ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

COMPUTER SCIENCE AND TECHNOLOGY

FOR

B.TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2022-23)

G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(AUTONOMOUS) (For Women)

Shaikpet, Hyderabad –500104.

DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

DEPARTMENT VISION

To build a prime transformative learning community that responds swiftly to the challenges of Information Technology.

DEPARTMENT MISSION

To foster an intellectual environment that delivers virtuous Information Technocrats with commitment to industry and society by strengthening the logical, analytical and applicative skills to excel academically and professionally. To inculcate good communication skills in students and introduce them to various codes of professional practices for carrying out effective team collaborations and project management in the field of IT.

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ACADEMIC REGULATIONS (R22)

For CBCS Based B.Tech. Degree Programmes

(Applicable for the students admitted into I year from the Academic Year **2022-23** and onwards)

1.0 Under-Graduate Degree Programme (UGDP) in Engineering & Technology (E&T)

G. Narayanamma Institute of Technology & Science (GNITS) - for Women, Hyderabad, an Autonomous College approved by AICTE, New Delhi, and affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, offers 4 Year (8 Semesters) Bachelor of Technology (B.Tech.) Degree Programme under Choice Based Credit System (CBCS) with effect from the Academic Year 2022 – 23 onwards in the following Branches of Engineering & Technology (Table 1.0):

S.No.	***Programme***
I.	Computer Science & Engineering **(CSE)**
II.	Electrical & Electronics Engineering **(EEE)**
III.	Electronics & Communication Engineering **(ECE)**
IV.	Electronics & Telematics Engineering **(ETE)**
V.	Information Technology **(IT)**
VI.	Computer Science & Engineering (Artificial Intelligence & Machine Learning) **(CSM)**
VII.	Computer Science & Engineering (Data Science) **(CSD)**
VIII.	Computer Science & Technology **(CST)**

Table 1.0

2.0 Eligibility for Admission

2.1 The Admission to the UGDP shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (TSEAMCET), OR the University, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

2.2 The medium of instruction for the entire UG Degree Programme in E&T shall be ENGLISH only.

3.0 B.Tech. Degree Programme Structure

3.1 The B.Tech. Degree Programmes at GNITS are of Semester Pattern, with 8 Semesters constituting 4 Academic Years and each Academic Year is of TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/AICTE specified Definitions/Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed under Clauses **3.2.1 to 3.2.4**. The Course Structure is organized based on the AICTE Model Curriculum for Under-Graduate Degree Courses in Engineering & Technology (Jan. 2018).

3.2.1 Semester Scheme:

Each UGDP is of 4 Academic Years (8 Semesters), with each academic year divided into two semesters of 22 weeks (≥90 working days) each. Each semester has 2 components of evaluation - 'Continuous Internal Evaluation (CIE)' and 'End Semester Examination or Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Course Structure/Curriculum as suggested by AICTE are followed. The terms 'SUBJECT' or 'COURSE' imply the same meaning here, and refer to 'Theory Subject', or 'Lab/Practical Course', or 'Design/ Drawing Subject', or 'Elective', or 'Open Elective", or 'Seminar', or 'Project', or 'Mini-Project', or 'Online Course', as the case may be.

3.2.2 All the Subjects/ Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a **L: T: P: C** (**L**ecture Periods: **T**utorial Periods: **P**ractical Periods: **C**redits) Structure based on the following general pattern:

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses, and Tutorials (T); and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses.
- Mandatory Courses (MC) will not carry Credits.

3.2.3 Subject/ Course Classification

All the Subjects/ Courses offered for the UGDP are broadly classified as: (a) Foundation Courses (FnC), (b) Core Courses (CoC), and (c) Elective Courses (E*l*C).

- Foundation Courses (FnC) are further categorized as:
  - i) HS (Humanities and Social Sciences including Management Courses),
  - ii) BS (Basic Sciences Courses), and
  - iii) ES (Engineering Sciences Courses);
- Core Courses (CoC) and Elective Courses (E*l*C) are categorized as PS (Professional Subjects), which are further subdivided as:
  - i) PC (Professional/ Departmental Core) Courses
  - ii) PE (Professional/ Departmental Electives) Courses
  - iii) OE (Open Electives) Courses; and
  - iv) Project Works (PW);

- Additional Courses:
  - ONLINE Courses (OL - offered on MOOCS platform by NPTEL/ IITs) approved by JNTUH;
  - MC - No Credits allocated.

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course Structure Grouping for each UG Degree Programme (or B.Tech. Degree Course) is as listed below (along with AICTE specified % Range of Credits) in Table 3.2.4:

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Course Description*	*Range of Credits (AICTE Model)*	*R22 Regulations at GNITS*
1)	**Foundation Courses (FnC)**	**BS – Basic Sciences**	Include - Mathematics, Physics, Chemistry, Biology Subjects	**15% - 20%**	**22.5 C (14.06 %)**
2)		**ES - Engineering Sciences**	Include fundamental engineering subjects	**15% - 20%**	**25 C (15.63 %)**
3)		**HS – Humanities & Social Sciences**	Include subjects related to Humanities, Social Sciences and Management	**5% - 10%**	**12 C (7.5 %)**
4)	**Core Courses (CoC)**	**PC – Professional Core**	Include core subjects related to the Parent Department/ Branch of Engg.	**30% - 40%**	**54.5 C (34.06 %)**
5)	**Elective Courses (E/C)**	**PE – Professional Electives**	Include Elective subjects related to the Parent Department/ Branch of Engg.	**10% - 15%**	**18 C (11.25 %)**
6)		**OE – Open Electives**	Elective subjects include subjects from other Technical and/ or Emerging Subject Areas	**5% - 10%**	**9 C (5.62 %)**

7)	**Projects Related Courses (PW)**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10% - 15%**	**19 C (11.88 %)**
8)		**Mini-Project**	Mini-Project/ Industrial Training / Internship/ UG Mini-Project		
9)		**Seminar**	Seminar based on core contents related to Parent Department/ Branch of Engg.		
10)	**Mandatory Courses**	**MC**	Mandatory Courses	**No Credits**	-
11)	**Additional Courses**	**ONLINE Courses (OL)**	Offered on MOOCS platform by NPTEL/ IITs	ADDI-TIONALs	24 C
Total Credits for UG (B. Tech.) Degree Programme				**160 (100%)**	**160 (100%)**

Table 3.2.4

4.0 Course Work

4.1 A student after securing admission, shall pursue the B.Tech. UG Degree Programme in a minimum period of 4 Academic Years, and a maximum period of 8 Academic Years (with effect from the Date of Commencement of I Year).

4.2 As suggested by AICTE, a 3-week 'Mandatory Induction Programme' shall be offered for all the Branches of Engineering at the start of the I Year UGDP, to enable the newly admitted students get acquainted with the new professional environment, to develop awareness and understanding of the engineering education requirements, and to get them prepared for the academic schedules ahead. The features, activities and pattern of the Induction Programme shall be as per the guidelines suggested in the Model Curriculum. Conventional class work shall commence only after the completion of the Induction Programme.

4.3 Each student shall Register for and secure the specified number of Credits (160 Credits) required for the completion of the UGDP and Award of the B.Tech. Degree in the respective Branch of Engineering.

4.4 Each Semester is structured to provide 20 Credits (20 C), totaling to 160 Credits (160 C) for the entire B.Tech. Programme.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each B.Tech. student and the Faculty Advisor assigned shall advise/counsel the student about the UGDP, its Course Structure and Curriculum, Choice/ Option for Subjects/Courses, based on the competence, progress, pre-requisites and interest of the student.

5.2 The Academic/Examination Section of the College invites 'Registration Forms' from the students apriori (before the beginning of the Semester) through 'ONLINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ONLINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

5.3 Every individual student is advised to register for all the number of credits (20 Credits) indicated in that semester workload of the respective UGDP Course Structure - this is termed as the 'Normal Work Load' (NWL).

5.4 A student can apply for ONLINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from her assigned Faculty Advisor, which should be submitted to the College Academic/ Examination Section through the Head of the Department. (a copy of the same is to be retained by the Head of the Department, Faculty Advisor and the student).

5.5 A student may be permitted to register for the Subjects/ Courses of her choice with the typical work load (20 Credits) suggested in the respective semester credit load allocation of that UGDP Course Structure as the Normal Work Load (NWL), and the Maximum Work Load per semester (MWL) – with permissible additional courses within the Course Structure (subject to a maximum of 2 Theory Courses and 1 Lab Course) of her choice, is limited to a total work load of 28 Credits, based on her PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses in the Department Course Structure and Syllabus contents.

5.6 The choice for the 'additional/extra' Subjects/Courses to reach the Maximum Work Load (MWL) of 28 Credits (above the NWL specified) in each semester must be clearly indicated on a request letter, which needs the specific approvals and signatures of the Faculty Advisor/ Counselor and the HoD on the hardcopy.

5.7 If the student submits ambiguous choices or multiple options or erroneous entries during ONLINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first correctly mentioned Subject/ Course in that category shall be taken into consideration, as applicable.

5.8 The Subject/Course Options exercised through ONLINE Registration are final and CANNOT be changed, and CANNOT be inter-changed; further, alternate choices shall also be not considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of the Department) in a semester could not be offered on account of any unforeseen or unavoidable reasons, then the student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements shall be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of class-work for that semester.

5.9 Dropping of the Subjects/ Courses may be permitted ONLY AFTER obtaining the prior approval from the Faculty Advisor assigned (subject to the retaining of the NWL), ‘within 15 Days of Time’ from the beginning of the current semester.

5.10 For the Mandatory Courses, a ‘Satisfactory Participation Certificate’ from the concerned authorities of the relevant semester is essential. No Marks or Grades or Credits shall be awarded for the Mandatory Courses.

6.0 Subjects/ Courses to be offered

6.1 A typical Section strength (or Class strength) for each semester shall be 60.

6.2 A Subject/ Course may be offered to the students, ONLY IF a Minimum of 30 Students opt for the same. The Maximum Class Strength of a Section is limited to 80.

6.3 More than ONE TEACHER may offer the SAME SUBJECT (Theory/ Tutorials/Lab./Practicals) in any semester. However, selection choice for students will be based on - ‘FIRST COME FIRST SERVE Basis and CGPA Criterion’ (ie., the first focus shall be on the earliest stamping of ONLINE ENTRY from the student for Registration in that semester, and the second focus, if needed, shall be on the existing CGPA of the student).

6.4 If more entries for the Registration of a Subject come into picture, then the Head of the Department concerned shall take necessary action, whether to offer such a Subject/ Course for TWO (or multiple) SECTIONS or NOT .

6.5 In case of the options coming from the students of the other Departments/ Branches/ Disciplines also (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the ‘Parent Department/Branch’ first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations if she acquires a minimum of 75% of attendance in aggregate of all the Subjects/Courses (including Mandatory or Non-Credit Courses) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

7.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted by the College Academic Committee (CAC) on genuine and valid grounds based on the student's representation with supporting evidence.

7.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

7.5 A student, whose shortage of attendance is not condoned in a semester is not eligible to take her End Examinations of that semester; she gets detained and her registration for that semester shall stand cancelled. She will not be promoted to the next semester. She may seek re-registration for all those Subjects registered in that semester in which she got detained, by seeking re-admission for that semester as and when offered; in case if there are any Professional Electives and/ or Open Electives, the same may also be re-registered if offered, however, if those Electives are not offered in later semesters, then alternate Electives may be chosen from the same set of Elective Subjects available under that Elective category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied in addition to the Attendance Requirements mentioned under Clause 7.0.

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course (except for Seminar and Mini-Projects), if she secures not less than 35% (14 marks out of 40 marks) in CIE (Continuous Internal Evaluation), not less than 35% (21 marks out of 60 marks) in SEE (Semester End Examination), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing **'C'** grade or above in that subject/ course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to the Seminar (IV Year II Semester) and the Mini-Projects (II Year II Semester, and III Year II Semester), if she secures not less than 40% of the total marks (that is, 40 out of

100 marks allotted) for each of them. The student would be treated as failed, if she - (i) does not submit a report on her Mini-Projects, or does not make a presentation of the same before the Evaluation Committee as per specified schedule, or (ii) does not present the Seminar as required in the IV year II Semester, or (iii) secures less than 40% of marks (that is, 40 marks) in the Mini-Projects/ Seminar evaluations. She may reappear once for each of the Mini-Projects/ Seminar evaluations, as and when they are scheduled again; if she fails in such 'one reappearance' evaluation also, she has to reappear for the same in the next subsequent semester, as and when they are scheduled, as supplementary candidate.

