataset using PANDAS and perform some basic operations. Visualize the above student dataset using MATPLOTLIB

II Year – II Semester	Employability Readiness Program (Skill Oriented Course)	L	T	P	C
Course Code: 1020202100		1	0	2	2

COURSE OBJECTIVES

1. To enhance the problem solving skills in the area of ‘Quantitative Aptitude’ this will enable the students to achieve in-campus placements and competitive examinations.
2. To improve the logical thinking capability of students by enhancing the skills in Reasoning.
3. To encourage the all-round development of students by focusing on verbal ability.
4. To perform better during Campus Recruitment and various interviews they face in their career.

COURSE OUTCOMES

CO	At the end of the course, the student will have the ability to:
CO1	Follow strategies in minimizing time consumption in problem solving and apply shortcut methods to solve problems and confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.
CO2	Apply various methods of solving a problem by analysing the concept and situation effectively.
CO3	Communicate effectively with improved vocabulary and able to write e-mails, essays and resumes appropriately.
CO4	Succeed in professional and personal life by applying all mathematical, reasoning and verbal skills.

Part-A**No. of lecture hours: 25****Aptitude**

Number System: Speed Maths, Numbers, Factors, Prime & Co-Primes, LCM, HCF, Divisibility rules, finding unit place digit and last two digits of an expression.

Averages and Ages: Average of different groups, change in averages by adding, deleting and replacement of objects, problems on ages.

Ratio, Proportion and Variations: Definition of Ratio, Ratio of Proportion, Comparison of ratios, Compound ratio, Direct and indirect proportion.

Allegation and mixtures: Allegation rule, Mean value of the mixture, Replacement of equal amount of quantity.

Percentages: Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings

Time and Work: Men and Days, Work and Wages, Hours and Work, Alternate days concept.

Time and Distance: Difference between the average and relative speeds, reaching the destination late and early, Stoppage time per hour, time and distance between two moving bodies.

Trains, Boats and Streams: Train crossing man, same and opposite directions, Speed of boat and stream.

Profit and loss: Relation between Cost price and Selling price, Discount and Marked price, Gain or Loss percentages on selling price

Simple and Compound Interest: Problems on Interest (I), Amount (A), Principal (P) and Rate of Interest(R), Difference between the simple interest and compound interest for 2 and 3 years.

Permutation and Combination: Fundamental rules, problems on permutations & combinations.

Outcome:

1. Apply shortcut methods to solve mathematical problems.
2. Follow strategies in minimizing time consumption in problem solving and to perform well in various competitive exams and placement drives.
3. Solve various Basic Mathematics problems by following different methods
4. Solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.

Logical Reasoning

Blood Relations: Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Series completion: Number series, Alphabet series, and Letter series.

Coding and Decoding: Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, deciphering individual letter codes by analysis.

Direction sense test: Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.

Clocks: Relation between minute-hour hands, angle vs. time, exceptional cases in clocks

Calendars: Definition of a Leap Year, Finding the odd days, finding the day of any random calendar date, repetition of calendar years.

Outcome:

1. Solve various Basic Mathematics problems by following different methods and analyses.

2. Follow strategies in minimizing time consumption in problem solving
3. Apply shortcut methods to solve problems and confidently solve any mathematical problems

Part-B

No. of lecture hours: 25

Verbal: Competitive Grammar: Verb-Tenses, Adjectives & Adverb, Preposition, Conjunction, Syntax (Activity based learning).

Word Etymology, One word substitutes, Word games – Vocabulary development.

Reading Comprehension: General Strategies for Reading Comprehension: Narrative Text, Strategies for Reading Comprehension: Expository Text, Main Idea/Summarization

Sentence Correction/ Improvement/ Completion, Subject-verb agreement, Repetition, Error in modifiers.

Direct-Indirect Speech, Active Passive Voice, Cloze Test

Outcome:

1. Understand the vocabulary.
2. Understand the core competencies to succeed in professional and personal life.
3. Students have the adequate writing skills that are needed in an organization.

Text Books:

1. Quantitative Aptitude by R S Agarwal, S Chand Publications
2. Quantitative Analysis. Third edition (Hall, William Thomas). Norris F. Hall · Cite this: J. Chem. Educ. 1942, 19, 7, 350.
3. A Modern Approach to Verbal Reasoning by R S Agarwal, S.Chand Publications.
4. Arun Sharma and Meenakshi Upadhyay for verbal ability

Reference Books:

1. Quantitative Aptitude – Abhijit Guha, McGraw Hills.
2. Logical Reasoning, Arun Sharma, McGraw Hill.
3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications
4. Mc Graw Hill Objective English 5 th edition.

II Year – II Semester	Environmental Science (Audit Course)	L	T	P	C
Course Code 1000202121		2	0	0	0

COURSE OBJECTIVES:

1. Classify, describe and explain the concepts of Ecosystems and environmental Studies.
2. Overall understanding of different types of natural
3. resources and its conservation.
4. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
5. An understanding of the environmental impacts of developmental activities and the importance of environmental management.
6. Awareness on the social issues, environmental legislations and global treats.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities.
CO3	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices.

**Strength of mapping (Intensity Scale) – 1(Lightly mapped), 2(Moderately mapped), 3(Heavily mapped)

UNIT I**[8 hrs]****Multidisciplinary nature of Environmental Studies:**

Definition Scope and its importance, Multidisciplinary nature of Environmental science.

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Energy flow in the ecosystem – Ecological pyramids - Ecological succession.

Social Issues and the Environment: Impacts of microbial toxins on human health. Urban problems related to energy- Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions. Climate change, Global warming, Acid rain, Ozone layer depletion.

UNIT II -

[3 hrs]

BIODIVERSITY AND ITS CONSERVATION: Definition: genetic, species and ecosystem diversity –Value of biodiversity, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India – Conservation of biodiversity.

UNIT III:

[8 hrs]

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources

UNIT IV –

[9 hrs]

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Noise pollution
- e. Nuclear hazards

Role of an individual in prevention of pollution – Pollution case studies

Environmental Laws: Wildlife Protection Act 1972 –Water pollution prevention and control Act 1974 - Forest Conservation Act 1980n –Air pollution prevention and control Act 1981. Environmental Protection Act 1986 and 2006 - – Public awareness

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes.

Sustainable Development: Goals of Sustainability, Conferences, Carbon credits and carbon footprints.

UNIT V –

[4 hrs]

Environmental Management:

EIA and EA: Introduction, definition, scope, objectives and methodology.

Disaster management: Definition, floods, earthquake, cyclone and landslides.

Ecotourism: Definition, principles, advantages and disadvantages

Environmental Diary

Field Trip

Field work/Environmental Visit: Visit to a local area to document environmental assets – reserve forest/eco-tourist spot : Visit to a local polluted site - Study of local environment - common plants, insects, birds - Study of simple ecosystems –pond, river, hill slopes etc - Visit to industries/water treatment plants/effluent treatment plants.

Text Books:

1. Text book of Environmental Studies for Undergraduate courses by ErachBharuncha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson Education.
3. Environmental Studies by Dr. S. Azeem Unnisa, Academic Publishing Company

Reference Books:

1. Textbook of Environmental Science by Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.
2. Text of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.
3. Comprehensive Environmental studies by J.P Sharma, Laxmi Publications.
4. Environmental sciences and Engineering – J Glynn Henry and Gary W Heinke – Prentice hall of India Private Limited.
5. A textbook of Environmental Studies by G.R Chatwal, Himalaya Publishing house.
6. Introduction to Environmental engineering and science by Gilbert M Masters and Wendell P Ela – Prentice hall of India private limited.

II Year – II Semester	Mini Project (EPICS)	L	T	P	C
Course Code 1012202260		2	0	0	0

Course Overview:

Course will explain the importance of engineers in the society. It will give a brief understanding of various social and global issues of the world. Course reminds that every engineer has a responsibility to solve the social problems of world, to make the world a better place to live in. In the process of serving the society, students need to identify a community problem for which a community project needs to be developed. After successful completion of project, the Project needs to be submitted to community for their benefit. For the effective development of the project, concepts like ‘Design thinking’ & ‘Project management’ will be taught in the course. In addition to that, various platforms like IoT, 3D Printing, Mobile app etc. will be explained which will be useful for effective project development.

EPICS means - **Engineering Projects In Community Service**

Course Objectives

Course objective is to remind students, that every engineer has a responsibility to serve the society. As part of fulfilling the responsibility, Students will create an Engineering project in the service of community. Students will learn the necessary concepts & technologies to develop effective projects

Course Outcomes with Bloom’s Taxonomy level and PO mapping:

	Course outcome	Bloom’s taxonomy	Bloom’s Taxonomy Level	PO
CO1	Understand the various social problems present in the world & they will be able to identify and select a community problem to develop a technological project.	Understanding, Identifying	L2 L3	PO-1, PO-2 PO-6, PO-9 PO-10
CO2	Learn the concepts of Design Thinking and Project management. Learn the technologies like Internet of Things, 3D Printing, Mobile App Creation, Thinker CAD, and Web	Understanding	L2	PO-3, PO-5, PO-11

	page development.			
CO3	Apply the engineering knowledge, mathematics, design thinking and project management to develop a community project.	Applying, Testing Summarize, Develop Validate	L3, L4 L5, L6 L6	PO-1, PO-2, PO-3, PO-5 PO-6, PO-7, PO-9, PO-10 PO-11,
CO4	Students will submit the project to the intended community and feedback to be collected from community. Any future support also will be provided by the students.	Understanding	L2	PO-1, PO-6, PO-8 PO-12

UNIT- I**L: 08****ENGINEER'S CONTRIBUTION TO SOCIETY:**

Major roles played by engineers in building a society – Importance of engineers to society – Various global issues, social problems & problems faced by different communities in the world – Engineering inventions which reduced the impact of many social problems.

EPICS:

Introduction to EPICS – Learning pedagogies - History of EPICS – Case studies of various EPICS projects of Purdue university – Case studies of various EPICS projects in India– Community visit – Selection of a community project by visiting a community / Studying about a community.

Outcome: Students will be able to understand the importance of Engineers in the society & will also recognize various ways by which engineers can contribute to society. Students will realize the need of Community projects.

Activity:

- Visiting a Community / Studying about a community to understand their Problems. Analyzing their problems and Identifying problems which can be solved through technology.
- Selecting one Social / Community problem from the identified problems to develop a technological solution/project.

UNIT II**L: 08****DESIGN THINKING & PROJECT MANAGEMENT:****DESIGN THINKING:**

Introduction to Design Thinking – Case study for design thinking process(IDEO)–

Requirement & Specifications from Users and community partners – Ideation and Concept generation – Design and Prototyping – Testing & Redesign – Detailed design and delivery.

PROJECT MANAGEMENT:

Introduction to Project & Project Management – Project Management Process – Stake Holders – Agile Practices in Project Management – Project management tools (Checklist, Precedence Table, Timeline using Gantt Chart) – Advanced project management tools – Significance of Documentation.

Outcome: Students will be able to understand process of ‘Design’ for any kind of project. Students will be able to learn the project management techniques. Students will apply this knowledge for developing projects.

Activities:

- Studying the Design thinking process of Shopping cart developed by IDEO
- Creating a project plan for the community project.

Unit-III

L: 10

PLATFORMS FOR DEVELOPING COMMUNITY PROJECTS:

Various platforms are used for developing projects. Some of the platforms used for project development are

- a. Internet of Things (IoT) & Embedded Systems
- b. 3D Printing
- c. Thinker CAD
- d. Mobile App creation
- e. Web Development

Internet of Things (IoT) & Embedded Systems:

Introduction to Internet of Things (IoT) & Embedded systems – Difference between IoT & Embedded systems - Before IoT vs. After IoT - Stages of IoT - Components of IoT&Embedded systems (boards, sensors, actuators) - Programming of IoT & interfaces to hardware- Cloud integration & Data collection - Application of IoT & future scope

3D Printing:

Introduction to 3D Printing - Before and After 3D Printing - Components for 3D Printing - Types of 3D Printing - Steps for creating a 3D Model - Scope of 3D Printing - 3D Milling, Laser cutting, 3D Carving machine using 3D Printing technology

Thinker CAD:

Thinker CAD circuit making: Circuit Design - Programming – Simulate

Thinker CAD 3D Modelling: Place – Adjust – Combine - 3D Print

Mobile App Creation:

1. Applications and Scope of Mobile Apps in society
2. Tools for creation of mobile apps (MIT APP, AppsGeyser&AppyBuilder)

Web Development:

1. Applications / Need for Webpage
2. Tools (various websites) for creation of Web pages (Wix, Weebly & GoDaddy)

Outcome: Students will be able to learn various platforms and apply the knowledge for developing social projects

Activities:

- Based on the requirements of community projects, students will select one or more platforms for project completion. Corresponding online courses will be learnt by students.

Unit-IV

P: 12

PROJECT DESIGN& PROTOTYPING:

Defining the Problem – Requirements & Specifications from Users / Community partners – Detailed Design – Creating a Prototype by considering key parameters.

Outcome: Students will be learning the fundamental process of Design. They will learn how to make use of customer requirements to the effective design process and the process of making a prototype.

Activities:

- Developing the Community Project

Unit-V

P: 12

PROJECT TESTING & SUBMISSION:

Prototype testing – Analyzing the performance of prototype – Redesign (in case of testing failure) – Submission to community partners / beneficiaries – taking the feedback for improvement of the project.

Outcome: Students will be able to learn the importance of testing and redesign in the real time projects.

Activity:

- On testing, if results are positive, project needs to be submitted to the community.

Reference Papers:

1. **EPICS:** Engineering projects in community service*, Edward j. Coyle, Leah H. Jamieson and William C. Oakes, International Journal of Engineering Education, 2005

Web links:

1. https://en.wikipedia.org/wiki/List_of_global_issues
2. <https://engineering.purdue.edu/EPICS/purdue/role-specific/purdue/team-documents/design-documents> - For Design thinking
3. <https://www.coursera.org/learn/uva-darden-project-management>
4. <https://www.coursera.org/specializations/project-management>
5. <https://www.coursera.org/learn/introduction-iot-boards> - Learn IoT.
6. https://en.wikipedia.org/wiki/3D_printing
7. <https://www.coursera.org/learn/3d-printing-applications>
8. <https://www.tinkercad.com/> - For Thinker CAD
9. <https://appinventor.mit.edu/> - For creating MIT Mobile APP
10. <http://appybuilder.com/> - For Creating own mobile app
11. <https://www.weebly.com/in> - For creating own websites
12. <https://www.wix.com/> - For Creating own websites

III Year I Semester

III Year
I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1012203100	Computer Networks	3	0	0	3
2	1005202203	Design and Analysis of Algorithms	3	0	0	3
3	1005202204	Data Warehousing and Data Mining	3	0	0	3
4 (Open Elective-I)	1001202140	Industrial waste and waste water Management	3	0	0	3
	1004203141	Data Communications				
	1000202103	Statistics for Data Science-II				
	1003203140	Green Engineering Systems				
5 (Professional Elective-I)	1005203100	Advanced Web Technologies	3	0	0	3
	1005203131	Computer Graphics				
	1005203136	NoSQL Databases				
	1005203135	Industrial Oriented Python Programming				
	1005203133	UNIX and Shell Programming				
6	1012203110	Computer Networks Lab	0	0	3	1.5
7	1012203111	Data Mining Lab	0	0	3	1.5
8	1012203180	Soft Skills	1	0	2	2
9	1099203120	Entrepreneurship Development-1	2	0	0	0
10	1012203160	Summer Internship	0	0	0	1.5
Total Credits						21.5
11	1012203150	Data Engineering	4	0	0	4

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203100	Computer Networks	3	0	0	3

COURSE OBJECTIVES:

1. Building a firm foundation for understanding fundamentals of Computer Networks.
2. Familiarize with the basic terminologies of Computer Networking area.
3. Understand the state of art in Network protocols, Architecture and Applications.
4. Acquire the knowledge of the basic protocols involved in Wired/Wireless communication process.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Define Network and its components and Illustrate the functionality of OSI and TCP/IP reference models.	PO1 PO2	2 3
CO2	Compare different network layer protocols and Demonstrate various types of routing technique.	PO1 PO2 PO3 PO4	2 2 2 2
CO3	Evaluate Architecture for Application layer protocols.	PO1 PO2 PO3	3 2 3
CO4	Choose appropriate protocol for desired communication service.	PO1 PO2 PO3 PO4	2 3 3 2

UNIT- I

Introduction: Network Topologies, Types of Networks: WAN, LAN, MAN. Reference models: The OSI Reference Model, the TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models.

Physical Layer: Guided Transmission media- Twisted-pair cable, Coaxial cable and Fiber optic cable.

[8 Hours]

UNIT- II

The Data Link Layer: Design issues: Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection: Parity check, Checksum, CRC, Error Correction: Hamming Code, Linear block codes, FEC.

Elementary Data Link Protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel

Sliding Window Protocols: One Bit Sliding Window Protocol, A Protocol Using Go-Back-N, Selective Repeat. [10 Hours]

UNIT- III

The Medium Access Control Sub Layer: The Channel Allocation Problem: Static Channel Allocation, Dynamic Channel Allocation.

Multiple Access Protocols: Aloha, pure ALOHA, Slotted ALOHA, CSMA: CSMA/CD, CSMA/CA, Collision Free Protocols, Limited Contention Protocols, Wireless LAN Protocols.

Ethernet: Classic Ethernet Physical Layer, Classic, MAC Sub-layer.

Wireless LAN'S: The 802.11 Architecture and Protocol Stack, The 802.11 Physical Layer, The 802.11 MAC Sub-layer Protocol. [10 Hours]

UNIT- IV

The Network Layer: Design Issues – Store and Forward Packet Switching, Services Provided to the Transport layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram Networks.

Routing Algorithms: The Optimality principle, shortest path Algorithm, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing.

Congestion Control Algorithms: Approaches to Congestion Control, Traffic Throttling-Load Shedding. [10 Hours]

UNIT- V

Transport Layer: Transport Services, Connection management, TCP and UDP protocols, ATM, AAL Protocol.

Application Layer: The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services. [10 Hours]

Text Books:

1. Computer Networks (5th Edition) – Andrew S. Tanenbaum. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010.
2. Computer Networks: A Top-Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education.