8.3 A student will not be promoted from the I Year to the II Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 20 Credits out of 40 Credits specified for the I Year, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.4 A student will not be promoted from the II Year to the III Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 48 Credits out of 80 Credits specified up to and inclusive of the II Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.5 A student will not be promoted from the III Year to the IV Year, unless she fulfils the Attendance and Academic Requirements and secures a total of 72 Credits out of 120 Credits specified up to and inclusive of the III Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

8.6 A student - (i) shall register for all the Subjects covering 160 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, (ii) puts up all the Attendance and Academic requirements for 160 Credits securing a minimum of C Grade (Pass Grade) or above in each Subject, (iii) earns ALL 160 Credits securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$5.0, and (iv) satisfactorily completes all Mandatory Courses; to successfully complete the UG Degree Programme. **THERE IS NO EXEMPTION OF CREDITS IN ANY CASE**

8.7 **B.Tech. Degree Programme with HONORS/ MINOR DEGREE in EMERGING AREAS as per AICTE Norms and JNTUH Specifications (with effect from 2022-23 Academic Year):**

a) GNITS offers B.Tech. Degree Programme with HONORS in CSE Branch of CSE Department, with the JNTUH stipulated Regulations and Eligibility Conditions. Accordingly, students need to acquire

20 additional Credits in specified subjects offered from identified Emerging Areas during III Year and IV Year, for HONORS specialization in the same Major Discipline/Branch of Engineering. The Academic Regulations, Eligibility Conditions, Registration and other details are listed in Annexure-H (enclosed).

b) GNITS offers B.Tech. Degree Programmes with MINOR DEGREE in the following Emerging Areas – (i) Artificial Intelligence & Machine Learning (AI & ML), (ii) Cyber Security (CS), (iii) Data Science (DS), (iv) Internet of Things (IoT), v) Advanced Web Development (AWD – under AICTE-LITE Programme - Online), with the JNTUH specified Regulations and Eligibility Conditions. Accordingly, students need to acquire 18 additional Credits in specified subjects offered from identified Emerging Areas, during III Year and IV Year, for MINOR DEGREE specialization from other Departments/Branches of Engineering.

The Academic Regulations, Eligibility Conditions, Registration and other details are listed in Annexure-M (enclosed).

c) Students who opt for the above HONORS/ MINOR DEGREE Programmes should not have any backlogs, as per JNTUH stipulations (details listed in Annexures - H and M).

d) If the student fails to get the JNTUH stipulated number of Credits (18 for Minor Degree and 20 for Honors) within 4 years from the date of commencement of their UGDP, then they shall get only the B.Tech. Degree with the Major Engineering Branch Specialization in which they were admitted in I Year, subject to completion of the required 160 C (as per NWL). All the other Credits they have acquired (beyond this 160 C) shall only be listed as 'Additional Subjects/ Courses chosen' in the Marks Memo along with the Grade obtained. The performances in these 'Additional Subjects' shall not be taken into account while calculating the SGPA and CGPA of the B.Tech. Degree Programme.

e) If a student takes prior permission and registers for any 'Additional Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 160 Credits as specified in the Course Structure of her Department, without HONORS/ MINOR DEGREE considerations (as listed above), the performances in those 'Additional Subjects' (although evaluated and graded) shall not be taken into account while calculating the SGPA and CGPA of the B.Tech. Degree Programme. For such 'Additional Subjects' registered, the % of marks and/or the Letter Grade alone may be indicated in the Marks Memo as a performance measure, subject to the completion of the Attendance and Academic Requirements as stated under Clauses 7.0 and 8.1 – 8.6.

8.8 Students who fail to earn 160 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date of the Commencement of their I Year, shall forfeit their seats in B.Tech. Programme and their admissions shall stand cancelled.

8.9 When a student is detained due to the shortage of attendance in any semester, she may be re-admitted into that semester as and when offered, along with the Academic Regulations of the Batch into which she gets readmitted. However, no Grade Allotments or SGPA/ CGPA calculations shall be done for that entire semester in which she got detained.

8.10 When a student is detained due to lack of Credits in any year, she may be readmitted in the next year(s), after the fulfilment of the Academic Requirements, along with the Academic Regulations of the Batch into which she gets readmitted.

8.11 A student who is eligible to appear for the End Semester Examination in any Subject/ Course, but is absent for a particular Subject/Course or has failed (failing to secure C Grade or above), may reappear for that Subject/ Course at the supplementary examination (SEE) as and when conducted. In such cases, her Internal Marks (CIE) assessed earlier for that Subject/Course shall be retained and carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating her performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of the Credits assigned) with a maximum of 100 marks for Theory, or Labs/ Practicals, or Engineering Graphics/ Engineering Drawing, or Elective Course, or Mini-Projects, or Seminar, or Project – I (Phase – I), or Project – II (Phase – II) etc. These evaluations shall be based on 40% CIE (Continuous Internal Evaluation) and 60% SEE (Semester End Examination) basis, and a Letter Grade corresponding to the % of marks obtained shall be given.

9.2 For all the Subjects/ Courses as mentioned under **9.1**, the distribution shall be: 40 Marks for the CIE and 60 Marks for the SEE for the entire UG Degree Programme.

9.3 **a)** For the Theory Subjects during the semester, the CIE assessment for 40 marks includes two Mid-Term Examinations. Each Mid-Term Examination is conducted for 30 marks, for a duration of 120 minutes, and it shall have two parts: i) Part-A (Objective/Quiz Paper) for 10 marks, and ii) Part-B (Descriptive Paper) for 20 marks. Average of these two Mid-Term Examinations is assessed for 30 marks.

The Objective/Quiz Paper is set with ten multiple choice/ fill-in the blanks/ match the following … type of questions for a total of 10 marks. The Descriptive Paper (for 20 marks) shall contain 6 full questions, out of which, the student has to answer 4 questions, each carrying 5 marks.

The remaining 10 marks of CIE are distributed as - i) 5 marks for Assignment (average of 2 Assignments submitted, each for 5 marks), and ii) 5 marks for - Subject Viva-voce/ PPT/ Poster Presentation/ Case Study on a topic in the concerned subject.

b) The first mid-term examination shall be conducted in the middle of the semester for the first 50% of the syllabus, and the second mid-term examination shall be conducted at the end of the semester for the remaining 50% of the syllabus.

c) There shall be 2 Assignments per semester, and 5 marks are allocated for each Assignment. The First Assignment should be submitted before the conduct of the first mid-term examination, and the Second Assignment should be submitted before the conduct of the second mid-term examination. The Assignments shall be as specified by the concerned subject teacher, and the Average of these two Assignments shall be taken into account for 5 marks.

d) Assessment (for 5 marks) for the Subject Viva-voce/ Poster Presentation/ Case Study on a topic in the subject concerned shall be carried out before the commencement of II Mid-Term Examinations.

e) Sum of these three components of marks - (i) Average of the two Mid-Term Examinations marks (for 30 marks), (ii) Average of the two Assignments marks (for 5 marks), and (iii) the Assessment for the Subject Viva-voce/ Poster Presentation/ Case Study on a topic in the subject concerned (for 5 marks) – shall be the final marks secured towards the CIE (40 marks) in that Subject/ Course. The student has to earn a minimum of 35 % (14 marks) out of these 40 marks allocated.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.
- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*
- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE*

- ***Special internal(Mid) examinations will not be conducted for the absent students in R22 academic regulations***

f) 60 marks are allocated for Semester End Examination (SEE), which is of 3 hours duration. The SEE Question Paper will have two parts: i) Part-A is for 10 marks and is compulsory - it consists of 10 questions of 1 marks each (Two questions from each unit) and ii) Part-B is for 50 marks – it consists of 5 questions of 10 marks each (one question from each unit, it may contain sub-questions); for each question there will be 'either/ or' choice, which means that there will be two questions from each unit and the student should answer one of these two.

9.4 For the Lab/Practical Subjects also, the Continuous Internal Evaluation (CIE) during the semester shall be for 40 Marks, and the End Semester Examination (SEE) shall be for 60 Marks. Out of the 40 Marks for internals (CIE), day-to-day assessment of the lab work shall be judged for 20 Marks; and one internal lab exam shall be conducted by the laboratory teacher concerned for 20 Marks, out of which 10 Marks are allocated for the viva-voce. The Semester End Examination (SEE) for Lab/Practical's shall be conducted at the end of the semester by Two Examiners nominated by the Head of the Department and approved by the Principal.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40%of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.
- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*
- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE*

9.5 For the Subjects with Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation etc.), the distribution shall be: 40 Marks for CIE (20 Marks for the day-to-day work and 20 Marks for the internal test) and 60 Marks for SEE. There shall be TWO internal tests in a semester and the AVERAGE of the two shall be taken into consideration for the award of Marks from the internal tests for CIE. In case of Drawing SEE (*Semester End Examination) question paper there is no compulsory part(Part-A). Drawing will have only one part with either or type pattern. Two questions from each unit will be given,* *students has to answer one question from each unit and carries 12 marks.*

9.6 Open Electives (OE): 3 Open Elective Courses shall be offered in the 8 Semester UG Degree Programme. Students are to choose each Open Elective, from the set of options given, in 3 different semesters (in III and IV Years). The students have to choose three Open Electives (OE1, OE2, OE3) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by her own (parent) department, if she has not registered that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

9.7 There shall be a Seminar Presentation in the IV Year II Semester. For the Seminar, the student shall collect the information on a technical topic, prepare a Technical Report and submit the Technical Report to the Department at the time of Seminar Presentation. The Seminar Presentation (along with the Technical Report submitted) shall be evaluated for 100 marks by Two Faculty Members assigned by the Head of the Department. There shall be no SEE or external examination for the Seminar.

9.8 **a)** There shall be two Mini-Projects – first one (Mini-Project 1 or MP1) will be during II Year II Semester (also termed Real Time Project, based on Laboratory Experiments and Teachers' advice); and the second one (Mini-Project 2 or MP2) is preferably in collaboration with an Industry with the relevant specialization (Industry Oriented Mini-Project), to be registered immediately after II Year II Semester examinations, and taken up during the summer vacation (between II and III Years) for about eight weeks duration. Students also have an option to choose Industry Internship (instead of Industry Oriented Mini-Project) for MP2, if they secure selection at any reputed Industry.

b) The Mini-Project Work shall be submitted in a Report form, and a presentation of the same shall be made before a Committee, which is evaluated for 100 marks by the Committee. The Committee shall consist of - 1) Head of the Department (for MP2) / a Professor of the Department (for MP1), 2) the Supervisor of Mini-Project, and 3) External Examiner (for MP2) / a Senior Faculty Member of the Department (for MP1). There shall be no internal marks for Mini-Projects. Performance evaluation of MP1 and MP2 shall be included in the II Year II Semester Grade Card and III Year II Semester Grade Card, respectively. The External Examiner for MP2 shall be nominated by the Principal from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the Head of Department. Performance Evaluations of MP1 and MP2 Mini-Projects will be included in the II Year – II Semester, and III Year – II Semester Grade Cards, respectively.

c) Industry Internship (for MP2, in place of collaborative Mini-Project) is exclusively meant for those students who have been considered eligible and selected accordingly by the Industry. Based on such selection letters from Industry, approvals will be given to students by the Principal of the Institution to carry out the Industry Internship for the specified period. The work performed during the Internship and the outcomes shall be reported in a Report form, which will also be evaluated in the same format (same as that of MP2 as stated in 9.8 b above).

9.9 Each student shall start the Project Work during the IV Year I Semester as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of the Department.

a) The Project Work shall be divided and carried out in 2 phases: Phase – I (Project - I) during IV Year I Semester, and Phase – II (Project - II) during IV Year II Semester, and the student has to prepare two independent Project Work Reports – *one each during each phase*. First Report shall include the Project Work carried out under Phase – I, and the Second Report (Final Report) shall include the Project Work carried out under Phase – I and Phase – II put together. Phase – I and Phase – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each Phase of the Project Work, 40 marks shall be for the CIE (Continuous Internal Evaluation/CIE), and 60 marks shall be for the End Semester Viva-voce Examination (SEE). The marks earned under CIE for both Phases of the Project shall be awarded by the Project Guide/ Supervisor, based on the continuous evaluation of student's performance and her presentations at the Project Review Committee (PRC) Meetings in the Department, during the two Project Work Phases/periods. The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department (HoD), Project Supervisor, and a Senior Faculty Member of the Department. The PRC shall monitor and review the progress of the Project Work, based on the PRC presentations and performance evaluations. The marks earned under SEE shall be awarded by the Project Viva-voce Committee/ Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Phase - I, the Viva-voce shall be conducted at the end of the IV Year I Semester, before the commencement of the Semester End Examinations, at the Department Level by the Project (Phase – I) Evaluation Committee comprising of HoD or One Professor (nominated by the HoD), Supervisor (no External Examiner).

d) For the Project Phase – II Viva-voce (or Final Project Viva-voce) shall be conducted by a Project (Phase -II) Evaluation Committee comprising of an External Examiner, HoD and the Project Supervisor at the end of the IV Year II Semester, before the commencement of the Semester End Examinations. The External Examiner shall be nominated by the Principal from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

e) The student would be treated as failed, if she - (i) does not submit a Report on her Projects (Phase – I or Phase – II), or does not make a presentation of the same before the Evaluation Committee as per specified schedule, or (ii) secures less than 40% of marks (that is, 40 marks) in the sum total of the CIE and SEE taken together, in her Projects evaluations. She may reappear once for each of the Projects evaluations, as and when they are scheduled again; if she fails in such 'one reappearance' evaluation also, she has to reappear for the same in the next subsequent semester, as and when they are scheduled, as supplementary candidate.

9.10 For the Mandatory Non-Credit Course offered in a semester, a 'Satisfactory grade letter(s)" will be awarded in Grade Memo only after securing ≥ 75% attendance in the Course.

9.11 ONLINE Courses (OL) – offered on MOOCs platform (by NPTEL/IITs): Provision is made to offer some identified Courses, PEs and OEs (or their nearest equivalent courses, along with the number of credits and period of duration, as notified by the HoD) over 'ONLINE' mode, in addition to the conventional 'OFFLINE' mode (regular class-room teaching), from III Year onwards. Students may choose any mode out of these two, within one week from the commencement of the current semester; however, for ONLINE mode choice, prior intimation and approval from the Head of the Department and Principal is necessary. If any student wishes to discontinue the ONLINE mode, she can switch back to OFFLINE mode with prior intimation to the Head of Department, preferably within 2 weeks from the beginning of the current semester. Prior to Registration of these ONLINE Courses (on MOOCS platform – offered by NPTEL/IITs), formal approval of the Courses by JNTUH is essential. On successful completion of the

ONLINE Course, the performance Grade – based on the certification from the 'MOOCS Course Conducting Authorities' (NPTEL/IITs), will be appropriately awarded to the student and the same will be recorded on her Grade Card.