Reference Books:

1. Computer Networking: A Top-Down Approach (6th Edition) – Kurose and Ross
2. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition) – Douglas E. Comer.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005202203	Design and Analysis of Algorithms	3	0	0	3

COURSE OBJECTIVES:

This course introduces different techniques to design algorithms using Divide and Conquer, Greedy Approach, Dynamic Programming, Randomized techniques, Multi-Threading, Backtracking and Branch and Bound. It also focuses on how to measure the time and space complexities of algorithms.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Able to analyze the performance of an algorithm in terms of time and space.	PO1 PO2 PO3	2 1 2
CO2	Give an intuition on how to find a solution to large problems by dividing them into smaller sub problems.	PO2 PO3	2 2
CO3	Identifying which designing technique can be used to solve a particular problem.	PO1 PO2 PO12	2 3 2
CO4	Able to analyse the complexities between naïve and parallel algorithms.	PO1 PO2	2 1

UNIT- I

Foundations of Algorithm: Algorithm, Algorithm Specification, Recursive Algorithm, **Analysis:** Space Complexity and Time Complexity, Asymptotic Notations, Amortized Analysis, **Sorting in linear time:** Counting sort. **[8 Hours]**

UNIT-II

Divide and Conquer: General method, Masters Theorem with proof, Applications: Binary search, Defective Chessboard, Finding the Maximum and Minimum, Quick sort, Merge sort, Matrix multiplication: Block and Strassen's matrix multiplication, Randomized Quicksort. **[10 Hours]**

UNIT-III

Greedy method: General method, Applications: Job sequencing with deadlines, knapsack problem, Single source shortest path problem, Optimal Merge Patterns.

Multithreaded Algorithms: Basics of dynamic multithreading, multithreaded matrix multiplication, multithreaded merge sort. **[8 Hours]**

UNIT-IV

Dynamic Programming: General method, Applications: Matrix chain multiplication, 0/1 knapsack problem, All pairs shortest path problem, Travelling salesperson problem, String Editing, Reliability design. **[12 Hours]**

UNIT-V

Backtracking: General method, Applications: n-queen problem, sum of subsets problem.

Branch and Bound: Control Abstraction for LC-Search, FIFO & LIFO Branch-and-Bound techniques, 15-Puzzle Problem. Introduction to NP-Hard and NP- Completeness. **[10 Hours]**

Text Books:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
2. Introduction to Algorithms, second edition, T. H. Cormen, C. E. Leiserson, R. L. Rivest and C.Stein, PHI Pvt. Ltd.
3. The Algorithm Design Manual, 2nd edition, Steven S. Skiena, Springer.
4. Design and Analysis of Algorithms, S. Sridhar, OXFORD UNIVERSITY PRESS.
5. Introduction to the Design and Analysis of Algorithms, Anany Levi, PEA

Reference Books:

1. Design and Analysis of Computer Algorithms, First Edition, V. AHO, Pearson
2. Design and Analysis of Algorithms, ParagHimanshu Dave, HimansuBalachandra Dave, Pearson Education.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T. Lee, S.S.Tseng, R.C.Chang and T.Tsai, McGrawHill.
4. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
5. Algorithms: Fourth Edition, Robert Sedgewick, Addison-Wesley, 2008

E-Books:

1. <https://kailash392.files.wordpress.com/2019/02/fundamentalsof-computer-algorithms-by-ellis-horowitz.pdf>
2. <https://web.ist.utl.pt/~fabio.ferreira/material/asa/clrs.pdf>

NPTEL/MOOC:

1. <https://nptel.ac.in/courses/106/106/106106131/>
2. <https://nptel.ac.in/courses/106/101/106101060/>

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005202204	Data Warehousing and Data Mining	3	0	0	3

COURSE OBJECTIVES:

This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for pre-processing of data. Modelling and design of data warehouses. Algorithms for classification, clustering and association rule analysis

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Understand data warehouse concepts, architecture, business analysis and tools	PO1	1
CO2	Understand data pre-processing and data visualization techniques	PO1 PO2 PO3	2 1 2
CO3	Study algorithms for finding hidden and interesting patterns in data	PO1 PO2 PO4	1 2 2
CO4	Understand and apply various classification and clustering techniques using tools.	PO1 PO2 PO5	2 1 3

UNIT- I**DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)**

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

[10 Hours]**UNIT-II****DATA MINING – INTRODUCTION**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

[8 Hours]**UNIT-III**

ASSOCIATION ANALYSIS

Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns. **[8 Hours]**

UNIT-IV

CLASSIFICATION

Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbour Classifiers, Bayesian Classifiers. **[12 Hours]**

UNIT-V

CLUSTERING ANALYSIS

Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph- Based Clustering, Scalable Clustering Algorithms. Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods. **[10 Hours]**

Text Books:

1. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
2. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining : Introductory and Advanced topics : Dunham, Pearson.
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.

E-Books:

1. https://www.academia.edu/6489220/Data_Mining_ebook
2. <http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf>

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1001202140	Industrial waste and Waste Water Management (Open Elective-I)	3	0	0	3

COURSE OBJECTIVES:

This course will give the student knowledge about Industrial waste water along with managing and treatment methods required for these waste water.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation	1 7	2 2
CO2	Impart knowledge on selection of treatment methods for industrial wastewater.	1 4 7	2 2 1
CO3	Describe the common methods of treatment in different industries	1 4 7	3 2 1
CO4	Explain operational problems of common effluent treatment plant	1 4 7	3 2 1

UNIT- I**INDUSTRIAL WATER QUALITY ANALYSIS****[8 Hours]**

Wastewater Quality characterization - Physical, Chemical and Biological; unit operations and processes used in water and waste water treatment.

UNIT- II**MISCELLANEOUS TREATMENT****[10 Hours]**

Introduction to Advanced water treatments - Adsorption - Ion Exchange - Reverse Osmosis - Electro dialysis - Micro, Ultra & Nano filtration - Chemical oxidation process.

UNIT- III**BASIC THEORIES AND INDUSTRIAL WASTEWATER MANAGEMENT [10 Hours]**

Measurement of industrial wastewater flow - Industrial wastewater sampling and preservation of samples for analysis - Toxicity of industrial effluents due to Heavy metals - Volume and Strength reduction -Neutralization - Equalization, Stabilization and proportioning.

UNIT- IV

INDUSTRIAL WASTEWATER DISPOSAL MANAGEMENT [12 Hours]

Discharges into Streams, Lakes and oceans and associated problems - Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges.

UNIT- V

PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES [12 Hours]

Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Paper and Pulp industries, Tanneries, Sugar Mills, Distillers, Dairy and food processing industries, Fertilizers, Textiles, Steel plants, Pharmaceutical Plants.

Text Books:

1. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
2. Industrial Wastewater Treatment by KVSG Murali Krishna.**E-Books:** (Specify links)
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi
4. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition

Reference Books:

1. Wastewater Engineering by Metcalf and Eddy Inc., Tata McGrawhill Co., New Delhi
2. H. S Peavy, D. R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill International Ed., 1985.
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1004203141	Data Communications (Open Elective-I)	3	0	0	3

Course Overview:

This course gives complete knowledge about various data communication techniques and various communication systems. In this course students can also study various error detection and correction methods.

Course Objectives:

1. To understand the basic concepts of data communication, OSI layered architecture model
2. Discuss the various communication systems.
3. To understand the various error correction and detection methods.

Course Outcomes:

COs	Course outcome	Skill	PO
CO1	Understand the network layer architecture	Understand	PO1
CO2	Learn about various digital modulation techniques.	Understand	PO1
CO3	Apply various errors correction and detection codes to digital data.	Apply	PO1,PO2,PO4
CO4	Learn about electromagnetic properties.,	Understand	PO1,PO2,PO4

Unit-I:**Introduction to Data Communications and Networking**

Standards Organizations for Data Communications, Layered Network Architecture. Serial and parallel Data Transmission, Open Systems Interconnection Model, Data Communications Circuits, Data communications Networks.

Signal Analysis, Electrical Noise, Signal-to-Noise Ratio, information Capacity, Bits, Bit Rate, Baud rate.

Unit-II: Metallic Transmission Lines, Transverse Electromagnetic Waves

Characteristics of Electromagnetic Waves, Advantages & Disadvantages of Optical Fiber cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications.

Unit-III: Digital Modulation

Digital communication block diagram, Pulse code Modulation, Companding.

Multiplexing: frequency division multiplexing and time division multiplexing.

Unit-IV:

Types of transmission media: Guided Media, Unguided Media, Transmission Impairments, Performance Wavelength, Shannon Capacity, Media Comparison, PSTN, Switching

Electromagnetic Polarization

Electromagnetic Radiation, Optical Properties of Radio Waves, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves.

Unit-V:

Data Communications Character Codes

Bar Codes, Error Control, Error Detection and Correction.

Introduction to networks and devices: Network classes, Repeaters, Hub, Bridges, Switches, Routers, Routing Algorithms, Distance Vector Routing, Link State Routing

Text Books:

1. Data Communications & Networking – 5th Edition- B A Forouzan- Tata McGraw-Hil.
2. Data and Computer Communications- 8th Edition- William Stallings- Pearson Education.

References:

1. Data Communications and Networks- 2nd edition -Achyut S Godbole- and AtulKahate Tata McGraw-Hill.
2. Computer Networks- 4th Edition- Andrew S Tanenbaum- Pearson-Prentice Hall.
3. Data and Computer Communications- 8th Edition- William Stallings- Pearson Education.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1000202103	Statistics for Data Science-II (Open Elective-I)	3	0	0	3

COURSE OBJECTIVES:

- To understand basic theoretical knowledge about fundamental principles for statistical inference.
- To understand different statistical test applied to samples to infer conclusions.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Conduct hypothetical testing for large samples and small samples
CO2	Calculate, and interpret, the correlation coefficient and regression models
CO3	Interpret production or service quality by using different quality control charts.
CO4	Analyze the time series data using different techniques

Unit-I

Test of Hypothesis-I: [8 Hours]

Concept and definition of statistical hypothesis, Type I and Type II errors. One tail, two-tail tests, level of significance, P –Values in Decision Making, confidence intervals.

Large sample tests: Hypothesis testing of means, proportions and difference between means and proportions.

Unit-II

Test of Hypothesis-II: [10 Hours]

Small Sample tests: Students' t-distribution: single mean, difference of means, paired t-test for difference of means, F-distribution and X² test. Test of independence of attributes - ANOVA for one-way and two-way classified data.

Unit-III

Correlation and Regression: [10 Hours]

The method of least squares – Inferences based on the least square's estimations, Regression: definition, linear regression, multiple regression and curve linear regression, Correlation: definition, correlation coefficient, rank correlation and correlation for bivariate distributions

Unit-IV

Statistical Quality Control methods: [9 Hours]

Introduction, types of control charts: control charts for variables and attributes, Methods for preparing control charts and distribution curve.

Unit-V

Statistical Methods in Time series Analysis data: [10 Hours]

Introduction, importance of Time series analysis, Methods in time series data analysis

Text Books:

- 1. Fundamentals of Mathematical Statistics by S.C. Gupta and V.K. Kapoor
- 2. Probability and Mathematical statistics by Prasanna Sahoo
- 3. Introduction to Time Series and Forecasting, Second Edition, by Peter J. Brockwel
Richard A. Davis

Reference Books:

- 1) Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1003203140	Green Engineering Systems (Open Elective-I)	3	0	0	3

COURSE OBJECTIVES:

The course aims to highlight the significance of alternative sources of energy, green energy systems and processes and provides the theory and working principles of probable sources of renewable and green energy systems that are environmentally friendly.

COURSE OUTCOME:

COs	Course Outcome
CO1	understanding various types of solar thermal collectors
CO2	Describe the working of a photovoltaic system and wind energy conversion system
CO3	Analyze the operation of fuel cells and biomass conversion technologies
CO4	Elaborate on ocean, geothermal, electrical and Mechanical systems

UNIT-I

INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extra-terrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sunshine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV

ENERGY EFFICIENT SYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT-V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

References:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering / D.YogiGoswami, Frank Krieth& John F Kreider / Taylor & Francis
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non conventional Energy Source/ G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203100	Advanced Web Technologies (Professional Elective-I)	3	0	0	3

COURSE OBJECTIVES:

1. To understand computer programming and application software, package/ suites.
2. Design static web application development and Students will gain the skills and front designs
3. Able to get project based experience needed for entry into web application and development careers.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Understand basic concepts of HTML & CSS to design web pages and web site	PO1	1
CO2	Able to Develop dynamic web pages using JavaScript.	PO1 PO2	1 1
CO3	Implementing the Node and React Js in web development	PO2 PO3 PO11 PO12	1 2 2 2
CO4	Analyze a given problem and apply requisite appropriate tools for designing interactive web applications	PO2 PO3 PO11 PO12	1 2 2 2

UNIT- I

HTML5:

New standard for HTML, XHTML, and the HTML DOM, New Features, Browser Support, New Elements in HTML5, New Markup Elements, New Media Elements, The Canvas Element, New Form Elements, New Input Type Attribute Values, Video on the Web, Video Formats. **[10 Hours]**

UNIT- II

HTML5 – Audio and Canvas:

Audio on the Web, Audio Formats, How It Works, All <audio> Attributes, HTML5 Canvas, What is Canvas? Create a Canvas Element, Draw With JavaScript, Understanding Coordinates, More Canvas Examples, HTML5 Web Storage, Storing Data on the Client, The local Storage Object, The session Storage Object, HTML5 Input Types, HTML5 New Input Types, Browser Support, Input Type – email, Input Type – url, Input Type – number, Input Type – range, Input Type - Date Pickers, Input Type – search, Input Type – color. **[10 Hours]**

UNIT- III

Introduction to CSS3:

What is CSS3? Differences between CSS3 and earlier CSS, Specifications How browsers are handling CSS3? CSS3 Selectors: Selectors Overview Explore specific selectors, Designing and Developing with CSS3: Background and color, Typography, CSS3 Box Model, Page layout, Media Queries, Implementing CSS3, Advantages and limitations of working with CSS.

Introduction to Bootstrap, design of responsive WebPages **[10 Hours]**

UNIT- IV

Introduction to JQUERY, selectors and events

Node JS: Node js - Basics and Setup, Node js Console, Node js Command Utilities, Node js Modules, Node js Concepts, Node js Events, Node js with Express js, Node js Database Access. **[8 Hours]**

UNIT- V

React JS:

Why React JS, React JSX, React JS components, State, Props, React Component API and Life cycle, Forms and Events. **[10 Hours]**

Text Books:

1. HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dream Tech Black Book
2. React. Js Book: Learning React JavaScript Library from Scratch, Book by Greg Sidelnikov
3. Node.js in Action, by Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, Nathan Rajlich
4. React in Action 1st Edition by Mark Tielens Thoma

Reference Books:

1. Build Your Own Website The Right Way Using HTML & CSS, 3rd Edition by ge The WordPress Anthology
2. The Principles of Beautiful Web Design, 2nd Edition by Jason Bear

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203131	Computer Graphics (Professional Elective-I)	3	0	0	3

COURSE OBJECTIVES:

This course focuses on giving introduction about computer graphics, its wide range of application areas. Also gives information about the graphics hardware, working of hardware and software which are needed for producing graphics. It gives information about basic scan conversion algorithms, 2D, 3D transformations and viewing mechanisms, clipping algorithms, color models and Animation techniques.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	To understand the various computer graphics hardware and display technologies.	PO1	2
CO2	To implement various type of scan conversion algorithms, line and polygon clipping algorithms.	PO1 PO2	2 2
CO3	To apply different 2D and 3D transformation techniques & viewing technologies to real world problems	PO1 PO2 PO3	3 2 1
CO4	To understand the basic concepts of gaming theory	PO1	3

UNIT- I

INTRODUCTION: Application areas of computer graphics, overview of graphics systems, video-display devices and raster-scan systems, random scan systems.

SCAN CONVERSION: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm;(algorithms & applications only) , scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm. **[8 Hours]**

UNIT- II

2D - GEOMETRICAL TRANSFORMS: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear

2D –VIEWING : The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland– Hodgeman polygon clipping algorithm (algorithms & applications only) **[10 Hours]**

UNIT- III

3D - OBJECT REPRESENTATION: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves.

3D - GEOMETRIC TRANSFORMATIONS: Translation, rotation, scaling, reflection and shear transformations, composite transformations. **[10 Hours]**

UNIT- IV

COLOR MODELS – Intuitive colour concepts – RGB colour model – YIQ colour model – CMY colour model – HSV colour model – HLS colour model; Colour selection.

COMPUTER ANIMATION: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications. **[8 Hours]**

UNIT- V

VISIBLE SURFACE DETECTION METHODS: Classification, back-face detection, depth-buffer, ray tracing method, depth sorting, BSP tree methods. **[10 Hours]**

Text Books:

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,”Computer Graphics: Principles and Practice”, , 3rd Edition, Addison- Wesley Professional,2013. .
2. Donald Hearn and Pauline Baker M, “Computer Graphics”, Prentice Hall, New Delhi, 2007

Reference Books:

1. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education, 2007.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203136	NoSQL Databases (Professional Elective-I)	3	0	0	3

Course Description:

The NoSQL database course will provide students with an introduction, overview and history of NoSQL databases (non-relational databases). The four types of NoSQL databases (e.g. Document-oriented, Key-Value Pair, Column-oriented and Graph) will be explored in detail.

Course Objectives:

1. Explore the emergence, requirements and benefits of a NoSQL database.
2. Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases).
3. Site principles behind the NoSQL databases, such as chapters from modern distributed database theory, P2P indexing or the Map Reduce programming model.

Course outcomes:

CO'S	At the end of the course , the students will have the ability to:	PO's mapped	Strength of mapping
CO1	Define NoSQL, its characteristics and history, and the primary benefits for using NoSQL databases	1,5,11	11
CO2	Define the major types of NoSQL databases including a primary use case and advantages/disadvantages of each type	1,3	3
CO3	Create wide-column, document, key-value, graph and object-oriented databases, add content, and run queries	1, 2	2
CO4	Understand the basic storage architecture and distributed file systems	1,3,5	5

UNIT-I

Introduction and Basic Concept: Define what a NoSQL database is, why we need NoSQL and how it is different from traditional databases, NoSQL database environment, benefits and drawbacks to using NoSQL database, NoSQL VS SQL. **[12 hours]**

Outcome: Understand the primary advantages and disadvantages between SQL and NoSQL

Activity: Identifying the scenarios and applications where NoSQL environment can be deployed

UNIT-II

Introduction to NoSQL Environment: Schema less Development, Data Models, Distribution Models, Consistency, Categories of NoSQL - Key-Value Stores , Wide-Column Family Stores, Document Databases, Graph Databases, Object-Oriented Databases. **[12 hours]**

Outcome: Understanding the conceptual model of schema less development.

Activity: Create a database and collection. For example a document collection meant for analysing Restaurant records can have fields like restaurant id, restaurant name, customer name, locality, date, cuisine, grade, comments.