9.12 a) student can re-register for subjects in a semester:

- ***If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Vivavoce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.***

  They may seek re-registration for all those subjects registered in that semester in which the student is failed. The student has to re-appear for CIE and SEE as and when offered.

  A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. His Continuous Internal Evaluation marks for 40 obtained in the previous attempt stand cancelled. The student has to obtain fresh set of marks for 40 allotted for CIE (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject). Head of the Dept. will take care of this

10.0 Grading Procedure

10.1 Marks shall be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practical, or Workshop/Drawing, or Elective Course, or Seminar, or Project, or Mini-Project, etc., and, based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified under 9.0, a corresponding Letter Grade shall be given.

10.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following (Table 10.2) 'Letter Grades and corresponding percentage of marks' shall be followed:

% of Marks Secured	*Letter Grade (Class Intervals)*	*Grade Points (UGC Guidelines)*
90% and above ($\geq 90\%$, $\leq 100\%$)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq 80\%$, $< 90\%$)	A^+ (Excellent)	9
Below 80% but not less than 70% ($\geq 70\%$, $< 80\%$)	A (Very Good)	8

Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (above Average)	6
Below 50% but not less than 40% (≥ 40% , < 50%)	C (Pass)	5
Below 40% (< 40%)	F (FAIL)	0

Table 10.2

10.3 The Grade Designations include 7 categories, namely … O, A+, A, B+, B, C and F.

10.3.1 A student obtaining F Grade in any Subject shall be considered 'FAILED' and will be required to reappear as 'Supplementary Candidate' in the End Semester Examination (SEE), as and when conducted later. In such cases, her Internal Marks (CIE Marks) in those Subject(s) will remain the same as those obtained earlier.

10.3.2 If a student fails to appear for SEE of any Subject (s) for any reason whatsoever, she is deemed to have 'failed', and she will get F Grade in all such failed Subject (s). She will be required to reappear as 'Supplementary Candidate' in the End Semester Examination (SEE), as and when conducted later. In these cases also, her Internal Marks (CIE Marks) in those Subject(s) will remain the same as those obtained earlier.

10.4 A Letter Grade does not imply any specific % of marks.

10.5 In general, a student shall not be permitted to repeat any Subject/ Course (s) for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, she has to repeat all the Subjects/Courses pertaining to that semester, when she is detained (as listed under Clauses 8.9- 8.10).

10.6 A student earns Grade Points (GP) in each Subject/ Course on the basis of the Letter Grade obtained by her in that Subject/Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/Course.

Credit Points (CP) = Grade Points (GP) x Credits - for a Course

10.7 The student passes the Subject/ Course only when she gets GP ≥ 5 (C Grade or above).

10.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (SCP) secured from ALL Subjects/ Courses registered in a semester by the Total Number of Credits registered during that semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = $\{\sum_{i=1}^{N} C_i\, G_i\} \,/\, \{\sum_{i=1}^{N} C_i\}$ **…. for each semester**

where 'i' is the Subject indicator index (takes into account all Subjects in a semester), 'N' is the no. of Subjects 'REGISTERED' for the semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

10.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all the semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL the registered Courses in ALL the semesters, and the Total Number of Credits registered in ALL the semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards at the end of each semester as per the formula

CGPA = $\{\sum_{j=1}^{M} C_j\, G_j\} \,/\, \{\sum_{j=1}^{M} C_j\}$ **… for all S semesters registered**

(ie., upto and inclusive of S semesters, S ³ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After the registration and completion of I Year I Semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

10.10 For the Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs shall be used.

10.11 SGPA of a semester will be mentioned in the Semester Grade Card or Grades Memorandum, if all the subjects of that semester are passed in first attempt. Otherwise, the SGPA shall be mentioned on the Grade Card, only when the student passes all subjects of that semester.

10.12 Passing Standards

10.12.1 A student shall be declared successful or 'passed' in a semester, only when she gets a SGPA ≥ 5.00 (at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire UG Degree Course, only when she gets a CGPA ≥ 5.00; subject to the condition that she secures a GP ≥ 5 (C Grade or above) in every registered Subject/ Course in each semester (during the entire UG Degree Course) for the Award of the Degree, as required.

10.12.2 A student shall be declared successful or 'passed' in any Non-Credit Subject/ Course, if she secures a 'Satisfactory grade' for that Mandatory Course.

10.13 After the completion of each semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that semester indicating the Letter Grades and the Credits earned. The Grade Card or the Grade Sheet shall show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA.

11.0 Declaration of Results

a. Computation of SGPA and CGPA are done using the procedure listed under Clauses 10.6 – 10.10.

b. CGPA is NOT indicative of the % of marks secured. However, in case if % of marks equivalent to the FINAL CGPA (computed at the end of UG Degree Programme) is required, then the following formula may be used as an estimate.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of Degree

12.1 **a)** A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG Degree Programme, and secures the required number of 160 Credits (with Final CGPA $\geq$ 5.0), within 8 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

b) B.Tech. with Honors/ Minor Degree shall be awarded by JNTUH to those successful and acquired 20 Credits (for Honors) and 18 Credits (for Minors) in addition to the stipulated 160 Credits for B.Tech. Degree, as per norms listed Clause 8.7 and Annexures H-M.

12.2 A student who qualifies for the Award of the Degree as listed under Clause 12.1, shall be placed in the following Classes (Table 12.2):

AWARD OF CLASS BASED ON FINAL CGPA
(at the end of the UG Degree Programme)

First Class with Distinction	Final CGPA 8.00 or more ##
First Class	Final CGPA below 8.00 but not less than 7.00
Second Class	Final CGPA below 7.00 but not less than 6.00
Pass Class	Final CGPA below 6.00 but not less than 5.00

Table 12.2

Note:

a) A student with Final CGPA (at the end of the UG Degree Programme) ≥ 8.00, and fulfilling the following conditions -

i) should have passed all the Subjects/ Courses within the first 4 Academic Years (or 8 Sequential Semesters) from the Date of Commencement of her First Academic Year,

ii) should not have been detained or prevented from writing the End Semester Examinations in any semester due to shortage of attendance or any other reason, shall be placed in 'FIRST CLASS with DISTINCTION'.

A student fulfilling the conditions listed under (a) above,alone will be the eligible candidate for the 'University/College Rank' and/or 'Gold Medal' considerations.

b) A student with Final CGPA (at the end of UG Degree Programme) ≥ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

c) A student with Final CGPA (at the end of the UG Degree Programme) < 5.00 will not be eligible for the Award of the Degree.

12.3 Award of 2-Year Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. program and requests for the 2 -Year B. Tech. (UG) Diploma Certificate.

2. The student once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.

3. The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.

4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in next Academic Year in the same college and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program)

13.0 Withholding of Results

13.1 If the student has not paid fees to the University/ College at any stage, or has pending dues against her name due to any reason whatsoever, or if any case of indiscipline is pending against her, the result of the student may be withheld, and she shall not be allowed to go into the next higher semester. The award or issue of the Degree may also be withheld in such cases.

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A student who has been detained in any semester of I, II, III and IV years of R18 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from thatsemester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

1. A student of R18 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R18 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

1. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
2. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. There is NO exemption of credits in any case.
3. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student Transfers

15.1 There shall be no Branch transfers after the completion of the Admission Process.

16.0 Scope

i) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

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 Principal is final.

iv) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College Authorities.

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ANNEXURE - H:

H1) JNTUH stipulated Regulations for B.Tech. Degree Course with Honors:

H1.1 Academic Regulations:

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.

b) For B. Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of the course are enclosed below in Clause H1.4. All these 20 credits need to be completed in III year and IV year only.

c) After registering for the Honors program, if a student is unable to pass all courses in first attempt and earn the required 20 credits, she shall not be awarded Honors degree. However, if the student earns all the required 160 credits of B. Tech., she will be awarded only B. Tech degree in the concerned branch.

d) There is no transfer of credits from courses of Honors program to regular B. Tech. degree course & vice versa.

e) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related departments in the college as well as from the MOOCS platform.

f) For the courses selected under MOOCS platform following guidelines may be followed:

i) Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Honors grade memo.

iv) Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The choice to opt/take the Honors program is purely on the choice of the students.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at any time; and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.

i) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

j) The B. Tech. with Honors program shall be offered at GNITS (W) from the AY 2022-23 onwards. The students who are pursuing their III year I semester in the current academic year can register for the Honors program if they fulfil the eligibility criteria.

k) A student can graduate with Honors if she fulfils the requirements for her regular B. Tech. program as well as fulfils the requirements for Honors program.

l) The institute shall maintain a record of students registered and pursuing their Honors programs branch-wise. The same report needs to be sent to the University once the enrolment process is complete.

m) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap/clash with other courses of study in the respective semesters.

H1.2 Eligibility conditions of the students for the Honors degree:

a) A student can opt for B.Tech. degree with Honors, if she passed all subjects in first attempt in all the semesters till the results announced and maintaining 7.5 or more CGPA.

b) If a student fails in any registered course of either B. Tech. or Honors in any semester of four years program, she will not be eligible for obtaining Honors Degree. She will be eligible for only B. Tech. degree.

c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year I Semester (V Semester), is mandatory.

d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the CGPA secured by the students till II year I semester.

e) The department concerned should be preferably NBA accredited and shall offer at least one M. Tech. Program.

f) Successful completion of 20 credits earmarked for Honors program with atleast 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.

g) For CGPA calculation of B. Tech. course, the 20 credits of Honors program will not be considered.

H1.3 Registration for the course in Honors Program:

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is Rs. 1000/- per one credit.

e) A fee for late registration may be imposed as per the norms.

H1.4 Academic Regulations/ Course Structure for Honors degree in B. Tech. Programs (Table H1.4):

S. No.	***Year/ Semester***	***Course to be Chosen From/ Studied***	***Mode of Learning***	***No. of Credits***
1	III-1	PE1 OR PE2	Blended/ Conventional	3
2	III-2	Research Methodologies	Conventional	3
3	III-2	PE3	Conventional	3
4	IV-1	PE4	Conventional	3
5	IV-1	PE5	Conventional	3
6	IV-2	Technical Paper Writing	Under the Mentorship of a Supervisor	2
7	IV-2	PE6 or an Inter-disciplinary Subject as suggested by University	MOOCS	3
		TOTAL CREDITS		20

Table: H1.4

Notes:

A) Professional Elective (PE) course should be selected (which is not studied) from each Professional Electives list provided in regular B. Tech. course.

B) Courses can be chosen as in above table.

C) **Technical paper writing:**

a) The student shall take up a problem/topic of engineering branches (inter-disciplinary nature) and apply the knowledge which she acquired while pursuing their engineering branch. It is expected to analyse, design and develop an application for the identified problem and write a technical paper/document.

Alternatively, the student - i) shall identify a research topic, analyse the problem, carryout the experiments, write a technical paper and publish in /communicate for a Scopus indexed journal/any journal with decent reputation, or ii) demonstrate a talent/an idea/ development of an innovative product.

b) The evaluation shall be done by the same committee which is constituted for project evaluation, along with the final semester project work.

c) The students should start exploration for the Technical Paper Writing immediately after the semester exams of III-II semester. Only the evaluation part shall be carried in IV-II semester.

D) The institute shall offer a course on Research Methodologies by combining the students of all branches (if the number of students is more, multiple parallel sessions may be conducted). The time slots in the time-tables of respective branches should be aligned. The external evaluation of Research Methodologies course shall be done by the University.

E) If the blended course option is chosen, for the subject in III-I semester, the learning should be partially in online mode and partially in offline mode. The external evaluation shall be done by the University; however, for the internal evaluation component, online assessment should also be taken into account while finalising the internal marks by the course teacher.

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ANNEXURE - M:

M1) JNTUH stipulated Regulations for B.Tech. Degree Course with Minors:

M1.1 Minor Courses and the Offering Departments (Table M1.1):

S. No.	*Minor Programme*	*Eligible Branches of Students*	*Offering Depart-ments @*	*Award of Degree*
1	Artificial Intelligence & Machine Learning	All Branches, except B.Tech. in CSE (AI & ML)/ B.Tech. (AI & ML)/B.Tech. (AI) / B.Tech. CSE (AI)	CSE	B.Tech. in Branch Name with Minor in Artificial Intelligence & Machine Learning
2	Cyber Security	All Branches, except B.Tech. in CSE (Cyber Security)/ B.Tech. (Cyber Security)	CSE	B.Tech. in Branch Name with Minor in Cyber Security
3	Data Science	All Branches, except B.Tech. in CSE (Data Science)/ B.Tech. (Data Science)	CSE	B.Tech. in Branch Name with Minor in Data Science
4	IOT	All Branches, except B.Tech. in CSE (IOT)/ B.Tech. (IOT)	ECE	B.Tech. in Branch Name with Minor in IOT
5	Innovation and Entrepre-neurship	All Branches	Manage-ment Science/ MBA	B.Tech. in Branch Name with Minor in Innovation and Entrepreneurship

@ as per AICTE guidelines.