UNIT-III

Wide-Column Databases: Column Family, Key and Keyspace, Categories of NoSQL, Examples using in Cassandra and MapR

Key-Value Databases: Major Keys, Minor Keys, Values, Examples using in Oracle NoSQL Database, Redis [12 hours]

Outcome: Creating wide-column, document, and key-value and run queries.

Activity: Writing simple queries such as displaying all the records, display selected records with conditions with specific conditions using Cassandra and Redis.

UNIT-IV

Document Databases: NoSQL, Attributes, Metadata, Formats, XML, JSON and BSON Examples using Elastic Search, Couch DB, MongoDB

Graph Databases: Edges, Nodes, Relationships, Examples using Neo4J, Info Grid, Graph Base [12 hours]

Outcome: Creating graph and object oriented and run queries.

Activity: Writing simple queries such as displaying all the records, display selected records with conditions with specific conditions using MongoDB.

UNIT-V

Cloud Computing with NoSQL Databases: Big Data, Remote Searches, Hadoop, Map Reduce, REST, AWS [12hours]

Outcome: Understand the basic storage architecture and distributed file systems.

Activity: Implementation of MapReduce program for a defined application.

Text Books:

1. Pramod J. Sadalage; Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Addison-Wesley.
2. Shashank Tiwari. Professional NoSQL. John Wiley and Sons.

Reference Books:

1. Sullivan. NoSQL for Mere Mortals, 1st ed. Addison-Wesley Professional, 2015

e-Resources:

1. Meier & Kaufmann. SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, 1st ed. Springer, 2019

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203135	Industrial Oriented Python Programming (Professional Elective-I)	3	0	0	3

COURSE OBJECTIVES:

1. To learn about Python programming language syntax, semantics, and the runtime environment.
2. To be familiarized with universal computer programming concepts like data types, containers.
3. To be familiarized with general computer programming concepts like conditional execution, loops & functions.
4. To be familiarized with general coding techniques and object-oriented programming

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Develop essential programming skills in computer programming concepts like data types, containers	PO1	3
CO2	Apply the basics of programming in the Python language	PO1 PO2	3 3
CO3	Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming.	PO5	2 3
CO4	Solve coding tasks related OOPS, and Multithreading	PO12	3

UNIT- I**INTRODUCTION TO PYTHON:**

Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow-: if, if-elif-else, for, while, break, continue, pass.

[6 Hours]

UNIT- II

STRINGS and DATA STRUCTURES:

Strings: Strings and text files, String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers, Data Structures: Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

[8 Hours]

UNIT- III

FUNCTIONS and STRING ALGORITHMS:

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. String terminology, Trie structure, String hashing: Calculating hash values, Pre-processing, Using hash values, Collisions and parameters, Z-algorithm, Knuth-Morris-Pratt (KMP) Matcher, Pattern Matching—Rabin–Karp, Longest Palindrome of a String—Manacher, suffix Trie, suffix array.

[8 Hours]

UNIT- IV

ARRAY:

Merge of Sorted Lists, Sum Over a Range, Duplicates in a Range, Maximum Subarray Sum, Query for the Minimum of a Range—Segment Tree, Query the Sum over a Range—Fenwick Tree, two pointers method, sliding window, nearest smaller elements, Windows with k Distinct Elements, Trapping Rain Water, Container with Most Water, Longest Substring Without Repeating Characters.

[8 Hours]

UNIT- V

SEARCHING:

Half-interval search, Complete search: Generating subsets, generating permutations, Backtracking, Pruning the search, meet in the middle, Peak Index in a Mountain Array, Find Minimum in Rotated Sorted Array, Longest Duplicate Substring, Count Negative Numbers in a Sorted Matrix, Minimum Size Subarray Sum, Median of Two Sorted Arrays. **[10 Hours]**

Text Books:

1. ReemaThareja, “Python Programming Using Problem Solving Approach”, Oxford University Press,2019.
2. Data Structure and Algorithmic Thinking with Python Book by Narasimha Karumanchi

Reference Books:

1. Charles Severance, " Python for Informatics- Exploring Information", 1st edition Shroff Publishers,2017.
2. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science)
3. Competitive Programming in Python: 128 Algorithms to Develop Your Coding Skills Book by Christoph Dürr and Jill-Jênn Vie
4. Core Python Programming - Covers Fundamentals to Advanced Topics Like OOPS, Exceptions, Data Structures, Files, Threads, Networking, GUI, DB Connectivity and Data Science Second Edition (English, Paperback, Rao R. Nageswara)

E-Books:

<https://www.python.org/doc/>

NPTEL/MOOC:

1. <https://cses.fi/book/index.php>
2. [Leetcode.com](https://leetcode.com)

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005203133	UNIX and Shell Programming (Professional Elective-I)	3	0	0	3

COURSE OBJECTIVES:

1. To provide knowledge of UNIX Operating System and its File System.
2. To develop the ability to formulate filtration techniques using filters.
3. To provide a comprehensive knowledge of SHELL programming, services and utilities.
4. To develop the ability to learn Distributed processing and multi-tasking.
5. To Create Productive environment for software development using rich set of tools.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Explain the architecture and features of UNIX Operating System and differentiate it from other Operating Systems	PO1	2
CO2	Demonstrate UNIX commands for file handling and process control	PO1	2
CO3	Build Regular expressions for pattern matching and apply them to various filters for a specific task	PO1 PO2 PO3 PO5	2 1 2 2
CO4	Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem	PO1 PO2 PO4 PO12	1 2 2 2

UNIT- I

Introduction to Unix-Brief History-What is Unix-Unix Components-Using Unix-Commands in Unix-Some Basic Commands-Command Substitution-Giving Multiple Commands.

The File system –The Basics of Files-What's in a File-Directories and File Names-Permissions-INodes-The Directory Hierarchy. **[8 Hours]**

UNIT- II

File Attributes and Permissions-The File Command knowing the File Type-The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrp Command Changing the Group of a File. **[8 Hours]**

UNIT- III

Using the Shell-Command Line Structure-Met characters-Creating New Commands-Command Arguments and Parameters-Program Output as Arguments-Shell Variables- -More on I/O Redirection-Looping in Shell Programs. Filters-The Grep Family-Other Filters-The Stream Editor Sed-The AWK Pattern Scanning and processing Language-Good Files and Good Filters. **[8 Hours]**

UNIT- IV

Shell Programming-Shell Variables-The Export Command- The read Command-Positional parameters-The \$? Variable knowing the exit Status-More about the Set Command-The Exit Command-The Expr Command: Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document(<<)-The Sleep Command-The Script Command-The Eval Command-The Exec Command. **[8 Hours]**

UNIT- V

The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation, synchronization and mutual exclusion-The Trap Command-The Stty Command-The Kill Command-Job Control.

Sockets- Socket system calls for connection oriented protocol and connectionless protocol, example- client/server program, socket options. **[10 Hours]**

Text Books:

1. The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
2. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

Reference Books:

1. Unix and shell programming by B.M. Harwani, OXFORD university press.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203110	Computer Networks Lab	0	0	3	1.5

COURSE OBJECTIVES:

1. Understand network layers, structure/format, and role of each network layer.
2. Able to design and implement various network application such as data transmission between client and server, file transfer, real-time multimedia transmission.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Ability to implement error detection techniques.	PO1 PO3	3 3
CO2	Ability to apply appropriate algorithm for finding of shortest route.	PO1 PO2 PO3	2 3 3
CO3	Ability to configure the routing table. And Implement and compare the various routing algorithms.	PO1 PO2 PO3	2 3 3
CO4	Ability to implement client/server communication and Implementing connection oriented and connectionless protocols.	PO1 PO2 PO3 PO5	2 3 3 2

LIST OF EXPERIMENTS

S. No.	Name of the experiment	Skill
1	Exercise – 1 Implementation a Basic Network using Topologies in Packet Tracer.	Understands different Network Topologies
2	Exercise – 2 Implement the three CRC polynomials on a data set of characters– CRC 12, CRC 16 and CRC CCIP.	Can Apply error detection mechanism.
3	Exercise – 3 Switch and Router configuration and Configuring VLAN in packet tracer.	Switch and Router configuration and Configuring VLAN in packet tracer.
4	Exercise – 4 Implement Dijkstra's algorithm to compute the Shortest path through a graph.	Ability to identify the shortest path in the network transmission.
5	Exercise – 5 Take an example subnet graph with weights	Identifying the route for transmitting the data over the

	indicating delay between nodes. Now obtain Routing table at each node using distance vector routing algorithm.	network.
6	Exercise – 6 Take an example subnet of hosts. Obtain broadcast tree for it.	Understands the concept of subnet and broadcasting
7	Exercise – 7 Implementation of Connection oriented concurrent service (TCP).	Implements Connection Oriented Service
8	Exercise – 8 Implementation of Connectionless Iterative time service (UDP).	Implements Connectionless Iterative time service
9	Exercise – 9 Configuration of DHCP Server and Implementation of DNS.	Configuration of DHCP Server
10	Exercise – 10 Implementation of HTTP (Hyper Text Transfer Protocol).	Implements Hypertext Transfer Protocol

Text Books:

1. Computer Networks (5th Edition) – Andrew S. Tanenbaum. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010.
2. Computer Networks: A Top-Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education.

Reference Books:

1. Computer Networking: A Top-Down Approach (6th Edition) – Kurose and Ross
2. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition) – Douglas E. Comer.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203111	Data Mining Lab	0	0	3	1.5

COURSE OVERVIEW:

To give a practical exposure on data pre-processing and analyzing the data using the data mining algorithms with supporting tools.

COURSE OBJECTIVES:

1. To obtain practical experience using data mining techniques on real world data sets.
2. Emphasize hands-on experience working with all real data sets.

LIST OF EXPERIMENTS

Credit Risk Assessment

Description:

The business of banks is making loans. Assessing the credit worthiness of an applicant is of crucial importance. You have to develop a system to help a loan officer decide whether the credit of a customer is good, or bad. A bank's business rules regarding loans must consider two opposing factors. On the one hand, a bank wants to make as many loans as possible. Interest on these loans is the banks profit source. On the other hand, a bank cannot afford to make too many bad loans. Too many bad loans could lead to the collapse of the bank. The bank's loan policy must involve a compromise: not too strict, and not too lenient. To do the assignment, you first need some knowledge about the world of credit. You can acquire such knowledge in a number of ways.

1. Knowledge Engineering. Find a loan officer who is willing to talk. Interview her and try to represent her knowledge in the form of production rules.
2. Books. Find some training manuals for loan officers or perhaps a suitable textbook on finance. Translate this knowledge from text form to production rule form.
3. Common sense. Imagine yourself as a loan officer and make up reasonable rules, which can be used to judge the credit worthiness of a loan applicant.
4. Case histories.

Find records of actual cases where competent loan officers correctly judged when, and when not to, approve a loan application.

The German Credit Data:

Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. Credit dataset (original) Excel spreadsheet version of the German credit data. In spite of the fact that the data is German, you should probably make use of it for this assignment. (Unless you really can consult a real loan officer!) A few notes on the German dataset

1. DM stands for Deutsche Mark, the unit of currency, worth about 90 cents Canadian (but looks and acts like a quarter).
2. owns telephone. German phone rates are much higher than in Canada so fewer people own telephones.

3. foreign_worker. There are millions of these in Germany (many from Turkey). It is very hard to get German citizenship if you were not born of German parents.

4. There are 20 attributes used in judging a loan applicant.

The goal is to classify the applicant into one of two categories, good or bad.

Subtasks: (Turn in your answers to the following tasks)

1. List all the categorical (or nominal) attributes and the real-valued attributes separately.
2. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.
3. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.
4. Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy?
5. Is testing on the training set as you did above a good idea? Why or Why not? (10 marks)
6. One approach for solving the problem encountered in the previous question is using cross-validation. Describe what cross-validation is briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why?
7. Check to see if the data shows a bias against "foreign workers" (attribute 20), or "personal-status" (attribute 9). One-way to do this (perhaps rather simple minded) is to remove these attributes from the dataset and see if the decision tree created in those cases is significantly different from the full dataset case, which you have already done. To remove an attribute, you can use the preprocess tab in Weka's GUI Explorer. Did removing these attributes have any significant effect? Discuss.
8. Sometimes, the cost of rejecting an applicant who actually has a good credit (case 1) might be higher than accepting an applicant who has bad credit (case 2). Instead of counting the misclassifications equally in both cases, give a higher cost to the first case (say cost 5) and lower cost to the second case. You can do this by using a cost matrix in Weka. Train your Decision Tree again, report the Decision Tree, and cross validation results. Are they significantly different from results obtained in problem 6 (using equal cost)?
9. Do you think it is a good idea to prefer simple decision trees instead of having long complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model?
10. You can make your Decision Trees simpler by pruning the nodes. One approach is to use Reduced Error Pruning - Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross-validation (you can do this in Weka) and report the Decision Tree you obtain? Also, report your accuracy using the pruned model. Does your accuracy increase?

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203180	Soft Skills (Skill Oriented Course)	1	0	2	2

The student will be able to:

- understand the fundamental principles of effective communication
- organize and express ideas in writing
- speak to produce messages suitably tailored for the topic, objective, audience, communication medium and context; and
- demonstrate clearly with logical coherence in the use of language.

Course Outcomes:

- Use English language fluently, accurately and appropriately.
- Discuss and discover barriers to effective communication.
- Show effective writing skills in academic and professional contexts.
- Demonstrate skills in listening comprehension, GDs and Interview.

Syllabus

1. Writing Skills – Blog writing and picture perception (creative writing)
2. Cover letter and Resume Writing (Resume has to be uploaded in LinkedIn or any professional platforms.)
3. Group Discussions
4. Mock Interviews
5. Listening Comprehension-Practice
6. Presentations-Group & Individual

Recommended Books:

- Simon Sweeny, English for Business Communication, CUP, First South Asian Edition, 2010.
- M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill Publishing Company Ltd. 2005
- Dr A Ramakrishna Rao, Dr. G. Natanam & Prof SA Sankaranarayanan, English Language Communication:
- A Reader cum Lab Manual, Anuradha Publications, Chennai, 2006
- Dr. Shalini Verma, Body Language- Your Success Mantra S. Chand, 2006.

III Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1099203120	Entrepreneurship Development (Audit Course)	2	0	0	0

COURSE DESCRIPTION:

This course provides business and non-business majors with the skills necessary to succeed as an entrepreneur. The fundamentals of starting and operating a business, and its types, and developing a business plan, obtaining financing from banks and financial institutions, marketing a product or service and developing an effective business model, basic knowledge on institutions like MSME's others, which provide financial and EDP's will be covered.

COURSE OBJECTIVES:

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

1. To understand the meaning, role and qualities of an entrepreneur.
2. To give an overview on the concept of Entrepreneurship
3. To know basic idea or knowledge about business plan and MSME's.
4. To understand the basic knowledge about Capital structure, Sources of finance.
5. To understand the concept of Creativity and Entrepreneurial Plan.

COURSE OUTCOMES: Acquaint the students with

CO's	At the end of the course, the student will have the ability to:	PO's mapped	Strength of Mapping
CO 1	Understand the outline of Entrepreneurship development	PO1,2	3
CO 2	To understand the factors, remedies for sickness of industry	PO1, 2,6	3
CO 3	To understand capital and financial sources, Govt. policies.	PO2, 4,	3
CO 4	To know how to select, generate idea, feasibility study and control of project.	PO6, 7, 8	3

UNIT I:

Introduction to Entrepreneur: Definition, requirements to be an entrepreneur, characteristic of successful entrepreneurs, Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Entrepreneur and Manager, Growth of entrepreneurship in India. Factors Affecting Entrepreneurial Growth. The role of entrepreneurship in economic development;

UNIT II:

Introduction to entrepreneurship: entrepreneurship process; Classification of entrepreneurship, Entrepreneurial motivation and barriers; Factors impacting emergence of entrepreneurship; Types of Entrepreneurships, Sick industries, Reasons for Sickness, Remedies for Sickness. Role of BIFR in revival, Bank Syndications.

UNIT III:

Introduction to Business, Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Types of Business Organization, Micro, Small and Medium scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation.

UNIT IV:

Capital structure, Sources of finance: debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs, Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT V:

Creativity and Entrepreneurial Plan: Business Idea Generation – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study: market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors.

Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

Text Books:

- VSP Rao, Kuratko: “Entrepreneurship”, Cengage Learning, NewDelhi,
- K.Ramachandran: “Entrepreneurship Development”, TMH, NewDelhi, 2012
- B.Janakiram, M Rizwana: “Entrepreneurship Development” ExcelBooks, New Delhi, 2011
- Rajeev Roy: “Entrepreneurship”, Oxford University Press, NewDelhi,2012
- Manjunatha, Amit Kumar Goudar: “Management andEntrepreneurship” University Science Press, New Delhi, 2011
- Eric A Morse, Ronald K Mitchell: “Cases in Entrepreneurship”, SAGE Publication, New Delhi, 2011.

References:

1. Couger, C-Creativity and Innovation (IPP, 1999)
2. Nina Jacob, -Creativity in Organisations (Wheeler, 1998)
3. Jonne&Ceserani-Innovation &Creativity(Crest) 2001.
4. BridgeSetal-Understanding Enterprise: Entrepreneurship and Small Business (Palgrave,2003)
5. Holt-Entrepreneurship: New Venture Creation (Prentice-Hall) 1998.
6. Singh P&Bhandekar A-Winning the Corporate Olympiad:TheRenaissan
cearadigm(Vikas)
7. Dollinger M J-Entrepreneurship (Prentice-Hall, 1999).
8. Tushman, M.L. & Lawrence, P.R. (1997)-Managing Strategic Innovation &
Change Oxford .
9. Jones T. (2003)-Innovating at the Edge: How Organizations Evolve and Embed
Innovation Capability.Butterwork Heinemann, U. K.
10. Amidon, D. M.(1997)-Innovation Strategy for the Knowledge Economy:The
Kanawakening.Butterwork-Heinemann, New Delhi, India.

E-Books and Online Resources

1. <https://www.dynamictutorialsandservices.org/2018/10/entrepreneurship-development-notes.html>
2. <https://www.google.com/search?client=avast-a-1&q=entrepreneurship+development+notes&oq=entrepreneurship+development+notes&aqs=avast..69i64j69i59i450l8.12j0j7&ie=UTF-8>

NPTEL/SWAYAMMOOCS:

1. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
2. https://onlinecourses.nptel.ac.in/noc21_hs102/preview

III Year II Semester

III Year

II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	1005202103	Software Engineering	3	0	0	3
2	1012203200	Machine Learning	3	0	0	3
3	1005203200	Cryptography and Network Security	3	0	0	3
4 (Professional Elective-II)	1005203230	Software Project Management	0	0	0	3
	1005203231	Distributed Systems				
	1005203233	Big Data Analytics				
	1019203200	IOT and its applications				
	1012203270	SWAYAM / NPTEL / MOOCS				
5 (Open Elective-II)	1001202240	Environment Pollution and Control	3	0	0	3
	1004203101	Microprocessors and Microcontrollers				
	1019203240	Introduction to Embedded Systems				
	1003202242	Industrial Robotics				
6	1012203210	Case Tools Lab	0	0	3	1.5
7	1054203110	Machine Learning Lab	0	0	3	1.5
8	1012203211	Cryptography and Network Security Lab	0	0	3	1.5
9	1012203280	Kotlin Programming	1	0	2	2
10	1099203220	Professional Ethics and Universal Human Values	2	0	0	0
Total Credits						21.5
INDUSTRIAL/RESEARCH INTERNSHIP						
11	1012203250	Data Visualization	4	0	0	4

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005202103	Software Engineering	3	0	0	3

COURSE OBJECTIVES:

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the importance of modeling and modeling languages.
4. To design and develop correct and robust software products.
5. To understand the quality control and how to ensure good quality software.
6. To understand the planning and estimation of software projects.
7. To understand the implementation issues, validation and verification procedures.
8. To understand the maintenance of software

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Apply the appropriate process models for the application development of SDLC	PO1 PO2 PO3 PO5	1 2 2 1
CO2	Understand the phases of SDLC from requirement gathering phase to design phase via Analysis Phase	PO1 PO2	2 1
CO3	Analyzing the strategies for coding and testing phase in Software product development	PO1 PO2 PO3	2 2 2
CO4	Apply the knowledge about estimation and maintenance of software systems and modeling the software project by using CASE tools	PO1 PO2 PO3 PO5	2 2 1 1

UNIT- I

Software and Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: Generic Process Models like Waterfall Models, Evolutionary Process Model, V-Model, Agile Model etc. Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process. **[10 Hours]**

UNIT-II

Requirements Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design?, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design.
[8 Hours]

UNIT-III

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

Coding And Testing: Coding, Code Review, Software Documentation, Testing and Test Case, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.
[10 Hours]

UNIT-IV

Software Reliability And Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Computer Aided Software Engineering: Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case Tools, Towards Second Generation CASE Tool, Architecture of a Case Environment
[9 Hours]

UNIT-V

Software Maintenance: Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management, Devops.

Software Reuse: what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level.
[8 Hours]

Text Books:

1. Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition Mc GrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education

Reference Books:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203200	Machine Learning	3	0	0	3

Course Overview:

This course provides how to recognize the characteristics and applications of machine learning. The course provides brief information about supervised, unsupervised, clustering algorithms and Artificial neural networks.

Course Objectives:

1. Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning
2. The ability to implement basic machine learning algorithms
3. Understanding of how machine learning algorithms are evaluated
4. Applying new concepts in machine learning

Course Outcomes:

CO'S	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Recognize the characteristics of machine learning that make it useful to real-world Problems	Understand/Remember	PO1,PO3,PO4
CO2	Characterize machine learning algorithms as supervised, semi-supervised, and Unsupervised	Understand/analyze	PO1,PO5,PO9
CO3	Be able to use support vector machine, regularized regression algorithms	Create	PO3,PO5,PO9,PO2
CO4	Understand the concept behind neural networks for learning non-linear functions	Evaluate/Apply	PO2,PO3,PO5,PO12

UNIT-I:

Introduction to Machine Learning

Introduction to machine learning, Definition, traditional programming vs machine learning algorithms, learning a system, supervised learning, unsupervised learning and reinforcement learning, application areas.

UNIT -II:

Classification and Regression Models

Linear separability and decision regions, linear discriminants, linear regression, logistic regression, decision trees-ID3 and C4.5, KNN

UNIT- III:

Dimensionality reduction and Support vector machines

Dimensionality reduction and Feature selection, Dimensionality reduction algorithms: LDA and PCA, Margin of a classifier, Support Vector Machine, Learning nonlinear hypothesis using kernel functions.

UNIT- IV:

Clustering and Ensemble Methods

Introduction to clustering: K-means clustering, Gaussian mixture model, Ensemble Methods: bagging and boosting, Random forest and Ada Boost algorithms and Bayesian learning algorithm.

UNIT -V:

ARTIFICIAL NEURAL NETWORKS:

Introduction, Theperceptron, the perceptron learning algorithm, Multilayer neural networks, activation functions, Back Propagation algorithm and introduction to Deep learning models: CNN

TEXT BOOKS

1. Tom Mitchell, “*Machine Learning*”, Mc Graw Hill publications, 1997
2. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
3. Introduction to Machine Learning with Python By Andreas C. Müller, Sarah Guido O'Reilly Media
4. Deep Learning by Josh Patterson, Adam Gibson ,O'Reilly Media

REFERENCE BOOKS

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben- David, Cambridge.
2. Machine Learning in Action, Peter Harington, 2012, Cengage.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203200	Cryptography and Network Security	3	0	0	3

COURSE OBJECTIVES:

1. To learn the principles and practice of cryptography and network security.
2. To gain knowledge in Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers)
3. To gain Knowledge in Public-key cryptography (RSA, discrete logarithms), Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes.
4. To gain knowledge in Email and web security, viruses, firewalls, digital right management, and other topics.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understanding the principles and practices of cryptography and network security
CO2	Understanding the concepts of symmetric block cipher or conventional key encryption or private key encryption or one key encryption.
CO3	Apply basic knowledge of public key cryptography or asymmetric key cryptography or two key cryptography
CO4	Understanding the cryptographic protocols, hash functions, authentication, key management, key exchange, signature, schemes, Email and web security, viruses, firewalls

UNIT- I

Basic Principles

Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography. **[8 Hours]**

UNIT-II

Symmetric Encryption

Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard. **[10 Hours]**

UNIT-III

Asymmetric Encryption

Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography **[10 Hours]**

UNIT-IV

Data Integrity, Digital Signature Schemes & Key Management

Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management. **[10 Hours]**

UNIT-V

Network Security

Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, Security at the Network Layer: IPSec, System Security **[10 Hours]**

Text Books:

1. Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, (3e) Mc Graw Hill.
2. Cryptography and Network Security, William Stallings, (6e) Pearson.
3. Everyday Cryptography, Keith M.Martin, Oxford.

Reference Books:

1. Network Security and Cryptography, Bernard Meneges, Cengage Learning.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203230	Software Project Management (Professional Elective-II)	3	0	0	3

COURSE OBJECTIVES:

1. To study how to plan and manage projects at each stage of the software development lifecycle (SDLC)
2. To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
3. To understand successful software projects that support organization's strategic.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	To understand the basic concepts and issues of software project management.	PO1	1
CO2	To conduct activities necessary to successfully complete and close the Software projects.	PO1 PO2	1 1
CO3	To implement the project plans through managing people, communications and change.	PO2 PO3 PO11 PO12	1 1 2 2
CO4	To develop the skills for tracking and controlling software deliverables.	PO2 PO3 PO11 PO12	1 2 2 2

UNIT- I

Introduction: Project, Management, Software Project Management activities, Challenges in software projects, Stakeholders, Objectives & goals

Project Planning: Step-wise planning, Project Scope, Project Products & deliverables, Project activities, Effort estimation, Infrastructure. **[10 Hours]**

UNIT- II

Project Approach Iterative & incremental Process Framework: Lifecycle phases, Process Artifacts, Process workflows.

Check Points of the Process: Major milestones, Minor milestones and Periodic status assessments. **[8 Hours]**

UNIT- III

Iterative Process Planning: Work Breakdown Structure, planning guidelines, cost and schedule estimating, iteration planning process, pragmatic planning.

Effort Estimation and Planning: Estimation techniques, Function Point analysis, SLOC, COCOMO, Use case-based estimation, Activity Identification Approaches, Network planning models, Critical path analysis. **[10 Hours]**

UNIT- IV

Risk Management:

Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach. **[10 Hours]**

UNIT- V

Creating a framework for monitoring & control:

Progress monitoring, Cost monitoring, Earned value Analysis, Defects Tracking, Issues Tracking, Status reports, Types of Resources, Identifying resource requirements, Resource scheduling **[10 Hours]**

Text Books:

1. "Software Project Management", Walker Royce: Pearson Education, First Edition, 2005.
2. "Software Project Management", Bob Hughes & Mike Cotterell, TATA Mcgraw-Hill, Fifth Edition, 1968..
3. "Software Project Management in practice", Pankaj Jalote, Pearson Education, First edition, 2002.

Reference Books:

1. "Software Project Management," Joel Henry, Pearson Education, first edition, 2005.
2. Effective Software Project Management, Robert K. Wysocki, Wiley, 2006.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203231	Distributed Systems (Professional Elective-II)	3	0	0	3

COURSE OBJECTIVES:

1. Explain difference between failure model and security model
2. Give outline of resource sharing concept
3. Explain client server communication.
4. Extract the features of Internet protocols
5. Describe important characteristics of distributed systems and the salient architectural features of such systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Develop distributed file system	PO1	1
CO2	Outline importance characteristics of distributed systems and the salient architectural features of such systems	PO1 PO4	1 2
CO3	Explain the features and applications of important standard protocols which are used in the distributed system	PO5	1
CO4	Interpret inter-process communication in a distributed system	PO2 PO12	1 2

UNIT- I

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model. **[10 Hours]**

UNIT- II

Interprocess Communication: The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast Comprehensions. **[10 Hours]**

UNIT- III

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads. **[10 Hours]**

UNIT- IV

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication. **[10 Hours]**

UNIT- V

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

[10 Hours]

Text Books:

1. Ajay D Kshemkalyani, MukeshSinghal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and Design”, Fourth Edition, Pearson Publication

Reference Books:

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI
2. <https://nptel.ac.in/courses/106/106/106106168/>

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005203231	Big Data Analytics (Professional Elective-II)	3	0	0	3

COURSE OBJECTIVES:

1. Optimize business decisions and create competitive advantage with Big Data analytics
2. Introducing Java concepts required for developing map reduce programs
3. Derive business benefit from unstructured data
4. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
5. To introduce programming tools PIG & HIVE in Hadoop ecosystem.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Preparing for data summarization, query, and analysis.
CO2	Applying data modeling techniques to large data sets.
CO3	Creating applications for Big Data analytics.
CO4	Building a complete business data analytic solution.

UNIT- I

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files. **[8 Hours]**

UNIT- II

Writing Map Reduce Programs: A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner. **[8 Hours]**

UNIT- III

Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators. **[10 Hours]**

UNIT- IV

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin. **[8 Hours]**

UNIT- V

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data. **[8 Hours]**

Text Books:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss

Reference Books:

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, SrinathPerera, Thilina Gunarathne

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1019203200	IOT and its Applications (Professional Elective-II)	3	0	0	3

COURSE OBJECTIVES:

The main objective of course make student to understand the IoT basic concepts, standards, communication protocols, technological relation and real time applications and their design, implementation and deployment issues..

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To Understand the Architecture, protocols and applications of IoT.
CO2	To Analyze the communication protocols and standards used in IoT
CO3	To Analyze and design the simple IoT applications to monitor or control IoT devices using simulation or hardware
CO4	To implement the real time IoT applications.

UNIT- I

[10 Hours]

Introduction to IoT:

Need of Internet of Things, Internet of Things ERA, Characteristics of Internet of Things, architectural view of Internet of Things, Technologies behind Internet of Things – Server-End Technology – Major Components of IoT system – Development Tools – API and device interfacing components

UNIT- II

[10 Hours]

IoT Design: Physical Design of IOT, Things in IoT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels, Sources of IoT, Examples of IoT – Smart Watch – Smart Home – Smart Phone.

UNIT- III

[8 Hours]

IoT Communication:

M2M communication – M2M to IoT – M2M architecture – software development tools, Communication Technologies – Wireless communication technologies – Wired Communication, IoT Protocols, IoT functional blocks – IoT communication models.

UNIT- IV

[8 Hours]

IoT Physical Devices & Endpoints: Basic building blocks of IoT devices, Introduction to Raspberry Pi , About the Board , Operation System on Raspberry Pi , Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Interfacing LED, Sensor with raspberry pi.

UNIT- V

[8 Hours]

Home Automation – Smart lighting – Home intrusion detection, Cities – smart parking, Environment – Weather monitoring system – Air Pollution Monitoring – Forest Fire Detection, Agriculture – smart irrigation system.

Text Books:

1. Internet of Things: A hands-On Approach, Arshdeep Bahga, Vijay Madisetti, 2014 edition, University Press.
2. The Internet of Things: Enabling technologies, Platforms and Use cases, Pethuru Raj and Anupama C. Raman, 2017 edition, CRC Press, Taylor and Francis Group.

Reference Books:

1. Internet of Things: Architecture and design Principles, Raj Kamal, Tata Mc-Graw hill Edition.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1001202240	Environment Pollution and Control (Open Elective-II)	3	0	0	3

COURSE OBJECTIVES:

The students will be explained

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution.
2. Differentiate the solid wastes and hazardous wastes based on characterization.
3. Introduces some basics of sanitation methods essential for protection of community health.
4. Provide basic knowledge on sustainable development.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Have knowledge on air pollutant control devices and the NAAQ standards.	1	1
CO2	Differentiate the treatment techniques used for solid and industrial wastewater treatment methods.	1 3	1 2
CO3	Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.	1 3	1 2
CO4	Appreciate the importance of sustainable development while planning a project or executing an activity.	1 3	1 1

UNIT- I**AIR POLLUTION****[6 Hours]**

Air pollution Control Methods– Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

UNIT- II**INDUSTRIAL WASTEWATER MANAGEMENT****[8Hours]**

Industrial wastewater Management:– Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards

UNIT- III**SOLID WASTE MANAGEMENT:****[8 Hours]**

Solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

UNIT- IV

ENVIRONMENTAL SANITATION AND HAZARDOUS WASTE [10 Hours]

Environmental Sanitation: Sanitation Methods for institutions and hospitals

Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT- V

SUSTAINABLE DEVELOPMENTS [8 Hours]

Sustainable developments Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development

Text Books:

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

Reference Books:

1. “Air Pollution Control: A Design Approach” by C David Cooper and F C Alley
2. “Encyclopaedia of Air Pollution Control Equipments: Selection, Design, Operation and Maintenance” by Frederick W Lipfert and Litao Wang Hsiaolan Liu
3. Environmental Pollution and Control , J Jefferey Peirce

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1004203101	Microprocessors and Microcontrollers (Open Elective-II)	3	0	0	3

COURSE OBJECTIVES

The objective of the course is to understand Architectures of basic microprocessors and Microcontroller, interfacing techniques and controlling different peripheral devices with 8086 and 8051.

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

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the concepts of microcomputer system and explore the architecture of microprocessors and microcontroller.
CO2	Explore hardware configuration of 8086 and able to write assembly language program for basic arithmetic applications.
CO3	Apply the knowledge of Interfacing memory and I/O devices with 8086
CO4	Develop interfacing circuit of different sensors and actuators with 8051. And Apply the knowledge of programming for industrial applications.

UNIT- I

INTRODUCTION TO MICRO COMPUTER SYSTEM AND MICROPROCESSORS:

[8 Hours]

Block diagram representation of microcomputer system / microprocessors and the role of various functional units. 8086 microprocessor architecture, Pin Configuration, 8086 Control signal interfacing, Minimum and Maximum mode operations, Read and write cycle timing diagrams.

UNIT II

8086 MICRO PROCESSOR:

[10 Hours]

Memory interfacing with 8086, Addressing modes, Instruction Set, Programming of 8086.

UNIT-III

INTERFACING WITH 8086:

[10 Hours]

8255 PPI architecture, Modes, Interfacing of different I/O devices (LEDs, Seven Segment Display units, ADC, DAC, Stepper motor) using 8255, Basic architecture of 8259 interrupt controller, 8257 DMA controller.

UNIT-IV

MICRO CONTROLLERS:

[10 Hours]

Architecture of 8051 microcontroller, Signals, I/O ports and Memory Organization, Timers and Counters, Serial Communication, Interrupts, Addressing modes, Instruction set and simple programs for 8051.

UNIT-V

8051 MICRO CONTROLLER PROGRAMMING:

[10 Hours]

Programming 8051; LED interfacing, seven segment interfacing, ADC, DAC, Sensor interfacing, Stepper motor interfacing.

Text Books:

1. Ray and Burchandi, “Advanced Micro Processors and Interfacing”, Tata McGraw–Hill.
2. Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
3. Kenneth J Ayala, “The 8051 Micro Controller Architecture, Programming and Applications”, Thomson Publishers, 2nd Edition.

Reference Books:

1. R.S. Kaler, “A Text book of Microprocessors and Micro Controllers”, I.K. International Publishing House Pvt. Ltd.
2. B Ram “Fundamentals of Microprocessor and Microcontrollers”.
3. Ajay V. Deshmukh, “Microcontrollers – Theory and Applications”, Tata McGraw–Hill Companies –2005.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1019203240	Introduction to Embedded Systems (Open Elective-II)	3	0	0	3

Course Overview: In this course, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, glue logic, development tools, firmware architecture, firmware design, and firmware debugging techniques will be discussed.

Course Objectives:

- The basic concepts of an embedded system are introduced and the various elements of embedded hardware and their design principles are explained.
- Different steps involved in the design and development of firmware for embedded systems is elaborated.
- Fundamental issues in hardware software co-design were presented and explained.
- Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
- Embedded system implementation and testing tools are introduced and discussed

Course Outcomes:

	Course outcome
CO1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function
CO2	Design the Embedded hardware by considering the hardware components required for an embedded system
CO3	Analyze the various embedded firmware design approaches on embedded environment to suit for desired application
CO4	Understand how to integrate hardware and firmware of an embedded system and apply this knowledge to real time operating system.

SYLLABUS

Unit-I: Embedded System -Definition, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Characteristics of an embedded system.

Unit-II: EMBEDDED HARDWARE DESIGN:

Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

Unit-III: EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

Unit-IV: HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware.

Unit-V: EMBEDDED SYSTEM DEVELOPMENT: The integrated development environment, Types of files generated on cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging, Boundary Scan, Embedded Software development process and tools.

Text Books:

1. Embedded Systems-architecture, programming and design by RajKamal 3rd edition, McGraw hill
2. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
3. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Reference Books:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1003202242	Industrial Robotics (Open Elective-II)	3	0	0	3

Course Overview:

The course covers the principles and working of robots and their significance in view of their importance in the current scenario and their potential future applications for industry automation.

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
2. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators.