Table: M1.1

M1.2 Academic Regulations for B. Tech. Degree with Minor Programs:

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.

b) For B. Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B. Tech degree). The list of courses of each Minor program, their respective credits weightage and semester-wise break-up of the courses are as specified by JNTUH authorities. All these 18 credits need to be completed in III year and IV year only.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of

B.Tech., he/she will be awarded only B. Tech degree in the concerned branch.

d) There is no transfer of credits from Minor program courses to regular B. Tech. degree course & vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.

f) For the course selected under MOOCS platform following guidelines may be followed:

i) **Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential.** University, before the issue of approval, considers the parameters like the Institute / Agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in Minor grade memo.

iv) Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The choice to opt/take a Minor program is purely on the choice of the students.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at any time; and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.

i) The student can choose only one Minor program along with her basic engineering degree. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

j) The B. Tech. with a Minor program shall be offered from the AY 2021-22 onwards. The students who are pursuing their III year I semester in the current academic year can register for the Minor program if they fulfil the eligibility criteria.

k) A student can graduate with a Minor if she fulfils the requirements for her regular B. Tech. program as well as fulfils the requirements for Minor program.

l) The Institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise. The same report needs to be sent to the University once the enrolment process is complete.

m) The Institute / Department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

M1.3 Eligibility conditions for the student to register for Minor Course:

a) A student can opt for B.Tech. degree with Minor program if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory.

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

M1.4 Registration for the courses in Minor Program:

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is Rs. 1000/- per one credit.

e) A fee for late registration may be imposed as per norms.

* * *

ACADEMIC REGULATIONS (R22)

For CBCS Based B.Tech. Degree Programmes for Students Admitted under Lateral Entry Scheme (LES)

(Applicable for the students admitted into II year from the Academic Year **2023-24** and onwards)

A) Eligibility for Admission ~

A.1 The Admission to the B.Tech. Programme (UG Degree Programme) shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (TSECET), OR the University, OR on the basis of any other order of merit approved by the University, subject to the reservations as prescribed by the Government from time to time.

B) B.Tech. Degree Course Structure for LES Students ~

B.1 Regular Full Time B.Tech. Degree Courses at GNITS are of Semester Pattern, with 8 Semesters constituting 4 Academic Years and each Academic Year is of TWO Semesters (First/Odd and Second/Even Semesters). Students admitted under LES shall join - the II Year stream of the Regular B.Tech. students in the relevant branch of engineering (admitted for 4 Year UG Degree Programme in the previous year); and their UGDP period therefore shall be 3 Years (II, III and IV Years) or 6 Semesters of the Regular Full Time B.Tech. Programme (commencing from II Year I Semester).

B.2 The LES Students, after securing admission, shall pursue their UG Degree Programme of study for not less than 3 years and not more than 6 years, from the year of admission.

B.3 Each student shall Register for and secure the specified number of Credits (120 Credits) required for the completion of the UGDP and the Award of the B.Tech. Degree in the respective Branch of Engineering.

C) Academic Requirements ~

C.1 A student will not be promoted from the II Year to the III Year, unless she fulfills the Attendance and Academic Requirements and secures a total of 24 Credits out of 40 Credits specified up to and inclusive of the II Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

C.2 A student will not be promoted from the III Year to the IV Year, unless she fulfils the Attendance and Academic Requirements and secures a total of 48 Credits out of 80 Credits specified up to and inclusive of the III Year II Semester, from all the relevant regular and supplementary examinations, whether she takes those examinations or not.

C.3 A student shall register for all the Subjects covering 120 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, puts up all the Attendance and Academic requirements for 120 Credits securing a minimum of C Grade (Pass Grade) or above in each Subject, and earns ALL 120 Credits securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the B.Tech. Degree Programme.

C.4 A student who fails to earn 120 Credits specified as per the Course Structure, and as indicated above, within 6 Academic Years from the year of admission (that corresponds to the II Year I Semester of the Regular Full Time B.Tech. Degree Programme), shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.

D) Award of Degree

D.1 A student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG Degree Programme, and secures the required number of 120 Credits (with final CGPA ≥ 5.0), within 6 Academic Years from the year of admission, shall be declared to have 'QUALIFIED' for the Award of the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

D.2 A student who qualifies for the Award of the Degree as listed under Clause **D.1**, shall be placed in the following Classes (Table D.2):

AWARD OF CLASS BASED ON FINAL CGPA
(at the end of the UG Degree Programme)

First Class with Distinction	Final CGPA 8.00 or more ##
First Class	Final CGPA below 8.00 but not less than 7.00
Second Class	Final CGPA below 7.00 but not less than 6.00
Pass Class	Final CGPA below 6.00 but not less than 5.00

Table: D.2

Note:

a) A student with Final CGPA (at the end of the UG Degree Programme) ≥ 8.00, and fulfilling the following conditions -

i) should have passed all the Subjects/ Courses within the first 3 Academic Years (or 6 Sequential Semesters) from the Year of Admission,

ii) should not have been detained or prevented from writing the End

Semester Examinations in any semester due to shortage of attendance or any other reason, shall be placed in 'FIRST CLASS with DISTINCTION'.

A student fulfilling the conditions listed under (a) above,alone will be the eligible candidate for the 'University/College Rank' and/or 'Gold Medal' considerations.

b) A student with Final CGPA (at the end of UG Degree Programme) $\geq$ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

c) A student with Final CGPA (at the end of the UG Degree Programme) $<$ 5.00 will not be eligible for the Award of the Degree.

E) Other Regulations ~

All the Academic Regulations as applicable for the B.Tech. 4 Year (Regular) Degree Programme students shall hold good for the B.Tech. Lateral Entry Scheme students also, but for the variations as described above, under Clauses A, B, C and D for LES students.

F) LES Students are not eligible for the 2-Year UG Diploma Certificate (that provision is available for the Regular 4 Year B.Tech. Course Students only).

B.Tech. 4 Year (8 semesters) Regular Programme in MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the student:	
1. (a)	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 subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student 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 subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3.	Impersonates any other student in connection with the examination	The student who has impersonated shall beexpelled from examination hall. The student isalso debarred and forfeits the seat. The performance of the original student who has been

		impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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.	Smuggles in the answer book, 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 subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	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 subject.

6.	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 ofhis relations, or indulges in any 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.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/ year. The students 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.
7.	Leaves the exam hall taking awayanswer script or intentionally tears of the script or any part there of inside oroutside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation ofthe course by the student is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student 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 colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who donot belong to the college will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects 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 subject and all other subjects the student 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 university for further action to award suitable punishment.	

B.Tech. 4 Year (8 semesters) Regular Programme in
COMPUTER SCIENCE AND TECHNOLOGY
COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2022-23)

I YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	121AA	Applied Chemistry	3	0	0	3
2	BS	121AB	Applied Physics	3	0	0	3
3	BS	121AG	Linear Algebra and Multivariable Calculus	3	1	0	4
4	ES	121AH	Programming for Problem Solving	3	0	0	3
5	HS	121AF	English for Skill Enhancement	2	0	0	2
6	BS	12101	Applied Chemistry Lab	0	0	2	1
7	BS	12102	Applied Physics Lab	0	0	3	1.5
8	ES	12108	Programming Lab	0	0	3	1.5
9	HS	12105	English Language and Communication Skills Lab	0	0	2	1
10	MC	12107	Gender Sensitization	0	0	2	-
			TOTAL	**14**	**1**	**12**	**20**

I YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	122AK	Numerical Techniques and Transform Calculus	3	1	0	4
2	ES	122AJ	Data Structures	3	0	0	3
3	ES	122AC	Basic Electrical Engineering	3	0	0	3
4	ES	122AE	Engineering Graphics	1	0	3	2.5
5	ES	12204	Engineering Workshop	1	0	3	2.5
6	ES	12209	Data Structures Lab	0	0	3	1.5
7	ES	12203	Basic Electrical Engineering Lab	0	0	3	1.5
8	ES	122AD	Design Thinking	2	0	0	2
9	MC	12206	Environmental Science and Technology	2	0	0	-
			TOTAL	**15**	**1**	**12**	**20**

B.Tech. 4 Year (8 semesters) Regular Programme in
COMPUTER SCIENCE AND TECHNOLOGY
COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2022-23)

II YEAR I SEMESTER

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	123AU	Probability and Statistics	3	0	0	3
2	PC	123AN	Design and Analysis of Algorithms	3	1	0	4
3	PC	123AM	Database Management Systems	3	1	0	4
4	ES	123AP	Digital Logic Design	3	0	0	3
5	PC	123AV	Python Programming	2	0	0	2
6	PC	12313	Database Management Systems Lab	0	0	3	1.5
7	PC	12317	Python Programming Lab	0	0	2	1
8	ES	12316	IT Workshop Lab	0	0	3	1.5
9	MC	12312	Constitution of India	2	0	0	-
TOTAL				**16**	**2**	**8**	**20**

II YEAR II SEMESTER

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	124BG	Discrete Mathematics	3	0	0	3
2	PC	124BK	Object Oriented Programming through JAVA	3	0	0	3
3	PC	124BL	Operating Systems	3	0	0	3
4	PC	124BB	Computer Organization and Architecture	3	0	0	3
5	PC	124BP	Software Engineering	3	0	0	3
6	PC	12425	Object Oriented Programming through JAVA Lab	0	0	3	1.5
7	PC	12423	Logic Circuits and Microprocessor Lab	0	0	3	1.5
8	PW	12424	Mini Project-1 (Real Time Project)	0	0	4	2
9	MC	12422	Human Values and Professional Ethics	2	0	0	-
TOTAL				**17**	**0**	**10**	**20**

B.Tech. 4 Year (8 semesters) Regular Programme in
COMPUTER SCIENCE AND TECHNOLOGY
COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2022-23)

III YEAR I SEMESTER

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	PC	125CN	Full Stack Development	3	1	0	4
2	PC	125CD	Computer Networks	3	0	0	3
3	PC	125BW	Automata and Compiler Design	3	0	0	3
4	PE1	**Professional Elective-1 (Offline/Online)**		3	0	0	3
		125BA	Artificial Intelligence				
		125CJ	Distributed Systems				
		125DG	Real-time Systems				
		125BR	Advanced Computer Architecture				
5	PE2	**Professional Elective-2 (Offline/Online)**		3	0	0	3
		125CE	Data Mining				
		125CC	Computer Graphics				
		125CY	Microprocessors and Microcontrollers				
		125BT	Advanced Operating Systems				
6	PC	12533	Full Stack Development Lab	0	0	3	1.5
7	PC	12531	Computer Networks Lab	0	0	3	1.5
8	HS	12528	Advanced Communication Skills Lab	0	0	2	1
			TOTAL	**15**	**1**	**8**	**20**

III YEAR II SEMESTER

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	126EG	Managerial Economics and Financial Analysis	3	0	0	3
2	PC	126EC	Information Security	3	1	0	4
3	PC	126ED	Internet of Things	3	0	0	3
4	PE3	**Professional Elective-3 (Offline/Online)**		3	0	0	3
		126CA	Cloud Computing				
		126EP	Software Project Management				
		126CX	Machine Learning				
		126EA	Image Processing				
5	OE1	**Open Elective-1 (Offline/Online)**		3	0	0	3
6	PC	12641	Information Security Lab	0	0	2	1
7	PC	12658	Internet of Things Lab	0	0	2	1
8	PW	12644	**Mini Project-2** Industry Oriented Mini Project/Internship (during Summer between II and III years)	0	0	4	2
			TOTAL	**15**	**1**	**8**	**20**

B.Tech. 4 Year (8 semesters) Regular Programme in
COMPUTER SCIENCE AND TECHNOLOGY
COURSE STRUCTURE
(Applicable for the Batch admitted from the Academic Year 2022-23)

IV YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	127FN	Fundamentals of Management	3	0	0	3
2	PC	127EQ	Software Testing Methodologies	3	0	0	3
3	PE4	**Professional Elective – 4**		3	0	0	3
		127EW	Blockchain Technologies				
		127FB	DevOps				
		127CZ	Mobile Application Development				
4	PE5	**Professional Elective – 5 (Offline/Online)**		3	0	0	3
		127CS	Information Retrieval Systems				
		127GE	Wearable Technologies				
		127FA	Design Patterns				
		127CL	Embedded Systems				
5	OE2	**Open Elective – 2 (Offline/Online)**		3	0	0	3
6	PC	12765	Software Testing Methodologies Lab	0	0	2	1
7	PC	**Lab (Linked to PE4)**		0	0	2	1
		12750	Blockchain Technologies Lab				
		12754	DevOps Lab				
		12760	Mobile Application Development Lab				
8	PW1	12763	Project Work (Phase – I)	0	0	6	3
TOTAL				**15**	**0**	**10**	**20**

IV YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	128GW	Entrepreneurship and Project Management **(Offline/Online)**	2	0	0	2
2	PE6	**Professional Elective – 6 (Offline/Online)**		3	0	0	3
		128GU	E-Commerce				
		128FZ	Soft Computing				
		128HC	High Performance Computing				
		128FS	Natural Language Processing				
3	OE3	**Open Elective – 3 (Offline/Online)**		3	0	0	3
4	PW	12870	Seminar (Presentation with Report before 1st Mid Exams)	1	0	2	2
5	PW2	12869	Project Work (Phase – II)	0	0	20	10
TOTAL				**9**	**0**	**22**	**20**

List of Open Elective offered by various Departments for B.Tech. Programme

(Applicable for the Batches admitted from the Academic year 2022-23 onwards)

S. No.	Name of the Department Offering	Open Elective-1 (B. Tech. III Year II Semester)	Open Elective-2 (B. Tech. IV Year I Semester)	Open Elective-3 (B.Tech. IV Year II Semester)
1	CSE/ IT/ CST	• Fundamentals of Data Structures (126KF) • Fundamentals of Database Management Systems(126KG) • Operating Systems (126KK) • Software Engineering (126KQ)	• Internet of Things(127KY) • Cyber Security (127KT)	• Cloud Computing(128LE) • Blockchain Technologies (128LD)
2	CSE (AI & ML)	• Fundamentals of Artificial Intelligence (126KD)	• Machine Learning Basics (127KZ)	• Introduction to Natural Language Processing (128LL)
3	CSE (Data Science)	• Fundamentals of Data Science(126KE) • R Programming (126KP)	• Data Visualization using Python (127KU)	• Data Mining (128LF)
4	ECE	• Biomedical Electronics and Applications (126KA) • Principles of Communication Technologies (126KN) • Verilog HDL(126KR)	• Sensors and Actuators (127KV) • Elements of Satellite Communications (127KW)	• Wearable Devices and its Applications (128LP) • Systems Engineering (128LG)
5	ETE	• Principles of Communications (126KM)	• Telecommunication Switching Systems (127LC)	-
6	EEE	• Engineering Materials (126KC)	• Renewable Energy Sources(127LA)	• Waste Management Techniques and Power Generation (128LN)
7	Mech. Engg.	• Operations Research (126KL)	• Research Methodology (127LB)	-
8	H&M	• Introduction to Data Analytics(126KJ) • Intellectual Property Rights(126KH)	• Industrial Management (127KX) • Behavioural Skills and Professional Communication (127KS)	• Marketing Management (128LM)
9	BS	• Disaster Management (126KB)	-	• Environmental Impact Assessment (128LH)

Note: Open Elective- Students should take Open Electives from List of Open Electives Offered by Other Departments/Branches Only.