CO's	Course outcome
CO1	Understand the various robot configuration and components
CO2	Choose appropriate actuators and sensors for a robot based on specific application
CO3	Analyze the kinematic and dynamic analysis for simple serial kinematic chains
CO4	Explain trajectory planning for a manipulator by avoiding obstacles.

Unit-I:

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

Unit-II:

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

Unit-III:

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

Unit-IV:

Differential transformation and manipulators, Jacobians – problems Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

Unit-V:

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Industrial Robotics / Groover M P / Pearson Edu. 2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

Reference Books:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.
4. Introduction to Robotics / John J Craig / Pearson Edu

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203210	Case Tools Lab	0	0	3	1.5

COURSE OBJECTIVES:

- Learn basic concepts of UML. Master the vocabulary, rules, and idioms of the UML and learn how to model it effectively.
- Understand how to apply the UML to solve a number of common modeling problems
- Model the systems, from concept to executable artifact, using object oriented techniques.
- Apply the knowledge of Software engineering and project management.

COURSE OUTCOMES:

- Sketch a Modeling with UML by Deploying Structural Modeling, Behavioral Modeling, Architectural Modeling.
- Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships
- Show the role and function of each UML model in developing object oriented software.
- Apply advanced behavioral modeling and architecture modelling for any case study.

LIST OF EXPERIMENTS

Experiment Number	Name of the Experiment	Skill
1	Familiarization with Rational Rose or Umbrello	Design software project in the form of Graphical representation
2	CASE STUDY: CUSTOMER SUPPORTING SYSTEM (Online Book store) a)Identify and analyze events b)Identify use cases c)Draw Event table d)Identify and analyze domain classes e)Represent domain class diagram using rational rose	Design customer supporting system in the form of Graphical representation
3	CASE STUDY: POINT OF SALE TERMINAL a)Identify and analyze events b)Identify Usecases c)Draw event table d)Identify and analyze domain classes e)Represent usecases and domain class diagram using rationalrose	In point of sale terminal we can perform the operations like Bar code scanning, Process sale, Close sale, Pay Bill. Tax calculation, Buy product.
4	CASE STUDY: LIBRARY MANAGEMENT SYSTEM a)Identify and analyze events b)Identify usecases	Library Management System is a project which deals with how to register, accessing of book, issue

	c) Draw event table d) Identify and analyze domain classes e) Represent class diagram for library management system	of the books and renewal of the books from library.
5	CASE STUDY: RAILWAY RESERVATION SYSTEM a) Develop sequence diagrams for each use case b) Identify MVC classes / objects for each use case c) Communication diagrams for each use case showing interactions among all the three-layer objects d) Develop detailed design class diagram (use GRASP patterns for responsibility assignment)	Online Railway Reservation System is a project which deals with the process of online booking, cancellation of tickets and online payment will be done.
6	CASE STUDY: HOSPITAL MANAGEMENT SYSTEM a) Develop sequence diagrams for each use case. b) Develop Communication diagrams for each use case showing interactions among all the three-layer objects. c) Develop detailed design class model (use GRASP patterns for responsibility assignment).	It deals with the collection of patient's information, diagnosis details, etc. Traditionally, it was done manually.
7	CASE STUDY :ATM APPLICATION a) Draw usecase diagram b) Draw sequence diagram c) Activity diagram	ATM Application is a system which deals with performing all Banking Transactions like cash withdrawal, balance enquiry, taking a mini statement of the transactions performed by the user.
8	CASE STUDY:AUCTION APPLICATION a) Draw sequence diagram b) Draw collaboration diagram c) Draw Activity diagram	The online auction system is a design about a website where sellers collect and prepare a list of items they want to sell and place it on the website for visualizing.
9	CASE STUDY:MULTITHREDED AIRPORT SIMULATION a) Draw sequence diagram b) Draw collaboration diagram	The project is focused on controller and pilot assistance systems for approach and ground movements.
10	CASE STUDY:SIMULATED COMPANY a) Draw use case diagram b) Draw sequence diagram c) Draw state chart diagram	Simulated company is an example that shows the documents produced when undertaking the analysis and design of an application that's simulates a small manufacturing company.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1054203110	Machine Learning Lab	0	0	3	1.5

Course Overview:

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as FIND-S, Candidate Elimination Algorithm, Decision tree (ID3 Algorithm), Backpropagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbor Algorithm, Locally Weighted Regression Algorithm.

Course Objectives:

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes:

	At the end of the course , the students will have the ability to:	PO's mapped	Strength of mapping
CO1	Understand the implementation procedures for the machine learning algorithms	PO5,PO6,PO8, PO10,PO12	1
CO2	Design Java/Python programs for various Learning algorithms.	PO1,PO2,PO5, P06	1
CO3	Apply appropriate data sets to the Machine Learning algorithms	PO5,PO6,PO8, PO10,PO12	2
CO4	Identify and apply Machine Learning algorithms to solve real world problems	PO1,PO2,PO5, P06	2

List of Experiments

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set

stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203211	Cryptography and Network Security Lab	0	0	3	1.5

COURSE OVERVIEW:

To give practical exposure on basic security attacks, encryption algorithms, authentication techniques. Apart from security algorithms, firewall configuration is also introduced.

COURSE OBJECTIVES:

1. To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
2. To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To familiarize symmetric and asymmetric cryptography

COURSE OUTCOMES:

	Course outcome	Skill	PO
CO1	Identify basic security attacks and services	understanding	PO1, PO2
CO2	To understand the implementation of Symmetric cryptographic algorithms	applying	PO1, PO2, PO4
CO3	To understand the implementation of Asymmetric cryptographic algorithms	applying	PO1, PO2, PO4
CO4	To understand the implementation of Various Cryptographic Hash algorithms	applying	PO1, PO2, PO4, PO5

LIST OF EXPERIMENTS

1. Working with sniffers for monitoring network communication using Wireshark
2. Implementation of Caesar Cipher technique
3. Decode the Given message which is encrypted using Caesar Cipher. Also Identify the key.
M = "AOPZPJYFWAVNYHWOFULADVYZLJBYPAFSHI"
4. Implement Simple Substitution Cipher
5. Decode the Given message which is encrypted using Simple Substitution cipher. Also identify the key. M =
"ceiraonxnrhvrcacvdfqaxeikar p qaxeikcepcprhiifafvriudkopfwefvgkigr du wipkr pf
izqinnifceardkwarmasifaodfratmerceiqdgihtdl ac hpraqpnnwqdrarcr du

rvhrcavcafmsikwxnpafcizcqepkppqkudk p gauuikifcqaxeikcizcqepkppqk ac
gauuikrukdoceiqpirpkqaxeikafcepceiqaxeikpnxephicarfdcraoxnwceipnxephicreaucig ac
arqdoxnicinwyvohnigceiraoxnirvhrcacvadfqaxeikduuikrsikwnaccniqdoovfaqqcadfriqvkcawpfg ac
tann hi redtfcepc ac qpf hi
ipranwhkdliisifhwepfgirxiqapnnwprceioirrpmirhiqdoindfmikodkicepfrisikpnevfgkigqaxeikcizcqep
kppqkikr”

6. Implement the Play fair Cipher
7. Implement the Pure Transposition Cipher
8. Implement DES Encryption and Decryption
9. Implement the BLOWFISH Encryption and decryption
10. Implement the AES Encryption and decryption
11. Implement RSA Encryption and Decryption
12. Implementation of CRC Hash Functions
13. Implement SHA – 128 Hash Functions

Text Books:

1. Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, (3e)
Mc Graw Hill.
2. Cryptography and Network Security, William Stallings, (7e) Pearson.

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012203280	Kotlin Programming (Skill Oriented Course)	1	0	2	2

Course Objective

- Understand all concepts of the Kotlin Programming Language.
- Learn Object-Oriented Programming Concepts.
- Understand the relationship between Kotlin and Java.
- Understand the best approaches for utilizing Kotlin in Android.
- Create your first Android Application using Kotlin.

Course Outcomes

- Build enterprise level mobile applications with Kotlin on Android.
- Understand both the basic and advanced concepts of Kotlin.
- Understand why use Kotlin over Java.
- Install and configure Android Studio.

SYLLABUS

1. Kotlin Program to Add Two Integers
2. Kotlin Program to Multiply two Floating Point Numbers
3. Kotlin Program to Find ASCII value of a character
4. Kotlin Program to Compute Quotient and Remainder
5. Kotlin Program to Swap Two Numbers
6. Kotlin Program to Check Whether a Number is Even or Odd
7. Kotlin Program to Check Whether an Alphabet is Vowel or Consonant
8. Kotlin Program to Find the Largest Among Three Numbers
9. Kotlin Program to Find all Roots of a Quadratic Equation
10. Kotlin Program to Check Whether a Number is Positive or Negative
11. Kotlin Program to Check Whether a Character is Alphabet or Not
12. Kotlin Program to Calculate the Sum of Natural Numbers
13. Kotlin Program to Find Factorial of a Number
14. Kotlin Program to Display Fibonacci Series
15. Kotlin Program to Display Characters from A to Z using loop
16. Kotlin Program to Count Number of Digits in an Integer
17. Kotlin Program to Reverse a Number
18. Kotlin Program to Calculate the Power of a Number
19. Kotlin Program to Check Whether a Number is Palindrome or Not
20. Kotlin Program to Check Whether a Number is Prime or Not
21. Kotlin Program to Display Prime Numbers Between Two Intervals

22. Kotlin Program to Check Armstrong Number
 23. Kotlin Program to Display Armstrong Number Between Two Intervals
 24. Kotlin Program to Display Prime Numbers Between Intervals Using Function
 25. Kotlin Program to Display Factors of a Number
 26. Kotlin Program to Make a Simple Calculator Using switch...case
 27. Kotlin Program to Find Factorial of a Number Using Recursion
 28. Kotlin Program to Reverse a Sentence Using Recursion
 29. Kotlin Program to calculate the power using recursion
 30. Kotlin Program to Calculate Average Using Arrays
 31. Kotlin Program to Find Largest Element in an Array
 32. Kotlin Program to Find Transpose of a Matrix
 33. Kotlin Program to Find the Frequency of Character in a String
 34. Kotlin Program to Count the Number of Vowels and Consonants in a Sentence
 35. Kotlin Program to Print an Array
 36. Kotlin Program to Concatenate Two Arrays
 37. Kotlin Program to Convert Character to String and Vice-Versa
 38. Kotlin Program to Check if An Array Contains a Given Value
 39. Kotlin Program to Join Two Lists
 40. Kotlin Program to Convert List (ArrayList) to Array and Vice-Versa
-

III Year – II Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1099203220	Professional Ethics and Universal Human Values (Audit Course)	2	0	0	0

Course Overview:

Universal Human Values & Professional Ethics subject provides character oriented education that instils basic values and ethnic value in one's individual professionalism.

Course Objectives:

1. To help the student to see the need for developing a holistic perspective of life.
2. To help students distinguish between values and skills and understand the need, basic guidelines, content and process of value education and Harmony.
3. To help the students understand their role as engineers, behavior and how to use ethical theories.
4. To help the students remember the codes, their responsibilities towards society, safety and risk.
5. Making the students aware and sensitive to value system in real life situations. To help the students to discriminate between ephemeral and eternal values.

Course Outcomes:

CO's	At the end of the course, the student will have the ability to:	PO's mapped	Strength of Mapping
CO1	Recognize importance of Universal human values, self-exploration and environment	PO8	3
CO2	Describe the core values that shape the ethical behavior of an engineer through value education, harmony and ethical human conduct.	PO8	3
CO3	Recall basics of professional ethics and Ethical theories.	PO8	3
CO4	Listing sustained happiness through identifying their responsibilities.	PO6	2

Unit-I

Universal Human Values-I – Introduction

Self-exploration- Aspirations and Concerns- Self-Management- Health- Relationships- Society- Natural Environment- Sharing and feedback

Unit-II

Universal Human Values-II - Understanding Harmony and Ethical Conduct

Introduction to Value Education- Harmony in the Human Being, Family and Society, Nature/Existence- Implications of the Holistic Understanding – a Look at Professional Ethics.

Unit-III

Engineering Ethics:

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics-Consensus and Controversy – Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics- Kohlberg’s Theory – Gilligan’s Argument – Heinz’s Dilemma

Unit-IV

Engineering as Social Experimentation & Engineers’ Responsibility for Safety and Risk

Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering-Engineers’- Responsibility for Safety and Risk: Safety and Risk, Concept of Safety – Types of Risks - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

Unit-V

Engineers’ Responsibilities and Rights:

Collegiality-Loyalty-Professionalism and Loyalty- Professional Rights –Professional Responsibilities-Conflict of Interest-Ethical egoism-Confidentiality-Acceptance of Bribes/Gifts- when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies- Occupational Crimes - Whistle Blowing -Cross-culture Issues.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. “Engineering Ethics and Human Values” by M.Govindarajan, S.Natarajan and V.S.SenthilKumar- PHI Learning Pvt. Ltd-2009
3. “Professional Ethics and Morals” by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications
4. “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
5. “Professional Ethics and Human Values” by Prof.D.R.Kiran

Reference Books:

1. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi.
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. “Indian Culture, Values and Professional Ethics” by PSR Murthy-BSP Publication
6. “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger–Tata McGraw-Hill–2003.
7. “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
8. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.
9. Samagrakranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
10. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK.

E-Books and Online Resources:

1. <https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf>
2. <https://india.oup.com/productPage/5591038/7421214/9780199475070>

NPTEL/SWAYAMMOOCS:

1. <https://nptel.ac.in/courses/109/104/109104068/>
2. https://onlinecourses.swayam2.ac.in/ntr19_ge06/preview

IV Year- I Semester

IV Year

I Semester

S. No.	Course Code	Course Title	L	T	P	C
1 (Professional Elective-III)	1005204132	Software Quality Assurance	3	0	0	3
	1005204130	Soft Computing				
	1004203236	Digital Image Processing				
	1005204133	Digital Forensics				
	1054202200	Artificial Intelligence				
2 (Professional Elective-IV)	1054203200	Deep Learning	3	0	0	3
	1012204130	Quantum Computing				
	1012204131	Block Chain Technologies				
	1012204132	Data Science				
	1012204133	Network Programming				
3 (Professional Elective-V)	1005204134	Social Network and Semantic Web	3	0	0	3
	1012204134	Digital Marketing				
	1012204135	Ad-hoc and Sensor Networks				
	1005204138	Cloud Computing				
	1012204136	Design Patterns				
	1012204170	SWAYAM / NPTEL / MOOCS				
4 (Open Elective-III)	1001204141	Remote Sensing Applications and GIS	3	0	0	3
	1004203237	Information Theory and Coding				
	1054204131	Business Analytics				
	1003204140	Nano Technology				
5 (Open Elective-IV)	1001204140	Disaster Management	3	0	0	3
	1004204140	Speech Processing				
	1054204136	Information Retrieval Systems				
	1003203132	Operations Research				
6	1099203200	Management Science	3	0	0	3
7	1012204180	Android Application Development	1	0	2	2
8	1099204120	IPR & Patents	2	0	0	0
9	1012204160	Industrial/Research Internship	0	0	0	2
Total Credits						22
10	1012204150	Data Acquisition and Productization	4	0	0	4

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005204132	Software Quality Assurance (Professional Elective-III)	3	0	0	3

COURSE OBJECTIVES:

1. Describe approaches to quality assurance
2. Understand quality models
3. Evaluate the system based on the chosen quality model

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Enumerate the Components of the Software Quality Assurance System.
CO2	Integrate Quality Activities in the Project Life Cycle
CO3	Interpret procedures, work instructions and list out the Software Quality Metrics and Costs.
CO4	Analyze the SQA Standards and estimate the role of Management in Quality Assurance.

UNIT- I

Introduction: The Software Quality Challenge, Software Quality, Software Quality Factors: The Components of the Software Quality Assurance System - Overview of Pre-Project Software Quality Components. **[8 Hours]**

UNIT-II

SQA Components in the Project Life Cycle: Integrating Quality Activities in the Project Life Cycle, Reviews Software Testing – Strategies Software Testing –Implementation, Assuring the Quality of Software Maintenance. **[8 Hours]**

UNIT-III

Software Quality Infrastructure Components: Procedures and Work Instructions, Supporting Quality Devices Staff Training, Instructing and Certification, Preventive and Corrective Actions.

Software Quality Management Components: Project Progress Control: Software Quality Metrics, Software Quality Costs. **[8 Hours]**

UNIT-IV

Standards, Certification and Assessment: SQA Standards ISO 9001 Certification Software, Process Assessment. **[8 Hours]**

UNIT-V

Organizing for Quality Assurance: Management and its Role in Quality Assurance, The Software Quality Assurance. [8 Hours]

Text Books:

1. Software Quality Assurance, Theory of implementation, Daniel Galin, Pearson.
2. Software Testing and Analysis. Process, Principles, and Techniques, MauroPezze and Michal Young, John Wiley 2008.

Reference Books:

1. Software Testing Techniques, BorizBeizer, 2nd Edition, DreamTech, 2009.
2. Foundations of Software Testing, Aditya P. Mathur, Pearson, 2008.
3. Software Testing and Analysis. Process, Principles, and Techniques, Mauro Pezze and Michal Young, John Wiley 2008.
4. Metrics and Models in Software Quality Engineering, Stephen H. Kan, 2nd Edition, Pearson, 2003
5. Software Testing and Quality Assurance: Theory and Practice, Kshirasagar Naik and Priyadarshi Tripathy (Eds), John Wiley, 2008

E-Resources:

1. softwaretestingfundamentals.com/software-quality-assurance/
2. <http://nptel.ac.in/courses/106101061/>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005204130	Soft Computing (Professional Elective-III)	3	0	0	3

COURSE OBJECTIVES:

1. To understand the concepts of feed forward & feedback neural networks.
2. To understand the concept of fuzziness involved in various systems.
3. To expose the ideas about genetic algorithm.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Identify and describe soft computing techniques and their roles in building intelligent machines	PO1 PO2	3 3
CO2	Comprehend machine learning and soft computing techniques in solving real world applications.	PO1 PO2 PO3	3 3 3
CO3	Apply fuzzy logic and reasoning to handle uncertainty	PO3	3
CO4	Apply genetic algorithms to combinatorial optimization problems and neural networks to pattern classification and regression problems	PO2 PO3 PO4 PO12	3 3 3 3

UNIT- I**INTRODUCTION ARTIFICIAL NEURAL NETWORKS:**

Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network. **Earlier neural networks:** ADALINE, MADALINE. **Neural Network Architectures:** Single layer feed forward network, Multi-layer feed forward network, Recurrent network. **[10 Hours]**

UNIT-II**SUPERVISED AND UNSUPERVISED LEARNING NETWORK**

Supervised Learning Network: Perceptron network, Back propagation network, Radial basis function network. **Unsupervised Learning Network:** Fixed weight competitive nets, Kohonen self-organizing feature maps, Counter propagation network, Adaptive reasoning theory. **[10 Hours]**

UNIT-III

Auto associative memory network, Hetro associative memory network, Bidirectional associative memory, Hopfield networks. **[8 Hours]**

UNIT-IV

FUZZY LOGIC FUZZY LOGIC:

Crisp set and Fuzzy set, Basic concepts of fuzzy sets, Fuzzy set operations, Fuzzy Arithmetic-fuzzy numbers, Fuzzy ordering, Fuzzy vectors. Fuzzy measures-belief and plausibility measure. Probability measure - Measure of fuzziness, Fuzzy integrals. Membership functions: Features of membership function, Fuzzification. Fuzzy Rule Based Systems: Fuzzy proposition, Formation and decomposition of rules, Fuzzy reasoning, Fuzzy inference systems, Fuzzy expert system. Defuzzification: Max-membership, Centroid method, Weighted average, Mean max. [10

Hours]

UNIT-V

GENETIC ALGORITHMS:

Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods. [10 Hours]

Text Books:

1. Simon Haykin, "A comprehensive foundation. Neural Networks", Pearson, Second Edition, 2001.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Timothy J. Ross, "Fuzzy logic with engineering applications", John Wiley & Sons, Third Edition, 2009.
2. Melanie Mitchell, "An Introduction to Genetic Algorithms", Prentice-Hall, 1998.

NPTEL/MOOC:

1. https://onlinecourses.nptel.ac.in/noc21_cs11

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1004203236	Digital Image Processing (Professional Elective-III)	3	0	0	3

Course Objectives:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing.
- Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).
- Assess the performance of image processing algorithms and systems (colour and morphological).

Course Outcomes:

COs	Course Outcomes
CO1	Explain the fundamentals of gray scale and color image processing.
CO2	Evaluate different transforms and compression methods on image for image processing applications.
CO3	Solve the methods to extract information from the image in terms of spatial filtering, frequency filtering, restoration and segmentation.
CO4	Examine the different techniques of color and multi resolution processing.

Unit-I:

Evolution of Digital image processing, Examples of fields that use digital image processing, Fundamental steps of digital image processing, Components of an image processing system, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between pixels.

Unit-II:

IMAGE TRANSFORMS: Orthogonal Sinusoidal Basis Function – Discrete Fourier Transform, Discrete Cosine Transform **Non-sinusoidal orthogonal basic function** - Haar, Walsh, Hadamard, Slant. **Statistics of input signal-** KL transform.

Unit-III:

Image Enhancement: Intensity Transformations, Histogram Equalization.

Image Enhancement in Spatial domain: spatial filtering, linear and non linear smoothing filter, sharpening spatial filters using first order and second order derivative.

Image Enhancement in Frequency domain: Image smoothing using low pass, Image sharpening using high pass filter.

Image Restoration techniques: A model of the image degradation/restoration process, Noise models, Restoration in presence of noise: Mean filters, Adaptive filters, Inverse filter, Wiener filter.

Unit-IV:

Image Compression: Need for image compression, Huffman coding, Arithmetic coding, LZW coding, Block Transform coding, Predictive coding (lossless and lossy).

Image Segmentation: Point, Line and Edge detection, Region based segmentation, Edge detection, Edge linking, Thresholding.

Unit-V:

Color Image Processing: Color models and their conversions, Pseudo color image processing, full color image processing, Color image smoothing and sharpening, Using color in image segmentation

Text Books:

1. "Digital image processing", Gonzalez, R. C., and R. Woods. 4th Edition." (2018).
2. "Digital image processing", Jayaraman, S., S. Esakkirajan, and T. Veerakumar, TMH publication. Year of Publication (2009).

Reference Books:

1. "Digital image processing using MATLAB", Gonzalez, Rafael C., Richard Eugene Woods, and Steven L. Eddins, Pearson Education India, 2020.
2. "Fundamentals of Digital Image Processing", Sharma, Dr Sanjay, SK Kataria and Sons, 2008.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005204133	Digital Forensics (Professional Elective-III)	3	0	0	3

COURSE OBJECTIVES:

1. Analyze and conduct a computer forensics examination and report the findings that will lead to the incarceration of the perpetrators.
2. Learn different aspects of digital evidence: ways to uncover illegal or illicit activities left on disk and recovering files from intentionally damaged media with computer forensics tools and techniques.
3. Acquire Knowledge on Network Forensics, Advanced Computer Forensics that protects information assets from potential intrusion, damage, or theft.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Analyze computer forensics services, computer forensics tools and techniques.
CO2	Analyze types of forensic systems for investigations.
CO3	Make use of computer forensic services and data recovery techniques and identify potential sources of electronic evidence for maintaining the integrity of digital evidence.
CO4	Perform basic forensic data acquisition and analysis using computer-based applications and utilities.

UNIT- I

Computer Forensics Fundamentals:

What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find it. **[8 Hours]**

UNIT-II

Types of Computer Forensics System: Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging (IM) Security Systems, Net Privacy Systems, Identity Management Security Systems, Identity Theft, Computer Forensics, Second Edition Biometric Security Systems, Homeland Security Systems. **[8 Hours]**

UNIT-III

Computer Forensics Services:

Occurrence of Cyber Crime, Cyber Detectives, Cyber Crime with Risk Management Techniques, Computer Forensics Investigative Services, Forensics Process Improvement. Data Recovery: Data Recovery Defined, Data backup and recovery, Role of Backup in Data Recovery, Data Recovery Solution, Hiding and Recovering Hidden Data. [8 Hours]

UNIT-IV

Evidence Collection and Data Seizure:

Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — Controlling Contamination: The Chain of Custody, Reconstructing the Attack. Duplication and Preservation of Digital Evidence - Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration — Practical Implementation. [8 Hours]

UNIT-V

Computer Forensics Analysis: Discovery of Electronic Evidence, Identification of Data, Reconstructing of Past Events. [8 Hours]

Text Books:

1. “Computer Forensics, Computer Crime Investigation,” John R. Vacca, Firewall Media, New Delhi, 2010.
2. “Computer Forensics and Investigations,” Nelson, Phillips Enfinger, Steuart, CENGAGE Learning, 2014.

Reference Books:

1. “Real Digital Forensics,” Keith J. Jones, Richard Bejtich, Curtis W. Rose, Addison- Wesley Pearson Education, 2006.
2. “Forensic Compiling, A Tractitioneris Guide,” Tony Sammes and Brian Jenkinson, Springer International edition, 2005.
3. “Computer Evidence Collection & Presentation,” Christopher L.T. Brown, Firewall Media, MA, 2nd edition, 2006.

E-Resources:

1. <https://www.cs.nmt.edu/~df/lectures.html>
2. <https://www.lynda.com/Developer-tutorials/Computer-Forensics-Essential-Training/170337-2.html>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1054202200	Artificial Intelligence (Professional Elective-III)	3	0	0	3

COURSE OBJECTIVES:

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously. The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is. And this course will introduce some basic search algorithms for problem solving. In this course students will learn about knowledge representation and reasoning and about the Expert Systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	The student should be able to identify problems that are amenable to solution by AI methods.	PO1 PO2 PO3	2 2 3
CO2	The student should be able to identify appropriate AI methods to solve a given problem.	PO1 PO2 PO3	2 2 2
CO3	Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).	PO3 PO5	3 2
CO4	The student should have knowledge in expert system	PO1 PO PO3 PO4 PO12	3 2 2 2 1

UNIT- I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE: Introduction, history, intelligent systems, foundations of AI, Applications of AI, current trends in AI.

PROBLEM SOLVING: Definition, characteristics of problem, types of Problem-solving techniques, General Problem Solver (GPS), Water Jug Problem, Missionaries and Cannibals Problem. **[10 Hours]**

UNIT- II

STATE-SPACE SEARCH: Definition, Examples, Exhaustive search techniques: BFS, DFS, IDDFS, Heuristic search techniques: Uniform Cost Search, Best First Search, A* algorithm & Constraint satisfaction Problem.

GAME PLAYING: Introduction about game playing, Mini-Max Algorithm, Alpha-Beta pruning algorithm. **[14 Hours]**

UNIT- III

LOGIC CONCEPTS: Introduction, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic.

PREDICATE LOGIC: Introduction, PNX Normal form, Skolemization, Resolution in Predicate Logic. **[12 Hours]**

UNIT- IV

KNOWLEDGE REPRESENTATION: Introduction, approaches to knowledge representation, knowledge representation using semantic network, knowledge representation using frames.

UNCERTAINTY MEASURE: PROBABILITY THEORY: Introduction, probability theory, Bayesian belief networks, Certainty factor theory, Dempster- shafer theory. **[12 Hours]**

UNIT- V

EXPERT SYSTEM: Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems, application of expert systems.

FUZZY LOGIC: Introduction, Fuzzy sets, Fuzzyset operations, Types of Membership functions, Multi valued logic, Linguistic variables, Hedges. **[12 Hours]**

Text Books:

3. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
4. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
5. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
6. Introduction to Artificial Intelligence, Patterson, PHI

Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F.Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1054203200	Deep Learning (Professional Elective-IV)	3	0	0	3

COURSE OBJECTIVES:

1. Learn deep learning methods for working with sequential data.
2. Learn deep recurrent and memory networks.
3. Learn deep Turing machines.
4. Apply such deep learning mechanisms to various learning problems.
5. Know the open issues in deep learning, and have a grasp of the current research directions.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Understand how to demonstrate the basic concepts fundamental learning techniques and layers.	PO1 PO2 PO4	1 2 2
CO2	Analyze the concept of different types of deep learning network models.	PO3 PO4 PO5	2 1 2
CO3	Classify the Probabilistic Neural Networks Implement tools on Deep Learning techniques	PO1 PO3 PO4 PO12	2 3 2 3

UNIT- I

INTRODUCTION:

Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network.

[8 Hours]

UNIT-II

Training Neural Network:

Risk minimization, loss function, back propagation, regularization, model selection, and optimization.

Conditional Random Fields:

Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

[10 Hours]

UNIT-III

Deep Learning:

Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

[8 Hours]

UNIT-IV

Probabilistic Neural Network:

Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders. [10 Hours]

UNIT-V

Applications:

Object recognition, sparse coding, computer vision, natural language processing.

Introduction to Deep Learning Tools: Caffe, Theano, Torch. [10 Hours]

Text Books:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish kumar, Tata McGraw-Hill Education, 2004.

E-Books:

1. https://books.google.co.in/books/about/ARTIFICIAL_NEURAL_NETWORKS.html
2. <https://www.mheducation.co.in/neural-networks-a-classroom-approach-9781259006166-india>

NPTEL/MOOC:

1. <https://www.coursera.org/specializations/deep-learning>
2. <https://nptel.ac.in/courses/106/106/106106184/>
3. <https://margaretmz.medium.com/deep-learning-moocs-1be70cf9737f>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012204130	Quantum Computing (Professional Elective-IV)	3	0	0	3

Course Objectives:

- This course teaches the fundamentals of quantum information processing, including quantum
- computation, quantum cryptography, and quantum information theory

Course Outcomes: By the end of this course, the student is able to

- Analyze the behaviour of basic quantum algorithms
- Implement simple quantum algorithms and information channels in the quantum circuit model
- Simulate a simple quantum error-correcting code
- Prove basic facts about quantum information channels

UNIT I

Introduction: Quantum Measurements Density Matrices, Positive-Operator Valued Measure, Fragility of quantum information: Decoherence, Quantum Superposition and Entanglement, Quantum Gates and Circuits.

UNIT II

Quantum Basics and Principles: No cloning theorem & Quantum Teleportation, Bell's inequality and its implications, Quantum Algorithms & Circuits.

UNIT III

Algorithms: Deutsch and Deutsch–Jozsa algorithms, Grover's Search Algorithm, Quantum Fourier Transform, Shor's Factorization Algorithm.

UNIT IV

Performance, Security and Scalability: Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

UNIT V

Quantum Computing Models: NMR Quantum Computing, Spintronics and QED MODEL, Linear Optical MODEL, Nonlinear Optical Approaches; Limits of all the discussed approaches, Future of Quantum computing.

Textbooks:

- 1) Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms And Code Samples, SHROFF/ O'Reilly.
- 2) Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition Packt
- 3) V.K Sahni, Quantum Computing (with CD), TATA McGrawHill.

References:

- 1) Chris Bernhardt, Quantum Computing for Everyone (The MIT Press)
- 2) Michael A. Nielsen and Issac L. Chuang, “Quantum Computation and Information”, Cambridge (2002).
- 3) Riley Tipton Perry, “Quantum Computing from the Ground Up”, World Scientific Publishing Ltd (2012).
- 4) Scott Aaronson, “Quantum Computing since Democritus”, Cambridge (2013).
- 5) P. Kok, B. Lovett, “Introduction to Optical Quantum Information Processing”, Cambridge.

e-Resources:

- 1) <https://nptel.ac.in/courses/104104082/>
- 2) https://swayam.gov.in/nd1_noc19_cy31/preview

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012204131	Block chain Technologies (Professional Elective-IV)	3	0	0	3

COURSE OBJECTIVES:

1. To understand abstract models of block chain technology
2. Ability to know how the various payment systems will work on real time.
3. Understand the mathematical analysis of the bit coin technology.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Familiarize the functional/operational aspects of crypto currency ECOSYSTEM.	PO1 PO2	3 2
CO2	Understand emerging abstract models for Block chain Technology.	PO1 PO2	2 1
CO3	Identify major research challenges and technical gaps existing in between theory and practice in cryptocurrency domain.	PO1 PO3 PO4	3 2 1
CO4	Develop a course project using a Bitcoin technology.	PO1 PO3 PO4 PO11 PO12	3 2 2 1 1

UNIT- I

Cryptography, Digital Signatures, Public VS Private Key Cryptography, MD VS SHA, Hashing Algorithm (SHA-256), Merkle Tree. **[10 Hours]**

UNIT-II

Tracking origin, Challenges of current transaction system, The emergence of bit coin, Revolutionizing the traditional business network, Explore, Benefits of block chain, Questions of trust. **[8 Hours]**

UNIT-III

Introduction to Bit coin, Double Spending Problem, Transactions, Time-Stamp Server, Proof-of-Work. **[10 Hours]**

UNIT-IV

Network, Incentive, Reclaiming Disk Space, Usage of Merkel Tree, Simplified payment verification, Combining and Splitting Values, Privacy. **[10 Hours]**

UNIT-V

Why the name, Business Suitability (Shared Ledger, Permissions, Consensus), Types of frictions, Achieving friction free business, Transforming Ecosystems, Use cases (Financing, Insurance, Supply chain management, Healthcare, IOT). **[10 Hours]**

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money, Mark Gates, Wise Fox Publisher, 2017

Reference Books:

1. Mastering Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, O' Reilly.
2. Selected papers from IEEE Symposium on security and Privacy, EUROCRYPT and PODC.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012204132	Data Science (Professional Elective-IV)	3	0	0	3

COURSE OVERVIEW:

Data science is an essential part of any industry today, given the massive amounts of data that are produced. Data science is one of the most debated topics in the industries these days. This is mainly focuses on basics and data loading, data wrangling techniques and visualization

COURSE OBJECTIVES:

1. To provide a comprehensive knowledge of data science using Python.
2. To learn the essential concepts of data analytics and data visualization

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:	POs Mapped	Strength of mapping
CO1	Able to understand, the features of Numpy library for analyzing the data.	Understand	PO1,PO3,P O5
CO2	Summarize the features of pandas library for analyzing the data.	Understand, Analyze	PO1,PO2,P O5
CO3	Make use of various file formats in loading and storage of data.	Apply	PO2,PO3,P O5
CO4	Apply data wrangling techniques to enrich the raw data into a desired format .Visualize the results in an appropriate pictorial representation	Apply and Analyze	PO1,PO2,P O3,PO5

UNIT- I**What is Data science?**

Datafication, Exploratory Data Analysis, The Data science process, A data scientist role in this process. (Text Book 2)

NumPy Basics: The NumPyndarray: A Multidimensional Array Object, Creating ndarrays Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Methods for Boolean Arrays , Sorting , Unique.(Text Book 1). **[10 Hours]**

Course Outcome: Able to understand the features of Numpy library for analyzing the data.

Activity: Implement a python program using Numpy library.

UNIT- II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures, Series, Data Frame, Index Objects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering, Sorting and ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.(Text Book 1) **[8 Hours]**

Course Outcome: Summarize the features of pandas library for analyzing the data.

Activity : Design a Application using Pandas

UNIT- III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format, Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in MongoDB (Text Book 1) **[10 Hours]**

Course Outcome: Make use of various file formats in loading and storage of data.

Activity: Writing data out to Text format

UNIT- IV

Data Wrangling:

Combining and Merging Data Sets, Database style Data Frame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.(Text Book 1). **[8 Hours]**

Course Outcome: Apply data wrangling techniques to enrich the raw data into a desired format. Visualize the results in an appropriate pictorial representation.

Activity: Apply different data wrangling techniques on raw data.

UNIT- V

Plotting and Visualization: A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots. (Text Book 1) **[8 Hours]**

Course Outcome: Apply data wrangling techniques to enrich the raw data into a desired format. Visualize the results in an appropriate pictorial representation.

Activity: Construct the various histograms and density plots to visualize the result.

TEXT BOOKS:

1. Wes McKinney, —Python for Data Analysis, O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'Neil, —Doing Data Science, O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

REFERENCE BOOKS

1. Joel Grus, —Data Science from Scratch: First Principles with Python, O'Reilly Media, 2015
2. Matt Harrison, —Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1012204133	Network Programming (Professional Elective-IV)	3	0	0	3

Course Overview:

The course presents the concepts necessary to understand the way works as well as the system's most commonly used commands. Data manipulation utilities and socket syntax for synthesizing command pipelines are emphasized. Comprehensive hands on exercises are integrated throughout to reinforce learning and develop real competency

Course Objectives:

1. Ability to understand and reason out the working of network Systems.
2. To teach students the use of basic socket programming Utilities.
3. To teach students the principles of socket programming
- 4 .To familiarize students with the concepts, design, and structure of the TCP/UDP programming.
5. To be able to build an application using java network programming.

Course Outcomes:

CO1: To understand the network topology and designing principle.

CO2: Interpreting the client server communication standard protocol and syntaxes.

CO3: Analysing and evaluating the TCP and echo server impact in multiplexing.

CO4: Understanding and design Network programming using Java networking.

UNIT-I:

Introduction to Network Programming:

OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

Outcome: Ability to understand and reason out the working of Unix base socket programming.