Ex: A Student of Computer Science and Engineering can take Open Elective Subject from all other departments/branches except Open Electives offered by CSE Dept.

I Year B.Tech. CST I-Semester **L T P C**

Course Code: 121AA **3 0 0 3**

APPLIED CHEMISTRY

(Common to EEE, ECE, ETE, CST)

Prerequisites: -Nil-

Course Objectives:

1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To acquire the knowledge of water treatment, electrochemistry and corrosion which are essential for the Engineers and in industry.
3. To acquire the skills pertaining to Polymers and Energy sources to apply them for various engineering fields etc.
4. To impart then knowledge of engineering materials and their aspects useful for understanding material chemistry.

UNIT 1: Water and its treatment: (~8 Lecture Hours)

Introduction to hardness of water: Causes of hardness and its units. Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications: Steps involved in the treatment of potable water, Disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of boiler feed water: Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods: Softening of water by Ion exchange process. Desalination of Brackish water–Reverse osmosis.

UNIT 2: Electrochemistry and corrosion: (~12 Lecture Hours)

Electrochemistry: Electrochemical cells, Electrode potential, Standard electrode potential. Nernst equation: derivation and significance. Electrochemical series and its applications. Construction and functioning of Hydrogen and Calomel electrode. pH determination using Calomel electrode. Batteries: Primary and Secondary batteries. Construction, working of Lithium Cell and Lithium-ion battery and its applications to electrical vehicles. Fuel cells: Construction and applications of Methanol Oxygen fuel cell.

Corrosion: Causes and effects of corrosion. Theories of chemical and electrochemical corrosion. Mechanism of electrochemical corrosion. Types of corrosion: Galvanic corrosion, Concentration cell corrosion, Waterline and Pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods-Cathodic protection: Sacrificial anodic protection and Impressed current cathodic methods. Surface coatings: Metallic coatings – Methods of coatings: Hot dipping, galvanization, tinning.

UNIT 3: Polymeric materials: (~8 Lecture Hours)

Definition of polymers, Classification of polymers with examples. Types of polymerization: Addition Polymerization (free radical mechanism) and condensation polymerization with examples – Nylon 6:6, Terylene. **Plastics:** Definition and characteristics. Plastics: thermosetting and thermoplastics. Preparation, properties and engineering applications of PVC , Bakelite, Teflon . **Rubbers:** Natural rubber and its vulcanization. **Elastomers:** Characteristics, preparation, properties and applications of Buna-S, Butyl and Thiokol rubber. **Conducting polymers:** Characteristics and Classification with examples, mechanism of conduction in trans- polyacetylene and applications of conducting polymers. **Biodegradable polymers:** Concept and advantages of biodegradable polymers. Preparation of Polylactic acid and poly vinyl alcohol and their applications.

UNIT 4: Energy sources: (~8 Lecture Hours)

Fuels-Introduction, Calorific value of fuel: HCV, LCV, Dulong's formula. Classification of fuels: Solid fuels: coal, analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels: Petroleum and its refining. Cracking types: Moving bed catalytic cracking. Knocking: Octane and Cetane rating. Synthetic petrol - Fischer-Tropsch's process. Gaseous fuels: Composition and uses of natural gas, LPG and CNG. Combustion: Definition, Calculation of air required for the combustion of fuel, numerical problems related to calorific value and combustion. Solar cells: Introduction and applications of Solar cells. Biodiesel: Transesterification and applications. 2G-Ethanol: Synthesis and applications.

UNIT 5: Engineering Materials: (~8 Lecture Hours)

Cement: Portland cement, its composition, setting and hardening of Portland cement. Special cement: Properties and uses of High alumina cement, White cement, and Waterproof cement. **Refractories:** Classification and Characteristics of a good refractory. Properties- Refractoriness and RUL. **Lubricants:** Functions and Classification of lubricants with examples. Characteristics of good lubricants. Mechanism of Lubrication: Thick film, thin film, and extreme pressure. Properties: Viscosity, Cloud and pour point, Flash and fire point.

Text Books:

1. P.C.Jain and M.Jain, Engineering Chemistry, Dhanpatrai Publishing Company, 2010.
2. Rama Devi and Rath, Engineering Chemistry, Cengage learning, 2022.
3. M. Thirumala Chary, E. Laxminarayana and K.Shashikala, AText book of Engineering Chemistry, Pearson Publications, 2021.
4. Y. Bharathi kumari, A Text book of Engineering Chemistry, VGS publications.

Reference Books:

1. Shikha Agarwal, Engineering Chemistry, Cambridge University Press, Delhi, 2015.
2. Shashi Chawla, Engineering Chemistry, Dhanpatrai and Company(P) Ltd. Delhi, 2011.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106170/
2. https://nptel.ac.in/courses/113105028
3. https://nptel.ac.in/courses/115107116

Course Outcomes:

After completion of the course, student will be able to

1. Understand the concepts, to identify and analyze the hardness of water and its softening techniques in industry and daily usage.
2. Apply the working principles of batteries and their applications in automobile field, corrosion and its prevention.
3. Learn the concepts of various types of polymers, conducting polymers, biodegradable polymers and their applications in industrial and medical fields.
4. Identify different types of energy sources and their applications in various engineering fields.
5. Analyze the usage and applications of various types of cements, lubricants and refractories in engineering field.
6. Learn the potential applications of chemistry in practical utility to become good engineers and entrepreneurs.

* * *

I Year B.Tech. CST I-Semester **L T P C**
Course Code: 121AB **3 0 0 3**

APPLIED PHYSICS

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

Through this course the student is to:

1. Understand the fundamentals of quantum mechanics and study the behaviour of a particle quantum mechanically.
2. Analyze the semiconductors and semiconductor devices.
3. Be able to classify the types and properties of dielectric and magnetic materials
4. Understand the construction and working principle of different types of lasers and light propagation through optical fiber.
5. Learn the fundamentals of nano material synthesis and characterizations.

UNIT 1: Quantum Mechanics (~9 Lecture Hours)

Introduction to quantum physics, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

Kronig-Penny model (using Bloch theorem, qualitative analysis and conclusions), Energy bands in solids. E-k diagram, classification of materials: Metals, Semiconductors and Insulators. Density of states (Qualitative) and electron occupation probability (Fermi-Dirac Distribution function analysis)

UNIT 2: Semiconductor Physics (~9 Lecture Hours)

Intrinsic and Extrinsic semiconductors, Carrier concentrations of Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination (Qualitative), Hall effect and calculation of Hall Coefficient (R_H).

Semiconductor Devices

Radiative and non-radiative recombination in semiconductors (Qualitative), Direct and Indirect band gap semiconductors, Diffusion and Drift currents, p-n junction diode, Zener diode and their V-I Characteristics, LED and Solar cell : construction, principle of operation and characteristics.

UNIT 3: Dielectric and Magnetic materials (~9 Lecture Hours)

Dielectric materials: Electric dipole, Dipole moment, Oscillating dipole, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector, Polarization Vector, Qualitative study of electronic, ionic and orientation polarizations, Local field (Qualitative treatment) and Clausius-Mossotti equation; Ferro-electricity –Behaviour of $BaTiO_3$, Piezoelectricity, Pyro-electricity.

Magnetic materials: Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility, origin of magnetic moment: Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, Domain theory(Qualitative), Hysteresis curve based on domain theory, soft and hard magnetic materials, properties of antiferro and ferri magnetic materials.

UNIT 4: Lasers and Fibre Optics (~9 Lecture Hours)

***Lasers*:** Characteristics of Lasers, Absorption, Spontaneous and stimulated emission process, Pumping, Population

inversion, Lasing action, Einstein's Coefficients and their relations. Types of Lasers: Ruby laser, Carbon dioxide (CO_2) laser, Semiconductor diode laser, Applications of laser.

Fibre Optics: Introduction, Optical fiber as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Types of Optical fibers, Losses associated with optical fibers, Applications of optical fibers (communication system, sensors).

UNIT 5: Nanomaterials: (~8 Lecture Hours)

Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-Gel, Precipitation, Combustion Methods; Top-Down Fabrication: Ball milling method, Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques (XRD, SEM & TEM) and Applications.

Text Books:

1. M.N.Avadhanulu, P.G.Kshirsagar & T.V. S.Arun Murthy, "A Text book of Engineering Physics", S.Chand Publications, 11th Edition, 2019.
2. J.P Srivastava, "Elements of Solid state physics", 2nd Edition, Prentice Hall India Publishers.
3. Donald A, Neamen, "Semiconductor Physics and Devices-Basic Principle", McGraw Hill, 4th Edition, 2021.
4. Palani Swamy, "Applied Physics", Scitech Publications.
5. Narasimha Reddy Katta, "Essentials of Nano science& Nanotechnology", Typical Creatives NANO DIGEST, 1st Edition, 2021.

Reference Books:

1. H.C.Verma, "Quantum Physics", TBS Publication, 2nd Edition 2012.
2. Halliday, Resnick and Walker, "Fundamentals of Physics", John Wiley & Sons, 11th Edition, 2018.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley Eastern, 2019.

4. S.L.Gupta and V.Kumar, “Elementary Solid State Physics”, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhya, “Nano Materials”, New Age International, 1st Edition, 2007.
6. Aliaksandr S. Bandarenka, “Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage” CRC Press Taylor & Francis Group.
7. M.C.Narayan, “International encyclopedia of Nanotechnology, Science and Physics”.

Online Resources:

1. https://www.youtube.com/channel/UCNNlt5I3Z-Qbswfo_7KAzNA/videos.

Course Outcomes:

After completion of the course, student will be able to

1. Explain the quantum mechanical aspects in physics and apply the same in differentiating the conducting properties of solids.
2. Asses and modify the carrier concentration of different types of semi-conductors and also be able to understand the working of semiconducting devices.
3. Choose materials on the basis of their electric and magnetic behaviour for different engineering applications.
4. Differentiate different types of Lasers, optical fibers and realize their application in engineering fields. Understand the underlying principles of Lasers and fiber optics
5. Appreciate the importance of nano materials and their applicability in modern engineering applications.
6. The student will be able to apply the tools and principles of modern physics to comprehend engineering applications.

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I Year B.Tech. CST I-Semester	**L T P C**
Course Code: 121AG	**3 1 0 4**

LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn the concepts of rank of a matrix and applying it to understand the consistency of the system of equations.
2. To solve a system of linear equations.
3. To study properties of Eigen values and Eigen vectors.
4. To find extreme values for functions of several variables.
5. To find the solutions of first and higher order ODE.
6. To evaluate the double and triple integrals for functions of several variables.

UNIT 1: Linear System of Equations (~ 8 Lecture Hours)

Types of real matrices and complex matrices, rank, echelon form, normal form, consistency and solution of linear systems (Homogeneous and Non-homogeneous), LU decomposition method.

UNIT 2: Eigen values and Eigen vectors (~8 Lecture Hours)

Eigen values, Eigen vectors and their properties. Cayley - Hamilton theorem (only statement), Inverse and powers of a matrix using Cayley - Hamilton theorem, Diagonalization.

UNIT 3: Functions of Several Variables (~10 Lecture Hours)

Limit & Continuity (Definitions), Partial derivatives, Chain rules, Total derivative, Differentiation of implicit functions, Jacobian, functional dependency. Maxima and Minima of functions of two variables (with and without constraints) and Lagrange's method of undetermined multipliers.

UNIT 4: Ordinary Differential Equations (~12 Lecture Hours)

First Order ODE – Exact Differential Equations, Differential Equations reducible to exact, Orthogonal trajectories, Law of natural growth & decay.

Linear differential equations of higher order with constant coefficients: Non-homogeneous differential equations with RHS term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters, Applications to Electrical circuits.

UNIT 5: Multiple Integrals and its Applications (~10 Lecture Hours)

Multiple Integrals - Double and Triple integrals, Change of variables, Change of order of integration.

Applications: Finding area as double integrals and volume as triple integrals.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N. P. Bali, Engineering Mathematics, 1st Edition, Lakshmi Publications.