Activity/Event: Seminar and Class test

UNIT-II:

TCP client server: Introduction, TCP Echo server functions, Normal startup, termination, POSIX signal handling, server process termination, Crashing of Server Host, Crashing and Rebooting of server host, Shutdown of server host.

Outcome: To create practical concept of TCP socket, echo server and IPV6 protocol implementation.

Activity/Event: Seminar and Class test

UNIT-III:

Sockets: Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function. I/O Multiplexing and socket options: I/O Models, select function, Batch input, shutdown function, poll function.

Outcome: Student will able to implement socket base programming and design customize server.

Activity/Event: Seminar and Class test

UNIT-IV:

Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. Elementary name and Address conversions: DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

Outcome: To familiarize students with the concepts, design, and structure of the UDP sockets and server with different type of implementation with DNS.

Activity/Event: Seminar and Class test

UNIT-V:

Java Network Programming: Network basics, The Networking classes and Interfaces, InetAddress – Factory Methods and Instance methods, Inet4Address and Inet6Address, TCP/IP Client Sockets, URL, URL Connection, HttpURLConnection, The URI Class, Cookies, TCP/IP Server Sockets, Datagrams – DatagramSocket, DatagramPacket, Example

Outcome: Student will able to understand the concept of network programming in Java.

Activity/Event: Seminar and Class test

Text Books:

1. Unix network Programming- The socket Networking API – Volume 1 – W.Richard Stevens, Bill Fenner, Andrew M. Rudoff
2. Java The complete Reference – Eighth Edition

Reference Books:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Unix and shell Programming, N B Venkateswarlu, Reem
4. Unix Concepts and Applications, 3/e, Sumitabha Das, TMH
5. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code : 1005204134	Social Networking and Semantic Web (Professional Elective-V)	3	0	0	3

COURSE OBJECTIVES:

1. To explain the analysis of the social Web and the design of a new class of applications that combine human intelligence with machine processing.
2. To describe how the Semantic Web provides the key in aggregating information across heterogeneous sources.
3. To understand the benefits of Semantic Web by incorporating user-generated metadata and other clues left behind by users.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Enumerate the measures of social network analysis.
CO2	Illustrate Electronic sources for network analysis and different Ontology languages.
CO3	Model and aggregate social network data.
CO4	Develop social-semantic applications and evaluate Web- based social network.

UNIT- I

Introduction to the Semantic Web and Social Networks:

The Semantic Web-Limitations of the current Web, The semantic solution, Development of the Semantic Web, The emergence of the social web. Social Network Analysis- What is network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis.

[8 Hours]

UNIT-II

Web data, Semantics and Knowledge Representation on the Semantic Web:

Electronic sources for network analysis- Electronic discussion networks, Blogs and online communities, Web-based networks. Knowledge Representation on the Semantic Web - Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web (RDF, OWL).

[8 Hours]

UNIT-III

Modeling and aggregating social network data:

State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.

[8 Hours]

UNIT-IV

Developing social-semantic applications:

Building Semantic Web applications with social network features, Flink: the social networks of the Semantic Web community, open academia: distributed, semantic-based publication management. **[8 Hours]**

UNIT-V

Evaluation of web-based social network extraction:

Differences between survey methods and electronic data extraction, Context of the empirical study, Data collection, Preparing the data, Optimizing goodness of fit, Comparison across methods and networks, Predicting the goodness of fit, Evaluation through analysis. **[8 Hours]**

Text Books:

1. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

Reference Books:

1. Semantic Web Technologies
2. Semantic Web and Semantic Web Services, Liyang Lu Chapman and Hall, CRC Publishers
3. Information sharing on the semantic Web, Heiner Stuckenschmidt, Frank Van Harmelen
4. Programming the Semantic Web

E-Resources:

1. <https://link.springer.com/content/pdf/10.1007%2F978-0-387-71001-3.pdf>
2. www.springer.com/in/book/9780387710006
3. https://en.wikipedia.org/wiki/Social_Semantic_Web

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1012204134	Digital Marketing (Professional Elective-V)	3	0	0	3

Course Description:

Social network analysis is used widely in the social and behavioral sciences, as well as in economics, marketing, and industrial engineering. The social network perspective focuses on relationships among social entities and is an important addition to standard social and behavioral research, which is primarily concerned with attributes of the social units. Social Network Analysis: Methods and Applications reviews and discusses methods for the analysis of social networks with a focus on applications of these methods.

Course Objectives:

1. Formalize different types of entities and relationships as nodes and edges and represent this information as relational data.
2. Plan and execute network analytical computations.
3. Use advanced network analysis software to generate visualizations and perform empirical investigations of network data.
4. Interpret and synthesize the meaning of the results with respect to a question, goal, or task.
5. Collect network data in different ways and from different sources while adhering to legal standards and ethics standards.

CO'S	At the end of the course , the students will have the ability to:	PO's mapped	Strength of mapping
CO1	Know basic notation and terminology used in network science.	PO1, PO2,	PO1
CO2	Be able to visualize, summarize and compare networks.	PO1, PO2, PO3	PO2
CO3	Illustrate basic principles behind network analysis algorithms.	PO1, PO2, PO4,	PO4
CO4	Be capable of analysing real work networks.	PO1, PO2, PO12	PO12

UNIT-I

Social Network Analysis: Introduction to networks including the basic concepts in social network analysis, i.e. nodes, edges, adjacency matrix, one and two-mode networks, node degree, connected components, average shortest path, diameter, preferential attachment, network centrality, Balance and Homophily, Erdos Number Project. **[12 hours]**

Outcome: student will learn basic notation and terminology used in network.

Activity: student should analyze their social networks using graph theory. They gather data on their own social relationships either from Facebook interactions.

(Use Microsoft Excel and Cytoscape to develop graphs of their own social networks.
<http://www.cytoscape.org/>)

UNIT-II

Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions. [12 hours]

Outcome: Understand random graph models for networks.

Activity: Design a random graph for social network.

UNIT-III

Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited. [12 hours]

Outcome: student will learn different topologies, contagions in networks.

Activity: Activity how to navigate on social network

UNIT-IV

Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The ErdosRenyi Model, Clustering Models. [12 hours]

Outcome: student will learn different models how to summarize and compare.

Activity: creating an activity how to compare different social network models.

UNIT-V

Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

[12 hours]

Outcome: Student be capable of analysing real work networks.

Activity: perform a real time activity to identify a design pattern.

Text Books:

- 1) S. Wasserman and K. Faust. “Social Network Analysis: Methods and Applications”, Cambridge University Press.
- 2) D. Easley and J. Kleinberg, “Networks, Crowds and Markets: Reasoning about a highly connected world”, Cambridge University Press, 1st edition, 2010.

Reference Books:

- 1) Maarten van Steen. “Graph Theory and Complex Networks. An Introduction”, 2010.
- 2) Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. “Social Media Mining: An Introduction”. Cambridge University Press 2014.
- 3) Maksim Tsvetovat and Alexander Kouznetsov. “Social Network Analysis for Startups”. O’Reilly Media, 2011.

E-Resources:

- 1) <https://www.classcentral.com/course/edx-social-network-analysis-sna-9134>
- 2) <https://www.coursera.org/learn/social-network-analysis>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1012204135	Ad-hoc Sensor Networks (Professional Elective-V)	3	0	0	3

Course Description:

The Unified Modeling Language (UML) provides a common, standard notation for recording both analysis models and design artifacts. A design pattern is a commonly occurring reusable piece in software system that provides a certain set of functionality.

Course Objectives:

- Architect sensor networks for various application setups
- Devise appropriate data dissemination protocols and model links cost
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers
- Evaluate the performance of sensor networks and identify bottlenecks

Course outcomes:

CO'S	Course Outcomes	PO's mapped	Strength of mapping
CO1	Evaluate the principles and characteristics of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.	2	3
CO2	Determine the principles and characteristics of wireless sensor networks.	3	3
CO3	Demonstrate the issues and challenges in security provisioning and also familiar with the mechanisms for implementing security and trust mechanisms in MANETs and WSNs.	2	2
CO4	Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc sensor networks.	4	2

UNIT-I

Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols. Multiple Access: wireless networks.

Unit Outcome: To understand basics on Manets.

UNIT-II

Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols, Routing Algorithms-Source initiated,

Hierarchical, Multipath.

Unit Outcome: To gain knowledge on TCP routing protocols.

UNIT-III

Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems. End to End congestion control design for the Internet

Unit Outcome: To know about challenges of adhoc security.

UNIT-IV

Basics of Wireless Sensors and Applications-.The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High- level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensors for smart environment, Deployment issues in WSN

Unit Outcome: To understand about wireless sensor applications

UNIT-V

Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–Tiny OS, LA-Tiny OS, SOS, RETOS, Imperative Language-nesC, Dataflow Style Language- Tiny GALs, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Unit Outcome: To apply simulation on WSN.

Text Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004.
2. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal, World Scientific Publications / Cambridge University Press, March 2006.
3. Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, 2009.
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
3. Ad hoc Networking, Charles E. Perkins, Pearson Education, 2001.
4. Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1005204138	Cloud Computing (Professional Elective-V)	3	0	0	3

COURSE OBJECTIVES:

After taking the course, students will be able:

1. To learn the basics of Cloud computing
2. To know the key concepts of Virtualization
3. To gain knowledge on cloud computing service models
4. To develop cloud implementation, programming and mobile cloud computing
5. To learn key components of Amazon web services.
6. To maintain the Cloud backup and solutions

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the basics of cloud computing and key concepts of virtualization
CO2	Gain knowledge on cloud computing service models, architectural design of store clouds
CO3	Develop cloud implementation, programming and mobile cloud computing, Understand the application of cloud resource management and scheduling algorithms for computing clouds.
CO4	Analyze and develop the backup strategies for cloud data based on features.

UNIT- I

SYSTEMS MODELING CLUSTERING, AND VIRTUALIZATION OF CLUSTERS AND DATA CENTERS [10 Hours]

Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security and Energy Efficiency. Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Resource Management, Virtualization for Data Center Automation.

UNIT-II

CLOUD PLATFORM ARCHITECTURE

Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware
[8 Hours]

UNIT-III

CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS

Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft AZURE, Emerging Cloud Software Environments. **[10 Hours]**

UNIT-IV

CLOUD RESOURCE MANAGEMENT AND SCHEDULING

Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines. **[10 Hours]**

UNIT-V

STORAGE SYSTEMS

Evolution of storage technology, storage models, file systems and database, distributed filesystems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore, Amazon Simple Storage Service (S3).

CLOUD SECURITY AND TRUST MANAGEMENT Cloud Security defense strategies, Distributed intrusion/ Anomaly detection. Data and software protection techniques, Reputation guided protection of Data Centre. **[10 Hours]**

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press.

Reference Books:

1. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH.
2. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH.

E-Books:

1. [https://www.ulektzbooks.com/books/SIA-Publishers-and-Distributors-\(P\)-Ltd./Cloud-Computing-\(JNTU-K\)-MTE3NTE=](https://www.ulektzbooks.com/books/SIA-Publishers-and-Distributors-(P)-Ltd./Cloud-Computing-(JNTU-K)-MTE3NTE=)
2. <https://www.smartzworld.com/notes/cloud-computing-pdf-notes-cc/>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1012204136	Design Patterns (Professional Elective-V)	3	0	0	3

Course Objectives:

1. Demonstration of patterns related to object oriented design.
2. Describe the design patterns that are common in software applications
3. Analyze a software development problem and express it
4. Design a module structure to solve a problem, and evaluate alternatives
5. Implement a module so that it executes efficiently and correctly

Course outcomes:

CO'S	At the end of the course , the students will have the ability to:	PO's mapped	Strength of mapping
CO1	Construct a design consisting of a collection of modules.	1,3,11	3
CO2	Examine well-known design patterns (such as Iterator, Observer, Factory and Visitor)	1,3	3
CO3	Identify appropriate patterns for design of given problem	1,2	2
CO4	Ability to understand and apply common design patterns to incremental/iterative development	1,3	3

UNIT-I

Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

[12 hours]

Outcome: Understand the design patterns and case study.

UNIT-II

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

[12 hours]

Outcome: Understand the design of creational patterns

UNIT-III

Structural Patterns: Adapter, Bridge, Composite, Decorator, açade, Flyweight, Proxy.
[12 hours]

Outcome: Understand the design of Structural patterns.

UNIT-IV

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.
[12 hours]

Outcome: Understand the design of Behavioral patterns

UNIT-V

Behavioral Patterns: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, a Brief History, the Pattern Community an Invitation, a Parting Thought.
[12 hours]

Outcome: Understand the design of behavioral patterns

Text Books:

- 1) “Design Patterns”, Erich Gamma, Pearson Education.

Reference Books:

- 1) “Head First Design patterns”, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
- 2) “Design Patterns in Java”, Steven John Metsker & William C. Wake, Pearson education, 2006
- 3) “J2EE Patterns”, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
- 4) “Design Patterns in C#”, Steven John metsker, Pearson education, 2004.
- 5) “Pattern Oriented Software Architecture”, F.Buschmann & others, John Wiley & Sons.

e-Resources:

- 1) <https://www.javatpoint.com/design-patterns-in-java>
- 2) https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1001204141	Remote Sensing Applications and GIS (Open Elective-III)	3	0	0	3

Course Overview:

This course will make the student to understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Objectives:

The student will be taught

To introduce the basic principles of Remote Sensing.

1. To explain platforms, sensors and image processing
2. To introduce the basic concepts of GIS
3. To explain the fundamental concepts of GIS and Spatial analysis
4. GIS application in various Engineering problems

Course Outcomes:

	Course Outcome
CO1	Retrieve the information content of remotely sensed data
CO2	To be familiar to understand of Image enhancement and Image classification
CO3	Create and input spatial data for GIS application
CO4	Analyze spatial and attribute data for solving spatial problems
CO5	Apply problem specific remote sensing data for engineering applications

Unit-I:

Basic concepts of GIS: Introduction, key components, spatial data, raster data models, vector data models, raster versus vector, GIS in Spatial analysis, digitization Process, data Base handling & types of data structures, map Projections, commercially available GIS hardware and software, organization of data in GIS.

Unit-II:

Image analysis: introduction, elements of visual interpretations, digital image processing- digital image data formats-BIS,BIL,BSQ, image pre-processing, image rectification, image enhancement, image classification, supervised classification, unsupervised classification.

Unit-III:

Remote sensing & GIS integration: Basic components of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, Sensors- types and characteristics, passive sensor, active sensor, platforms- airborne remote sensing, space borne remote sensing, data pre-processing, Integration of Remote Sensing & GIS.

Unit-IV:

RS & GIS Techniques for Natural resources Management:

Land use/land cover classification systems, Forest cover, agriculture, wasteland management & Water Resources Management.

Unit-V:

Python for Geographic data analysis:

Introduction to Python GIS, Tools available for GIS in pure python, Geometric objects in spatial data model.

RS & GIS Techniques for Natural Disasters Management:

Earthquakes, Landslides, cyclones and Floods – Hazard Zonation, Risk assessment, Relief and Rehabilitation measures

Text Books:

1. Remote sensing and image interpretation by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley and Sons Inc
2. Remote sensing of the Environment by John R Jensen, Pearson Publication
3. Concepts & Techniques of GIS by C.P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications
4. Geographic Information Systems: A management perspective, Stan Aronoff; WDL publication Ottawa, Canada; 1995,

Reference Books:

1. Burrough P.A., Principles of Geographical Information System for Land Resources Assessment, Oxford Publications, 1980
2. Kang-tsung Chang Introduction to Geographical Information System, Fourth Edition, Tata McGraw Hill, 2008
3. Pindie Fu and Jiulin Sun, Web GIS: Principles and applications, ISBN: 9781589482456, ESRI, 2010
4. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU KAKINADA 2001, B.S. Publications.
5. Lo C P, Yeung A K W, Concepts and Techniques of Geographic Information Systems, Prentice Hall. India.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1004203237	Information Theory and Coding (Open Elective-III)	3	0	0	3

COURSE OBJECTIVES:

- To define and apply the basic concepts of information theory.
- To learn the principles and applications of information theory in communication systems
- To study various data compression methods and describe the most common such methods
- To understand the theoretical framework upon which error-control codes are built

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To familiarize with the concepts of measurement of information in terms of probability and entropy, and the relationships among conditional and joint entropies.
CO2	To apply linear block codes & cyclic codes for error detection and correction.
CO3	To apply convolution codes for performance analysis of coding schemes.
CO4	To design BCH & RS codes for Channel performance improvement against burst errors

UNIT –I

Coding for Reliable Digital Transmission and Storage:

[8 hours]

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

UNIT –II

Linear Block Codes:

[8 hours]

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding

UNIT –III

Cyclic Codes:

[8 hours]

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes.

UNIT –IV

Convolutional Codes:

[8 hours]

Encoding of Convolutional Codes, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding.

UNIT –V

BCH AND RS CODES:

[8 hours]

Algebraic Description, Frequency Domain Description, Decoding Algorithms for BCH and RS Codes.

TEXT BOOKS:

1. Digital communications, Simon Haykin, John Wiley, 2005
2. Error Correcting Coding Theory, Man Young Rhee, McGraw-Hill Publishing, 1989.

REFERENCE BOOKS:

1. Error Correction Coding - Mathematical Methods and Algorithms, Todd K. Moon, Wiley India, 2006.
2. Information Theory- Coding and Cryptography, Ranjan Bose, TMH, 2nd Ed, 2009.

E-Books: (Specify links)

1. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-451-principles-of-digital-communication-ii-spring-2005/video-lectures/lecture-12-reed-solomon-codes/>
2. <https://www.youtube.com/watch?v=3o-R0wOu2uO>
3. https://www.researchgate.net/publication/305641094_Error_Detection_and_Correction_Using_Reed_Solomon_Codes
4. <https://www.springer.com/gp/book/9783030058395>

NPTEL/MOOC: (Specify Links)

1. <https://nptel.ac.in/courses/117/106/117106031/>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1054204131	Business Analytics (Open Elective-III)	3	0	0	3

Course Objective:

- The course is designed to gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- The course familiarizes the students with the processes needed to develop, report, and analyze business data.

Unit I

Introduction to Business Analytics: Evolution of Business analytics, scope, Data for Business Analytics, Models in Business Analytics, problem solving with business analytics- Types of data, Integrating Analytics with business, Business Analytics for Competitive Advantage, Descriptive, Predictive, and Prescriptive Analytics, Dashboards Business Analytics Process Cycle.

Unit II

Analytics on Spreadsheets: Basic Excel, Excel Formulas, Excel Functions, Data Queries. Descriptive Analytics: Descriptive Statistical measures - Populations and samples, Statistical notations, Measures of Location, Measures of Dispersion, and Measures of Association.