Reference Books:

1. B.V.Ramana, Higher Engineering Mathematics, 1st Edition, Tata McGraw-Hill Publications.
2. E.Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley and Sons Publisher.
3. Srimanta Pal, SubodhC.Bhunia, Engineering Mathematics, 1st Edition, Oxford Higher Education.
4. R K Jain & S R K Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishers.

Online Resources:

1. https://nptel.ac.in/courses/111106051
2. https://www.youtube.com/watch?v=mIeeVrv447s

Course Outcomes:

After completion of the course, students will be able to

1. Solve and analyse the solution for the system of equations.
2. Compute the Eigen values and Eigen vectors which come across under linear transformations.
3. Determine the extreme values of functions of two variables with/ without constraints.
4. Find the solutions of ordinary differential equations.
5. Evaluate double and triple integrals.
6. Apply the knowledge of mathematics for real situations.

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I Year B.Tech. CST I-Semester **L T P C**

Course Code: 121AH **3 0 0 3**

PROGRAMMING FOR PROBLEM SOLVING

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To use the syntax and semantics of C Programming Language.
4. To decompose a problem into functions and to develop modular reusable code.
5. To implement C programs in structured programming approach to solve problems.

UNIT 1: (~10 Lecture Hours)

Introduction to Computers: Computer systems, computing environments, computer languages, creating and running programs, program development, algorithms and flowcharts, number systems - binary, decimal, hexadecimal and conversions.

Introduction to C Language: Background, C programs, identifiers, types, variables, constants, input/output, operators (arithmetic, relational, logical, bitwise etc.), expressions, precedence and associativity, expression evaluation, type conversions.

Statements: Selection statements (making decisions) – if and switch statements.

UNIT 2: (~9 Lecture Hours)

Repetition Statements (Loops):while, for, do-while statements, Loop examples, other statements related to looping – break, continue.

Functions: Designing structured programs, functions, user defined functions, inter function communication, standard functions, scope, storage classes - auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, limitations of recursion.

UNIT 3: (~10 Lecture Hours)

Arrays: Concepts, using arrays in C - declaration and definition, accessing elements in array, storing values in arrays, array applications- linear search, binary search and bubble sort, two dimensional arrays, multi-dimensional arrays.

Pointers: Introduction (basic concepts), pointers for inter function communication, pointers to pointers, compatibility, pointer applications - arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, pointers to void, strings - concepts, C strings, string input / output functions, arrays of strings, string manipulation functions.

UNIT 4: (~9 Lecture Hours)

Enumerated, Structure and Union Types: The type definition (typedef), enumerated types, structures - declaration, initialization, accessing structures, operations on structures, complex structures - nested structures, structures containing arrays, structures containing pointers, arrays of structures, structures and functions, passing structures through pointers, self-referential structures, unions, bit fields.

UNIT 5: (~8 Lecture Hours)

Introduction to files, using files in C, reading data from files- fscanf(), fgets(), fgetc(), fread(), writing data to files- fprintf(), fputs(), fputc(), fwrite(), detecting the end-of-file, error handling during file operations, random access to files, command line arguments, preprocessor commands.

Text Books:

1. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured Programming Approach Using C, 3rd Edition, Cengage learning.
2. Reema Thareja, Introduction to C Programming, 2nd Edition, Oxford University Press.

Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw-Hill.
2. E.Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
3. B.W.Kernighan and Dennis Ritchie, C Programming Language, 2nd Edition, PHI.

Online Resources:

1. https://drive.google.com/file/d/1Yvq27- sSPOxjJakf1c XpWq76L0F0cu_/view
2. https://cs50.harvard.edu/college/2022/spring/

Course Outcomes:

After completion of the course, students will be able to

1. Relate various computing environments and formulate solutions to problems using algorithms and flowcharts.
2. Understand data types and control structures to solve problems.
3. Divide a problem into functions and synthesize a complete program.
4. Use arrays, pointers and strings to formulate programs.
5. Apply user defined data types to model real world data.
6. Develop solutions to problems using file-handling functions.

I Year B.Tech. CST I-Semester **L T P C**
Course Code: 121AF **2 0 0 2**

ENGLISH FOR SKILL ENHANCEMENT

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: This course will enable the students to

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

UNIT 1: (~7 Lecture Hours)

Chapter entitled **'Toasted English'** by R.K.Narayan from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT 2: (~7 Lecture Hours)

Chapter entitled **'Appro JRD'** by Sudha Murthy from "*English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT 3: (~6 Lecture Hours)

Chapter entitled **'Lessons from Online Learning'** by F.Haider Alvi, Deborah Hurst et al from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English. **Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses **Reading:** Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/ Resume.

UNIT 4: (~6 Lecture Hours)

Chapter entitled **'Art and Literature' by Abdul Kalam** from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Standard Abbreviations in English.

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT 5: (~6 Lecture Hours)

Chapter entitled **'Go, Kiss the World'** by Subroto Bagchifrom *"English: Language, Context and Culture"*

published by Orient Blackswan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

Reading: Reading Comprehension-Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) - Types of Reports - Writing a Report.

Note: ***Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.***

Note: 1. As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is* ***Open- ended****,* besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

Note: **2**. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents.

They are advised to teach 40 percent of each topic from the syllabus in blended mode.

Text Books:

1. "English: Language, Context and Culture" published by Orient BlackSwan Pvt. Ltd, Hyderabad. 2023 Print.
2. Fusion: Integrated Reading & Writing by Kepler published by CENGAGE [e-Book] "English for Skill Enhancement" by Orient Black Swan Pvt. Ltd, Hyderabad, 2023 Print.

Reference Books:

1. Effective Academic Writing by Liss and Davis (OUP).
2. Richards, Jack C, Interchange Series. Introduction, 1,2,3. Cambridge University Press, 2022.
3. Wood,F.T., Remedial English Grammar. Macmillan, 2007.
4. Chaudhuri, Santanu Sinha. Learn English: AFun Book of Functional Language, Grammar and Vocabulary. 2nd Edition, Sage Publications India Pvt. Ltd., 2018.
5. Technical Communication. Wiley India Pvt. Ltd., 2019.
6. Vishwamohan, Aysha. English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd, 2013.
7. Swan, Michael. Practical English Usage. Oxford University Press. Fourth Edition, 2016.

Online Resources:

1. https://nptel.ac.in/courses/109106116 [English Language for Competitive Exams by Prof.Aysha Iqbal, IIT Madras.]
2. https://onlinecourses.nptel.ac.in/noc22_hs77/preview [Developing Soft skills and Personality by Prof.T.Ravichandran, IIT Kanpur.]

Course Outcomes:

After completion of the course, student will be able to

1. Understand the importance of vocabulary and sentence structures
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known and unknown passages.
5. Take an active part in drafting paragraphs, letters, essays, abstracts, precis and reports in various contexts.
6. Acquire basic proficiency in reading and writing modules of English.

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I Year B.Tech. CST I-Semester **L T P C**
Course Code: 12101 **0 0 2 1**

APPLIED CHEMISTRY LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness of water to check its suitability for drinking purpose.
2. Perform estimations of acids and bases using conductometry, potentiometry and pH metry methods.
3. Prepare polymers such as Bakelite and nylon-6 in the laboratory.
4. Skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

List of Experiments:

I. Volumetric Analysis:

1. Estimation of hardness of water complexometric titration by using EDTA
2. Estimation of ferrous iron by Dichrometry.
3. Estimation of ferrous iron by Permanganometry.

II. Conductometry:

Estimation of the amount of given acid by Conductometry.

III. Potentiometry:

1. Estimation of the amount of given acid by Potentiometry.
2. Estimation of the amount of Fe^{2+} by Potentiometry using Potassium dichromate.

IV. pH Metry:

Determination of an acid concentration using pH meter.

V. Colorimetry:

Estimation of Copper using Colorimetry.

VI. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon – 6

VII. Lubricants:

1. Estimation of saponification value of a given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VIII. Virtual lab experiments

1. Batteries for electrical vehicles.
2. Functioning of solar cell and its applications.

Text books:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007)

Reference books:

1. Vogel's text book of practical organic chemistry 5th edition
2. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.

Online Resources:

1. https://www.youtube.com/watch?v=EGV9MBzqdoA
2. http://www.titrations.info/EDTA-titration-water-hardness
3. https://www.youtube.com/watch?v=_0MteudoAqA
4. https://archive.nptel.ac.in/content/storage2/courses/104103071/pdf/mod16.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the concepts of error, its analysis and also to develop the skills to tabulate the experimental data and derive valid conclusions.
2. Have hands on experience in performing the electro-analytical techniques such as Conductometry, Potentiometry and pHmetry.
3. Gain the ability to prepare polymeric materials like Bakelite and Nylon-6.
4. Estimate the Saponification value and viscosity of Lubricant oil.
5. Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate.
6. Apply theoretical knowledge to real world situations, emphasizing the practical applications of chemical principles.

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I Year B.Tech. CST I-Semester **L T P C**
Course Code: 12102 **0 0 3 1.5**

APPLIED PHYSICS LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: Through this course the student is to

1. Determine and classify magnetic materials and electro-magnetization.
2. Determine the type of semiconductor and Study the temperature dependence of resistivity.
3. Bring out the basic characteristics of semiconductor devices.
4. Construct basic electrical circuits and understand the effect of different components of the circuit on the electric parameters.
5. Learn the fundamentals of fiber optics and apply diffraction phenomenon.

Any of the following Ten experiments to be performed:

List of Experiments:

1. Biot – Savart's law to verify Magnetic field along the axis of current carrying coil – Stewart and Gees method.
2. Study B-H curve of a magnetic material.
3. To determine Energy gap of a material taken in the form of p-n junction diode.
4. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
5. To study V-I characteristics of a solar cell.
6. V-I characteristics of a p-n junction diode and Zener diode.
7. Measurement of Time constant of an R-C circuit (Charging and Discharging).
8. Resonance Phenomena & Q-factor of L-C-R circuit (Series/Parallel).
9. Evaluation of numerical aperture of a given optical fiber.
10. Bending and attenuation losses of fibers.
11. Dispersive power of the material of a prism – Spectrometer.
12. Wavelength of light and determining the LPI of unknown grating of a diffraction grating using laser.
13. To find Rigidity modulus of given material using Torsional pendulum experiment.
14. Melde's experiment – Transverse and longitudinal modes.
15. Quantum dots.
16. Polarimeter-Polarization of light.

Text Books:

1. Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)
2. Engineering Physics - 2nd Edition NEW AGE Publications by M R Srinivasan.

Reference books:

1. Experiments In Engineering Physics (A Lab. Manual & W.B) - M.N.Avadhanulu, A.A.Dani & P.M.Pokley. Publisher, S. Chand Limited.
2. Science and Technology of PHOTOVOLTAICS - 2nd Edition- BS Publications by P.Jayarama Reddy.

Online Resources:

1. https://www.vlab.co.in/broad-area-physical-sciences
2. http://www.bsauniv.ac.in/UploadImages/Downloads/PHYSICS-LAB-MANUAL2017-(new- regulation).pdf
3. http://jnec.org/Lab-manuals/FE/Physics.pdf
4. https://www.myphysicslab.com/ (simple simulations)
5. https://www.iist.ac.in/departments/physics-lab
6. https://wci.llnl.gov/simulation

Course Outcomes:

After completion of the course, students will be able to

1. Students are introduced to handling different instruments, interpret the data and correlate the samewith their understanding of its theory.
2. Study the electro-magnetization characteristics and determine hysteresis loss.
3. Determine hall coefficient and energy gap of the semiconductor (takenas a diode).
4. Differentiate Zener and p-n junction diode and to determine fill factor of a semiconductor solar cell.
5. Determine the time constant, resonance and quality of the circuit consisting of R, C &/ L components.
6. Determine wavelength of laser light and differentiate different types of lasers, optical fibers losses.

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I Year B.Tech. CST I-Semester **L T P C**

Course Code: 12108 **0 0 3 1.5**

PROGRAMMING LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To gain familiarity with the programming environment to edit, compile, run and debug programs.
2. To apply the syntax and semantics of C Programming Language.
3. To develop modular, reusable and readable C programs using the concepts like arrays, functions etc.
4. To implement programs using file handling functions.

List of Experiments:

Week 1: Familiarization with programming environment

Introduction to the working environment, compiling, running and debugging C programs, simple C programs.

Week 2: Simple computational problems using arithmetic expressions

a. Write a C program which reads time required (in hours and minutes) to complete two tasks and then print the total time in hours and minutes.
b. Write a C program which reads five students marks in a test and then prints average mark of passed students (assume that a minimum of 35 is needed to pass) using operators.
c. Assume an object is thrown upwards with some initial velocity, u (in m/sec). Write a C program to find the maximum height which it can reach. Assume acceleration due to gravity is $9.8m^2$ /sec.
   Hint: Maximum height, $h=u^2 /2g$.

Week 3: Problems involving if-then-else structures and switch statement

a. Write a C program to check whether a given number is even or odd using bitwise operator.
b. Write a C program to find the roots of a quadratic equation.
c. Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, division and modulus using switch statement.

Week 4: Iterative problems

a. Write a C program to find whether a given number is Armstrong or not.
b. Write a C program to determine if the given number is a prime number or not.
c. Write a C program to calculate the following Series: $Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

d. Write a C program to find the number of even and odd digits in a given number.

Week 5: Simple functions

a. The least common multiple (LCM) of two positive integers a and b is the smallest integer that is evenly divisible by both a and b. Write a C program that reads two integers and calls LCM (a, b) function that takes two integer arguments and returns their LCM. The LCM (a, b) function should calculate the least common multiple by calling the GCD (a, b) function and using the following relation: LCM (a, b) = ab / GCD (a, b).

b. Write a function to find the factorial of a positive integer.

c. Write a menu-driven C program that allows a user to enter 3 numbers and then choose between finding the smallest, largest, sum, or average. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

d. Write a C program that reads two integers and calls a factorial function to compute ${}^{n}C_{r}$ value.

Week 6: Recursive functions

a. Write a C program that reads two integers x and n and calls a recursive function to compute x^n.

b. Write a C program that uses a recursive function to solve the Towers of Hanoi problem.

c. Write a C program that uses a recursive function to generate Pascal's triangle.

d. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program which calls a recursive function to generate the first n terms of the sequence.

Week 7: Applications of 1D Array

a. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user using Sieve of Eratosthenes algorithm.

b. Write a C program to implement linear search on a list of integers.

c. Write a C program to implement binary search on a list of integers.

d. Write a C program to implement Bubble sort to sort a given list of integers in ascending order.

Week 8: Applications of 2D arrays

a. Write a C program that reads two matrices and performs Addition of two matrices using functions.

b. Write a C program that reads two matrices and performs Multiplication of two matrices using functions.

Week 9: Applications of Strings

a. Write a C program to perform the following
   i) To insert a sub-string into a main string at a given position.
   ii) To delete n characters from a given position in a string.
b. Write a C program to determine whether the given string is a palindrome or not.
c. Write a C program to replace a substring with another in a given line of text.
d. Write a C program to sort array of strings.

Week 10: Pointers and Dynamic Memory Allocation

a. Write a C program to find the number of times a given word (i.e., a short string) occurs in a sentence. (i.e., a long string).
b. Using pointers, write a function that receives a character string and a character as argument and deletes all occurrences of this character in the string. Function should return the corrected string with no spaces.
c. Write a C program to find the maximum element from a set of elements. The number of elements will be decided during the execution of the program.

Week 11: Structures

a. Write a menu-based program in C that uses a set of functions to perform the following Operations:
   i) Reading a complex number   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Subtraction of two complex numbers
   v) Multiplication of two complex numbers
   Represent the complex number using a structure
b. Declare a structure to store the following information of an employee: Employee code, Employee name, Salary, Department number, Date of joining (it is itself a structure consisting of day, month and year). Write a C program to store the data of N employees where N is given by the user (Use dynamic memory allocation). Include a Menu that allows user to select any of the following features:
   i) Use a function to display the employee information who are drawing the maximum and minimum salary.
   ii) Use a function to display the employee records in ascending order according to their date of joining.

Week 12: File Handling

a. Write a C program to display the contents of a file to standard output device.

b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command-line arguments.

d. Write a C program to reverse the first n characters in a file. The file name and n are specified on the command line. Use fseek function.

Text Books:

1. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured Programming Approach Using C, 3rd Edition, Cengage learning.

Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, 2nd Edition, McGraw-Hill.
2. Yashavant P. Kanetkar, Let Us C, 13th Edition, Bpb Publications.
3. B.W.Kernighan & Dennis Ritchie, C Programming Language, 2nd Edition, PHI.
4. E.Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.

Online Resources:

1. https://drive.google.com/file/d/1Yvq27-qsSPOxjJakf1cXp Wq76L0F0cu_/view
2. https://cs50.harvard.edu/college/2022/spring/

Course Outcomes:

After completion of the course, the students will be able to

1. Use tools to compile, debug, run and test the program.
2. Translate algorithms into executable programs.
3. Implement programs using control structures and arrays.
4. Develop modular and reusable code using functions.
5. Demonstrate usage of pointers, strings and structures.
6. Solve problems using file concepts.

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I Year B.Tech. CST I-Semester **L T P C**
Course Code: 12105 **0 0 2 1**

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

To facilitate computer assisted multimedia instruction enabling individualized and independent language learning.

1. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
2. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
3. To improve the fluency of students in spoken English and neutralize the impact of dialects.
4. To train students to use language appropriately for public speaking, group discussions and interviews.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab.
b. Interactive Communication Skills (ICS) Lab.

Listening Skills:

Objectives

1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions.

   Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

   - Listening for general content
   - Listening to fill up information

- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts.
2. To enable students express themselves fluently and appropriately in social and professional contexts.
    - Oral practice
    - Describing objects/situations/people
    - Role play – Individual/Group activities
    - Just A Minute (JAM) Sessions

    The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise 1:

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise 2:

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - *Testing Exercises.*

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise 3:

CALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.

-*Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise 4:

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - *Testing Exercises*

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non- verbal Communication - Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise 5:

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -*Testing Exercises*

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

   System Requirement (Hardware component):

   Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

   i) Computers with Suitable Configuration.

   ii) High Fidelity Headphones.

2. **Interactive Communication Skills (ICS) Lab:**

   The Interactive Communication Skills Lab: ASpacious room with movable chairs and audio- visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

Source of Material (Master Copy):

Exercises in Spoken English. Part 1,2,3. CIEFL and Oxford University Press.

Note: *Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.*

Suggested Software:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley.
3. Punctuation Made Easy by Darling Kindersley.
4. Oxford Advanced Learner's Compass, 10th Edition.
5. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
6. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
7. English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
8. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
9. Digital All Orell Digital Language Lab (Licensed Version)

Referred Lab Manual: English Language Communication Skills – Manual cum Workbook published by CENGAGE, 2022.

Reference Books:

1. English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd., 2022.
2. Shobha, KN&Rayen, J. Lourdes. Communicative English – A workbook. Cambridge University Press, 2019.
3. Kumar, Sanjay & Lata, Pushp. Communication Skills: A Workbook. Oxford University Press, 2019.
4. Board of Editors. ELCS Lab Manual: A Workbook for CALL and ICSLab Activities. Orient Black Swan Pvt. Ltd., 2016.
5. Mishra, Veerendra et al. English Language Skills: A Practical Approach. Cambridge University Press, 2020.

Online Resources:

1. https://nptel.ac.in/courses/109103183 [Phonetics and Phonology: A broad overview by Prof. Shakuntala Mahanta, IIT Guwahati]
2. https://nptel.ac.in/courses/109104031 [Communication Skills by Dr.T.Ravichandran, IIT Kanpur]

Course Outcomes:

After completion of the course, student will be able to

1. Differentiate between the letters of the alphabet and the phonetic symbols.
2. Demonstrate the right pronunciation of the words in English using phonetic transcription and word stress.
3. Speak with proper intonation, voice modulation and tonal groups.
4. Maximise the listening comprehension skills through various language modules.
5. Develop Speaking skills with clarity and confidence individually and in groups to discuss and present the topics chosen and understand the nuances of team dynamics.
6. Work individually and discuss in teams to present the topics and demonstrate their public speaking skills and presentation skills through various aids like posters, PPTs etc.,

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I Year B.Tech. CST I-Semester **L T P C**

Course Code: 12107 **0 0 2 -**

GENDER SENSITIZATION

(Mandatory Course)

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

UNIT 1:

Understanding Gender

Gender: Why Should We Study It? (*Towards a World of Equals:* Unit -1)

Socialization: Making Women - Making Men (*Towards a World of Equals:* Unit -2) Introduction - Preparing for Womanhood - Growing up Male - First lessons in Caste - Different Masculinities.

UNIT 2:

Gender and Biology

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals:* Unit -4) Declining Sex Ratio - Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals:* Unit -10) Two or Many? - Struggles with Discrimination.

UNIT 3:

Gender and Labour

Housework: The Invisible Labour (*Towards a World of Equals:* Unit -3) "My Mother doesn't Work." - "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals:* Unit -7) Fact and Fiction - Unrecognized and Unaccounted work - Additional Reading: Wages and Conditions of Work.

UNIT 4:

Issues of Violence

Sexual Harassment: Say No! (*Towards a World of Equals:* Unit -6) Sexual Harassment, not Eve-teasing - Coping with Everyday Harassment-Further Reading: "Chupulu".

Domestic Violence: Speaking Out (*Towards a World of Equals:* Unit -8)

Is Home a Safe Place? -When Women Unite [Film] - Rebuilding Lives - Additional Reading: New Forums for Justice - Thinking about Sexual Violence (*Towards a World of Equals:* Unit -11) - Blaming the Victim -"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT 5:

Gender: Co – Existence

Just Relationships: Being Together as Equals (*Towards a World of Equals:* Unit -12) Mary Kom and Onler - Love and Acid just do not Mix - Love Letters. Mothers and Fathers - Additional Reading: Rosa Parks-The Brave Heart.

Text Books:

"***Towards a World of Equals: A Bilingual Textbook on Gender***" written by A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, DeepaSreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**,Telangana State in the year 2015.

Reference Books:

1. Menon, Nivedita. Seeing like a Feminist, New Delhi: Zubaan-Penguin Books 2012.
2. Abdulali Sohaila. "I Fought for My Life…and Won." Available online at: http://www.thealternative.in/ lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_hs51/preview [Contexualising Gender by Prof.Rasmi Gaur, IIT Roorkee]
2. https://onlinecourses.nptel.ac.in/noc19_hs57/preview

   [Gender justice and Workplace security by Prof.Dipa Dube, IIT Kharagpur]

Course Outcomes:

After completion of the course, student will be able to

1. Relate the understanding of gender sensitization to basic dimensions of the biological, sociological, psychological and legal aspects of gender through discussion of materials derived from research, facts, everyday life, literature and film.
2. Develop a finer grasp of how gender discrimination works in our society and how to counter it.
3. Maximize their insight into the gendered division of labour and its relation to politics and economics.

4. Perceive the genders Men and women as professionals equipped to work and live together as equals.
5. Develop a sense of appreciation of women in all occupations.
6. Identify, Understand and respond to Gender issues and to address them legally protecting and safeguarding the individual's rights.

Assessment Criteria:

SATISFACTORY PARTICIPATION CERTIFICATE shall be issued only after securing greater than or equivalent to **75%** of the attendance in the course along with the active Classroom interaction and participation by the students.

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I Year B.Tech. CST II-Semester **L T P C**
Course Code: 122AK **3 1 0 4**

NUMERICAL TECHNIQUES AND TRANSFORM CALCULUS
(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn an alternative method for analytical methods in mathematical concepts.
2. To apply numerical techniques in solving ordinary differential equations.
3. To study the properties of vector valued functions and differential operators.
4. To attain the knowledge on integrals of vector valued functions.

UNIT 1: Numerical Techniques – I (~9 Lecture Hours)

Numerical Solutions of Algebraic and Transcendental Equations: Introduction, Bisection Method, Regula- Falsi method, Iteration method and Newton Raphson method.

Solving linear system of equations by Gauss-Jacobi and Gauss-Seidel method.

Curve Fitting: Fitting a linear, second degree, exponential curve by method of least squares for the discrete data.

UNIT 2: Numerical Techniques – II (~9 Lecture Hours)

Numerical integration: Newton-Cote's Quadrature Formula, Trapezoidal Rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ Rule. **Numerical solution of Ordinary Differential Equations:** Solution of ordinary differential equations by Taylor's Series, Picard's method of Successive approximations, Euler's and Modified Euler's method, Fourth Order Runge-Kutta Method.

UNIT 3: Laplace Transforms (~10 Lecture Hours)

Laplace Transforms - Laplace Transform of Standard functions, First and Second Shifting Theorems, Transforms of derivatives and integrals, Multiplication and Division by 't', Laplace Transform of Periodic Function, Unit Step function, Dirac's Delta function.

Inverse Laplace Transform- Method of Partial Fractions, Convolution theorem (only statement), First and Second shifting theorem.

Applications of Laplace Transforms to Ordinary Differential Equations.

UNIT 4: Vector Differentiation (~10 Lecture Hours)

Scalar and Vector point functions, Gradient, Divergence, Curl and related properties, Unit Normal Vector, Directional Derivatives and Angle between the surfaces, Laplacian operator, Vector identities.

UNIT 5: Vector Integration and Integral Theorems (~10 Lecture Hours)

Vector Integration - Line Integral-Work Done-Potential function, Area, Surface and Volume Integral.

Vector Integral Theorems: Green's theorem, Stoke's theorem and Gauss's divergence theorem (onlystatements) and their verification.

Text Books:

1. Dr.B.S Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. M.K.Jain, S.R.K.Iyengar and R.K.Jain, Numerical Methods for Science and Engineering Computation, 6th Edition, New Age International Publishers.

Reference Books:

1. R K Jain & S R K Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishers.
2. Murray R Spiegel and Seymour Lipschutz, Vector Analysis, 2nd Edition, Schaums' Outlilne Series.
3. S.S.Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd.

Online Resources:

1. https://nptel.ac.in/courses/111106101
2. https://nptel.ac.in/courses/111107108

Course Outcomes:

After completion of the course, students will be able to

1. Find the root of the algebraic and transcendental equation and solution of a linear system of equations.
2. Fit a curve for the given data.
3. Find the Numerical solutions for a given first order initial value problem and evaluate definite integral numerically.
4. Learn Laplace Transform techniques and apply for solving ODE.
5. Understand the concepts of Gradient, Divergence and Curl of a Vector and scalar point functions.
6. Evaluate the line, surface and volume integrals.

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I Year B.Tech. CST II-Semester **L T P C**

Course Code: 122AJ **3 0 0 3**

DATA STRUCTURES

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Understand the notations used to analyze the performance of algorithms.
2. Understand and analyze various searching and sorting algorithms.
3. Understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, graphs and their representations.
4. Choose an appropriate data structure for a specified application.