Statistical Inference: Hypothesis testing, one-Sample Test, Two-Sample Test, Two tailed Hypothesis for mean, ANOVA. Predictive Analytics:

Simple Linear regression, Multiple Linear regression, Residual Analysis, Building regression models, Regression with categorical Independent variables – CASE STUDIES.

Unit III

Machine Learning, Supervised Learning and Unsupervised Learning, Clustering & Segmentation, Affinity/ Association Analysis, Data Reduction, Visual Analytics and Data Visualization Prescriptive Analytics: Building Linear Optimization models, Implementing Linear Optimization models on spreadsheets, Solving Linear Optimization models- CASE STUDIES.

Unit IV

Marketing Analytics, Models and metrics- Market Insight – Market data sources, sizing, PESTLE trend analysis, and porter five forces analysis - Market basket Analysis, Text Analytics, Spreadsheet Modelling - Sales Analytics: E Commerce sales mode, sales metrics, profitability metrics and support metrics.

Unit V

Introduction to Big Data, Master Data Management. Data Mining on what kind of data, What kinds of patterns can be mined, Which technologies are used, Which kinds of applications are targeted, Major issues in Data Mining. Getting to know your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring data Similarity and Dissimilarity.

References:

1. Analytics at Work by Thomas H. Davenport, Jeanne G.Harris and Robert Morison, Harvard Business Press, 2010.
2. Getting Started with Business Analytics: Insightful Decision – Making by David Hardoon, Galit Shmueli, Chapman & Hall/CRC, 2013.
3. Business Intelligence: A Managerial Approach by Efraim Turban, Ramesh Sharda, Dursun Delen and Daid King, Pearson Publication, 2012.
4. Business Intelligence Making Decision through Data Analytics, Jerzy Surma, Business Expert Press, 2011.
5. Successful Business Intelligence: Secrets to Making BI a Killer App by Cindi Howson, Tata McGraw Hill Edition 2012.
6. R for Everyone: Advanced Analytics and Graphics, Jared Lander, Addison Wesley.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1003204140	Nano Technology (Open Elective-III)	3	0	0	3

COURSE OVERVIEW:

This course is to provide an insight into the fundamentals of Nanoscience and nanotechnology. The course provides basics of nanomaterials, quantum mechanics and statistical mechanics. The intended course covers the whole spectrum of nanomaterials ranging from overview, synthesis, properties, and characterization of nanophase materials. To provide knowledge of various industrial applications of nanotechnology.

COURSE OBJECTIVES:

On successful completion of the course, students should be able to: Understand the basic scientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.

COURSE OUTCOMES:

After completing this Course, the student should be able to:

COs	Course Outcomes
CO1	Discuss the fundamental principles of nanotechnology and their application to biomedical engineering
CO2	Apply engineering and physics concepts to the nano-scale and non-continuum domain.
CO3	Choose appropriate synthesis technique to synthesize quantum nanostructures of desired size, shape and surface properties
CO4	Evaluate state-of-the-art, characterization methods for nanomaterials, and determine nanomaterial safety and handling methods required during characterization.

Unit-I:

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

Unit-II:

PROPERTIES OF MATERIALS: Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

Unit-III:

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

Unit-IV:

CHARACTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezo response microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

Unit-V:

CARBON NANO TECHNOLOGY: Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nanocrystalline diamond films, graphene, applications of carbon nano tubes.

APPLICATIONS OF NANO TECHNOLOGY: Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

Text Books:

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.

References:

1. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J. Owens, Wiley publishers.
2. Nanotechnology by Jermy J Ramsden, Elsevier publishers.
3. Nano Materials- A.K. Bandyopadhyay/ New Age Introdu.
4. Nano Essentials- T. Pradeep/TMH.
5. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers.
6. Principles of Nanotechnology by Phani Kumar, Scitech.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1001204140	Disaster Management (Open Elective-IV)	3	0	0	3

Course Overview:

Disaster management is an advanced skill that can minimize damage caused by earthquake, flood or storm. This course provides the understanding and ability to analyze different uncertain situation during the natural calamity. Through this course student can learn the stages of disaster in hydrological disaster. This course also develops the potential of new, evolving technologies to meet vulnerability mapping, modelling and emergency management needs for geological hazards, hydrological and coastal hazards.

Course Objectives:

1. Understand different types of disaster and its triggering features
2. Understand and analyses hydrological disaster
3. Understand and develop models for geological disaster
4. Able to understand the coastal hazard and shore defence structures
5. Capable to preparing vulnerability mapping and risk assessment and developing Emergency Management System.

Course Outcomes:

At the end of the course the student will be able to;

	Course Outcome	Cognitive level as per Bloom's Taxonomy	PO
CO1	To know the basic concepts in Disasters and its triggering factures	Understanding	1,2,5
CO2	To understand stages of hydrological disaster	Understanding	1,2
CO3	To analysis the causes, effects, impacts and of hydrological, geological and coastal hazards.	Understanding, Analyzing	1,2
CO4	To understand the mitigation procedure of uncertain events	Analyzing	1,3,5,6

Unit-I:

Disasters: Definition- Hazard Risk, Mitigation, Natural and human induced disasters types of hazards, disasters and catastrophes – Disaster Management.

Unit-II:

Hydrological Hazards: Flooding – PMP – PMF – Inundation mapping -flood prone area analysis and management. Dam breach analysis - Drought- types of drought - Factors influencing drought - delimiting drought prone areas - drought index, SPI and Palmer.

Unit-III:

Geological Hazards: Earthquakes; location, faults, causes, types, associated hazards and impacts, Richter scale and Modified Mercalli scale. Mass movements: Definition of landslide - types – causes - slope stability analysis.

Unit-IV:

Coastal Hazards – storm surge – Tsunami and floods – cyclone – coastal vulnerability – shore line erosion – shore defense structures.

Unit-V:

Mitigation and Management: Hazard, Risk and Vulnerability mapping and modelling using GIS. Case studies for earth quake zonation. Risk Assessment – Preparedness GIS case studies for earthquake, landslide–risk assessment–GIS, landslide and cyclones. Emergency Management Systems (EMS) in the Disaster Management Cycle.

Text Books:

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.

Reference Books:

1. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.
2. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
3. Arnold M et.al Ed. (2006) Natural Disaster Hotspots: Case Studies. The World Bank Hazard Management Unit Washington, D.C.204p.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1004204140	Speech Processing (Open Elective-IV)	3	0	0	3

Course Objectives:

1. Familiarize with the fundamentals of speech processing
2. Familiarize with models for speech analysis and perception
3. Understand frequency and time-frequency analysis of speech signal.
4. Develop the ability to calculate features and fundamental frequency of speech signal.
5. Familiarize with basic speech coding techniques, like pitch extraction, spectral analysis

Course Outcomes:

After completion of the course students able to:

COs	Course Outcomes
CO1	Explain the Field of Artificial Intelligence from general AI to self-driving cars.
CO2	Analysis and synthesis of speech using different technologies, explain how they work, and discuss their strengths and limitations.
CO3	Illustrate the working principles of Tube type Microwave sources and its applications and advantages.
CO4	summarize the applications of different Speech methods (TTS, ASR and spoken language acquisition)

Unit-I:

Introduction: speech production and perception, information sources in speech, linguistic aspect of speech, acoustic and articulatory phonetics, nature of speech, models for speech analysis and perception.

Unit-II:

Short-term processing: Need, approach, time, frequency and time-frequency analysis; Short-term Fourier transform (STFT): overview of Fourier representation, non-stationary signals, development of STFT, transform and filter-bank views of STFT.

Unit-III:

Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Unit-IV:

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and

Implementation issues.

Unit-V:

Speech coding: Need and parameters, classification, waveform coders, speech-specific coders, GSM, CDMA and other mobile coders; Applications: Some applications like pitch extraction, spectral analysis and coding standard.

Books:

1. “Theory and Applications of Digital Speech Processing”, Lawrence Rabiner and Ronald Schafer, Prentice-Hall, 2011.

reference Books:

1. Discrete-Time Speech Signal Processing, T.F. Quatieri, Prentice-Hall, 2002
2. “The Scientist and Engineer’s Guide to Digital Signal Processing”, Steven W. Smith, California Technical Publishing.
3. Springer Handbook of Speech Processing, Benetsy, M.M. Sondhi, Y. Huang (eds.), Springer-Verlag, 2008.
4. Discrete-Time Processing of Speech Signals, J.R. Deller, J.H.L. Hansen, and J.G. Proakis, Wiley India Pvt. Ltd., 2000.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1054204136	Information Retrieval Systems (Open Elective-IV)	3	0	0	3

Course Objectives:

- To provide the knowledge on information retrieval system capabilities.
- To introduce different computational search problems and evaluate search engines.
- To introduce different applications of informational retrieval techniques in the internet or web environment.
- To discuss about information visualization and system evaluation.

Course Outcomes:

Students will be able to

- Understand various functionalities and capabilities of Information Retrieval System.
- Gain knowledge on cataloging and data structure methodology for IRS.
- Differentiate various clustering algorithms and indexing.
- Differentiate various user search techniques and system search techniques.
- Understand the concepts of information visualization and text search.

UNIT – I Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, IRS VS DBMS, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities, Subject Approach To Information.

UNIT – II Catalog and Indexing: Objectives of Indexing, Indexing Languages, Indexing Process, Information Extraction. Data Structure: Stemming Algorithms, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext Data Structure.

UNIT – III Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing. Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

UNIT-IV User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the Internet and Hypertext.

UNIT-V Information Visualization: Introduction, Cognition and Perception, Information Visualization Technologies. Text Search Algorithms: Introduction, Software Text Search Algorithms, Hardware Text Search Systems.

Text Books:

1. Gerald J. Kowalski, Mark T. Maybury, “ Information Storage and Retrieval Systems – Theory and Implementation”, Second Edition, , Springer
2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

Reference Books:

1. Robert Korfhage, “Information Storage & Retrieval” , John Wiley & Sons.
2. Yates and Neto, “Modern Information Retrieval” Pearson Education.
3. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
4. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1003203132	Operations Research (Open Elective-IV)	3	0	0	3

COURSE OBJECTIVES:

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

COURSE OUTCOMES:

COs	Course outcome
CO1	Understand the various practical problems in manufacturing and service organizations.
CO2	Analyse the allocation models
CO3	Design iterations in the Transportation, assignment, game, inventory problems
CO4	Develop iterations in the replacement, sequencing, queuing problems

UNIT- I**LINEAR PROGRAMMING PROBLEM**

Introduction to LPP, Linear programming problem formulation –graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT- II**TRANSPORTATION PROBLEM:**

Formulation – optimal solution, unbalanced transportation problem –degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- travelling salesman problem.

SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through ‘m’ machines.

UNIT- III

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

INVENTORY: Introduction – single item – the concept of EOQ, deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – with shortages.

UNIT- IV

WAITING LINES: Introduction – single channel – poisson arrivals – exponential service times – with infinite population and finite population models– multichannel – poisson arrivals – exponential service times with infinite population single channel poisson arrivals

THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

UNIT- V

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Text Books:

1. Optimization Theory and Applications/ S.S.Rao/Wiley Eastern Limited, New Delhi.
2. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers
3. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

Reference Books:

1. Engineering Optimization / Kalyanmanai Deb/Prentice Hall of India, New Delhi.
2. Optimization Techniques-Theory and applications/C.Mohan& Kusum Deep/New Age International
3. Operations Research /S.D.Sharma / MacMillan Publishers
4. Introduction to O.R/Hiller & Libermann/TMH
5. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1099203200	Management Science (Open Elective-IV)	3	0	0	3

Course Overview: This course is intended to familiarize the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organizational structure, production operations, marketing, Human resource Management, product management and strategy.

Course Objectives:

1. To familiarize with the process of management and to provide basic insight into select contemporary management practices
2. To provide conceptual knowledge on functional management and strategic management.

Course Outcomes:

COS	Course outcome	Po s mapping	Strength of mapping
CO1	Illustrate basic insights of management principles	PO6, PO11, PO12	3
CO2	Summarize Production process, and Inventory techniques	PO8, PO10, PO11, PO12	2
CO3	Apply Strategies and policies to functional areas	PO8, PO10, PO11, PO12	3
CO4	Understand Contemporary management Practices	PO6, PO11, PO12	3

Unit-I

Introduction to Management: Concept –nature and importance of Management –Generic Functions of Management – Scientific Management – Administrative Management - Theories of Motivation (Maslow's, hertz berg and X-Y Theory) – Designing organization structure ,Decision making process- Principles of organization.

Unit-II

Operations Management: Plant location, Principles and Types of plant layout , Work study- Statistical Quality Control- Control Charts (X Bar chart &R-charts, P-chart and C-chart) - production methods (job, batch mass production) – Material Management: Need for Inventory control- Tools and techniques of Inventory Control - EOQ, ABC analysis, HML, SDE, VED, and FSN analyses.

Unit-III

Strategic Management: Strategic Management Process - Vision, Mission, Goals, and Strategy - Environmental Scanning –Strategy Formulation – Strategy Implementation – Strategy Control. Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM, Identifying Critical Path- (Simple Problems)

Unit-IV

Functional Management: Concept of HRM: Definition, Functions. Concept of HRM, HRD and PMIR- Functions of HR Manager, Job Evaluation and Merit Rating, Concept of MM- Definition, Marketing Functions, Marketing Mix, Product Life Cycle.

Unit-V

Contemporary Management Practices: Basic concepts of MIS, Just-in-Time(JIT) system, Total Quality Management(TQM), Six sigma and Modes of Logistics, Enterprise Resource Planning (ERP), Business process Re-engineering, Green Marketing, Human Resource Accounting, MRP, CMM, Supply Chain Management, Business Process outsourcing (BPO), Bench marking, Balanced Scorecard.

Text Books:

- 1.Dr. P. Vijaya Kumar &Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
- 2.Dr. A. R. Aryasri, 'Management Science' TMH 2011.
- 3.Dr. P. Vijaya Kumar &Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.
- 4.Dr. A. R. Aryasri, 'Management Science' TMH 2011

Reference Books:

1. Koontz &Weihrich: 'Essentials of management' TMH 2011
2. Seth & Rastogi: Global Management Systems, Cengage learning , Delhi, 2011
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. Biswajit Patnaik: Human Resource Management, PHI, 2011

NPTEL/SWAYAMMOOCS:

- 1.https://onlinecourses.swayam2.ac.in/imb19_mg08/preview
- 2.<https://www.coursera.org/learn/strategic-management>

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1012204180	Android Application Development (Skill Oriented Course)	1	0	2	2

COURSE OBJECTIVES:

1. To demonstrate their understanding of the fundamentals of Android operating systems
2. To demonstrate their skills of using Android software development tools
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform
4. To demonstrate their ability to deploy software to mobile devices
5. To demonstrate their ability to debug programs running on mobile devices

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Install and configure Android application development tools
CO2	Design and develop user Interfaces for the Android platform.
CO3	Save state information across important operating system events.

SNO	Lab Experiment
1	Visiting Card
2	Design a Calculator
3	Create a SIGN Up activity with Username and Password.
4	Develop an application to set an image as wallpaper.
5	Write a program to create an activity with two buttons START and STOP
6	Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity.
7	Develop a simple application with one Edit Text so that the user can write some text in it.

8	Create an activity like a phonedialer with CALL and SAVE buttons.
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Text Books:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

Reference Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.
2. Head First Android Development 2e: A Brain-Friendly Guide, Dawn Griffiths, 2017, O'Reilly.

E-Books:

1. Android Development Tutorials, Vogella, Tutorialspoint, Google, Vogella.com; Tutorialspoint.com, etc.
<https://freecomputerbooks.com/Android-Development-Tutorials.html>
2. Android Developer Fundamentals Course: Practical Workbook, Google Developer Training Team, GitBook (2017).
<https://freecomputerbooks.com/Android-Developer-Fundamentals-Course-Practical-Workbook.html>

NPTEL/MOOC:

1. <https://nptel.ac.in/courses/106/106/106106147/>
2. https://onlinecourses.swayam2.ac.in/aic20_sp02/preview

IV Year – I Semester	B. Tech (IT) – VR20	L	T	P	C
Course Code: 1099204120	IPR and Patents (Audit Course)	2	0	0	0

Course Overview:

The aim of this subject is to introduce the basic concepts of Intellectual property laws to the students for first time and familiarize them with the kind of rights, remedies and licensing regime associated with each kind of intellectual property so that students can have a basic understanding of Intellectual Property laws.

COURSE OBJECTIVES:

Upon successful completion of this subject students should be able:

1. To introduce fundamental aspects of Intellectual Property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3. To disseminate knowledge on copyrights and its related rights and registration aspects
4. To disseminate knowledge on trademarks and registration aspects
5. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
6. To aware about current trends in IPR and Govt. steps in fostering IPR

COURSE OUTCOMES: To acquaint the students with:

CO's	At the end of the course, the student will have the ability to:	PO's mapped	Strength of Mapping
CO 1	Interpret the various aspects of IPR	PO6, PO8, PO12	3
CO 2	Conclude importance of Copyrights, Trademarks & Trade Secrets	PO6, PO8, PO12	3
CO 3	Obtain Patent Rights for New Innovations	PO6, PO8, PO12	2
CO 4	Elaborate on Privacy Issues	PO6, PO8, PO12	1

UNIT I

- Introduction to Intellectual Property Law – Evolutionary past – Types of Intellectual Property
 - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration –Geographical indications- Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues- India's New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law - Semiconductor Chip Protection Act-Fair use and Fair Dealing concepts

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law - Invention Developers and Promoters-Non patentable inventions

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Concept of distinctiveness -Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law-Plant Variety Protection and Farmer's Right- Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime

Text Books

1. “Law Relating to Intellectual Property Rights” by V K Ahuja
2. “Intellectual Property Rights” by Neeraj Pandey and Khushdeep Dharni

Reference Books

3. “Intellectual Property Rights: Text and Cases” by R Radhakrishnan and S Balasubramanian
4. “Intellectual Property Rights-Infringement And Remedies” by Ananth Padmanabhan
5. “Intellectual Property Rights (IPRs): TRIPS Agreement and Indian Laws” by E T Lokganathan
6. .B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications Universal law Publishing Pvt. Ltd., India 2000
7. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi ,2010

8. Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford. P. Narayanan, Intellectual Property Law, Eastern Law House

E-Books and Online Resources

9. Intellectual Property Rights A general Introduction
<https://www.pdfdrive.com/intellectual-property-rights-a-general-introduction-e41126141.html>

NPTEL/SWAYAMMOOCS:

10. <https://www.my-mooc.com/en/mooc/intellectual-property-law-policy-part-1-pennx-iplaw1x/>