UNIT 1: (~10 Lecture Hours)

Basic Concepts: Algorithm-Introduction, Performance analysis – Time Complexity and Space Complexity, Asymptotic Notation – Big O, Omega and Theta notations, Complexity Analysis Examples.

Introduction to Data Structures: Linear and Non-linear data structures.

Review of Pointers: Pointers, Self-referential structures

Linear List: Array and Linked Representations, Singly Linked List, Operations – Insertion, Deletion and Searching, Circularly Linked List, Operations – Insertion, Deletion and Searching, Doubly Linked List, Operations– Insertion, Deletion and Searching, Applications of Linked List – Sparse matrix.

UNIT 2: (~9 Lecture Hours)

Stack: Definition, Array and Linked implementations, Applications– Infix to Postfix Conversion, Postfix Expression Evaluation, Recursion.

Queue: Definition, Array and Linked implementations, Circular Queues– Insertion and Deletion Operations.

UNIT 3: (~8 Lecture Hours)

Trees: Definitions, Terminology, Applications, Properties, Binary Tree - Array and Linked representations, Binary Tree Traversals, Threaded Binary Tree-Definition.

Priority Queues: Definition and Applications, Max Priority Queue – Implementation, Max Heap - Definition, Insertion and Deletion.

UNIT 4: (~8 Lecture Hours)

Searching: Linear Search, Binary Search,Hashing: Introduction, Hash Tables, Hash Functions, Overflow Handling. **Dictionaries:** Linear List Representation, Hash Table Representations, Operations - Insertion, Deletion and Searching.

Sorting: Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Methods.

UNIT 5: (~ 10 Lecture Hours)

Graph: Definitions, Terminology, Applications, Properties, Graph Representations - Adjacency Matrix, Adjacency Lists, Graph Traversal Methods – DFS and BFS

Search Trees: Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion.

Balanced Search Trees: AVL Trees- Definition and Insertion, B-Trees- Definition and Examples, Comparison of Search Trees.

Text Books:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Data structures using C, 2nd Edition, Oxford higher education.
2. A. S. Tanenbaum, Y. Langsam and M.J. Augenstein, Data Structures using C, PHI/Pearson Education.
3. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
4. D. Malhotra, N. Malhotra, Data Structures and Program Design Using C: A Self-Teaching Introduction, Mercury Learning and Information.
5. D. Samanta, Classic Data Structures, 2nd Edition, PHI.

Online Resources:

1. www.geeksforgeeks.org/data-structures
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Outcomes:

After completion of the course, students will be able to

1. Determine and analyze the complexity of given algorithms.
2. Use basic data structures such as linked list, stack and queue.
3. Implement various kinds of searching and sorting techniques.
4. Design programs using advanced data structures like hash tables, binary trees, heaps and graphs.
5. Build and compare search trees and balanced search trees.
6. Choose appropriate data structures as applied to specified problem definition.

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I Year B.Tech. CST II-Semester **L T P C**

Course Code: 122AC **3 0 0 3**

BASIC ELECTRICAL ENGINEERING

(Common to EEE, ECE, ETE & CST)

Prerequisites: Physics

Course Objectives:

1. Concepts of Basic Magnetic and Electrical AC&DC Circuits.
2. Understand the concepts of Electrical Machines
3. To understand the VI characteristics of various Electronic components like Diode, BJT and SCR.

UNIT 1: Magnetic Circuits and DC Circuits (~11 Lecture Hours)

Magnetic Circuits: Flux, flux density, Magnetic field Intensity, reluctance, MMF, Faraday's laws of Electromagnetic induction – statically & dynamically induced EMF-Lenz's law - Fleming's rules, Simple problems **DC Circuits:** Electrical Circuit elements: R, L and C, voltage and current sources, KCL & KVL, Analysis of simple DC Circuits, Nodal and Mesh analysis of simple circuits with DC excitation, Simple problems.

UNIT 2: Single Phase AC Circuits (~10 Lecture Hours)

Network Theorems: Superposition, Thevenin's and Norton's Theorems with independent sources (DC excitation only), Simple Problems.

1-φ AC Circuits: Representation of sinusoidal waveforms, Average and RMS values, phasor representation, power factor; Impedance and Power triangles, Resonance in Series RLC Circuit.

UNIT 3: DC Machines & Batteries (~9 Lecture Hours)

DC Machines:

DC Generators: Construction, principle of operations and types, EMF equations, simple problems.

DC Motors: Principle of operation, significance of Back EMF, Torque equation, Characteristics & applications, losses & efficiency, Direct Load test.

Batteries: Types, ratings and Applications.

UNIT 4: AC Machines (~7 Lecture Hours)

Transformers: Construction, Principle of Operation, EMF Equation, Losses and efficiency (Direct Load Test) **Induction motors**: Construction, Principle of Operation, Production of rotating magnetic field, Speed-Torque characteristics, Applications, simple Problems.

Synchronous Generators: Construction, Classification, Principle of Operation.

Synchronous Motors: Principle of operation and applications.

UNIT 5: Basic Electronics (~7 Lecture Hours)

Operation of PN Junction Diode, BJT & SCR and their Static Characteristics, Half wave and Full Wave Diode bridge rectifiers.

Text Books:

1. T.K.Nagasarkar and M.S.Sukhija, Basic Electrical Engineering, Oxford University Press, 3rd Edition, 2018.
2. D.P.Kothari and I.J.Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 3rd Edition, 2010.
3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, 2001.
4. D.P.Kothari and I.J.Nagrath Theory and problems of Basic Electrical Engineering, PHI, 2016.

Reference Books:

1. P. S. Bimbhra, Power Electronics, Khanna Publications, 2018.
2. D.C.Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 1st Edition, 2009.
3. Jimmie J. Cathey, Syed A. Nasar, Basic Electrical Engineering, Schaum's Outline.
4. Huges, Electrical and Electronic Technology, Person, 2010.

Online Resources:

1. https://nptel.ac.in/courses/108108076

Course Outcomes:

After completion of the course, students should be able to

1. Understand the concept and analyze the Magnetic & DC circuits.
2. Analyze the 1ϕ Ac circuits and Network theorems with DC excitation.
3. Demonstrate and analyze the DC Electrical machines.
4. Demonstrate and analyze the Transformers.
5. Demonstrate and analyze the rotating AC Machines.
6. Understand the Basic Electronic devices.

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I Year B.Tech. CST II-Semester **L T P C**
Course Code: 122AE **1 0 3 2.5**

ENGINEERING GRAPHICS

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: The course will enable the students

1. To impart skills of drawing instruments and their use to convey exact and complete information of any object.
2. To construct conics and cycloidal curves used for various engineering applications.
3. To impart knowledge about standard principles of orthographic projection of objects
4. To develop different surfaces of simple solids.
5. To differentiate between isometric view and projection and conversion of isometric views to orthographic views vice-versa.
6. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products.

UNIT 1: (~3 Lecture Hours and 9 Practical Hours)

Introduction to Engineering Graphics: Principles of Engineering Graphics and their significance.

Scales- Plain & diagonal.

Conic Sections- Construction of ellipse, parabola and hyperbola (general method only).

Cycloidal curves: Cycloid, Epicycloid and Hypocycloid (general methods only).

UNIT 2: (~3 Lecture Hours and 9 Practical Hours)

Orthographic Projections: Principles of orthographic projections-conventions- Projections of points in all positions; projection of straight lines-line inclined to one reference plane and with two reference planes (excluding traces and midpoint problems).

UNIT 3: (~3 Lecture Hours and 9 Practical Hours)

Projections of Planes: Plane inclined to one reference plane and with two reference planes.

Projections of Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simple position and axis inclined to one reference plane only.

UNIT 4: (~3 Lecture Hours and 9 Practical Hours)

Development of Surfaces: Basic concepts of development of surfaces, Methods of development – Parallel line development and radial line development, Development of prisms, pyramids, Cylinders and cones.

UNIT 5: (~ 4 Lecture Hours and 12 Practical Hours)

Isometric Projection: Principles of Isometric Projection – Isometric Scale Isometric Views – Isometric views of Lines, Planes and Simple Solids only.

Orthographic Views: Conversion of Isometric Views to Orthographic Views.

Introduction to computer aided drafting (For internal evaluation weightage only) Introduction to Computer Aided Drafting, views and commands, orthographic projection of points, lines, planes and solids. Conversion of orthographic projection into isometric view.

Note: Syllabus for external examination will be from 1-5 units in conventional mode and introduction to computer aided drafting is exempted from the external examination.

Text Books:

1. Basanth Agrawal and Agrawal C.M., Engineering Graphics, 1st Edition, Tata McGrawHill, 2018.
2. Bhatt N.D.,Engineering Drawing, 53rd Edition, Charotar Publishing house Pvt.Ltd., 2016.

Reference Books:

1. Venugopal.K, Engineering Drawing and Graphics Plus Autocad, New Age International (P) Ltd., New Delhi, 2010.
2. Dhananjay A Jolhe, Engineering Drawing, Tata McGrawHill, 2014.
3. T. Jeyapoovan, Vikas: Engineering Drawing and graphics Using AutoCAD, 3rd Edition, S. Chand and company Ltd.
4. K Balaveera Reddy, Computer Aided Engineering Drawing, CBS Publishers & distributors, 2015.

Online Resources:

1. www.engineeringdrawing.org
2. Virtual labs(www.vlab.co.in)

Course Outcomes:

After completion of the course, students will be able to

1. Acquire proficiency in instrumental drawing and will be able to visualize the object, draw conic sections and cycloidal curves.
2. Draw and understand about orthographic projections of points, straight lines.
3. Improve visualization skills in different types of planes and solids.
4. Draw and understand about the development of surfaces of various solids.
5. Ability to read, understand and interpret engineering drawings.
6. Apply computer aided drafting tools to create objects.

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I Year B.Tech. CST II-Semester **L T P C**
Course Code: 12204 **1 0 3 2.5**

ENGINEERING WORKSHOP

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: The course will enable the students

1. To gain a good basic working knowledge required for the production of various engineering products.
2. To provide hands on experience about use of different Engineering materials, tools, equipments and processes that are common in the Engineering field.
3. To develop a right attitude, team working, precision and safety at work place.
4. To study commonly used carpentry joints.
5. To have practical exposure to various welding and joining processes.

I) Trades for Exercises: (~12 Lectures + 36 Practices)

At least two exercises from each trade:

i) Carpentry
ii) Fitting
iii) Tin-Smithy and Development of jobs carried out and Soldering
iv) House-wiring
v) Foundry
vi) Black smithy

II) Trades for Demonstration and Exposure:

i) Plumbing ii) Welding

Text Books:

1. B.L. Juneja, “Workshop Practice”, Cengage publications.
2. K. Venugopal, “Workshop Manual”, Anuradha Publications.

Reference Books:

1. P. Kannaiah and K. L. Narayana, “Workshop Manual”, 2nd Edition, Scitechpublications (I) Pvt. Ltd., Hyderabad, 2015.
2. K. Venugopal, Dr. V. Prabhu Raja and G. Sreekanjana, “Workshop Manual”,1st Edition, Anuradha Publications, 2012.
3. Hajra Choudury S.K., Hajra Choudury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Media Promoters and Publishers private limited, Mumbai, vol I 2008 and Vol II 2010.

Online Resources:

1. www.technologystudent.com

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate and understand the Engineering workshop safety regulations.
2. Identify and use marking tools, measuring equipment and to work to prescribed accuracies.
3. Understand the practical difficulties encountered in industries during any assembly work.
4. Do simple electrical work through their carrier.
5. Design different prototype in the fittings, carpentry, foundry, black smithy and sheet metal work.

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I Year B.Tech. CST II-Semester **L T P C**
Course Code: 12209 **0 0 3 1.5**

DATA STRUCTURES LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Write data structure programs using arrays, structures and pointers.
2. Develop applications using linear data structures such as linked lists, stacks and queues.
3. Learn to write programs to implement various sorting and searching algorithms.
4. Write programs to implement various non-linear data structures like trees, graphs and search trees.

List of Experiments:

Week 1: Write a C program to create structure with the name – student, which contains the fields - name, rollno and gender. With the help of pointer read and display the student details.

Week 2: Write a C program that uses functions to perform the following operations on a singly linked list of integers:

a. Creation b. Insertion c. Deletion d. Display

Week 3: Write a C program that uses functions to perform the following operations on a doubly linked list:

a. Creation b. Insertion c. Deletion d. Display

Week 4: Write a C program to implement stack using an array and a linked list.

Week 5: Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent. Implement the stack using an array.

Week 6: Write a C program to implement a queue using an array and a singly linked list.

Week 7: Write a C program that uses functions to perform the following:

a. Search for a key element in a list of elements using linear search.
b. Search for a key element in a list of sorted elements using binary search.
c. To arrange a list of elements in ascending order using insertion sort.

Week 8:

a. Write a C program that implements selection sort algorithm to arrange a list of elements in descending order.

b. Write a C program that implements heap sort algorithm for sorting a list of integers in ascending order.

Week 9:

a. Write a C program that implements quick sort algorithm to arrange a list of elements in ascending order.

b. Write a C program that implements merge sort algorithm for sorting a list of integers in ascending order.

Week 10: Write a C program to implement all the functions of a dictionary using hashing.

Week 11: Write a C program that uses functions to perform the following:

a. Create a binary search tree of integers.

b. Traverse the above binary search tree recursively in preorder, inorder and postorder.

c. Search for an integer key in the above binary search tree recursively.

d. Traverse the above binary search tree non-recursively in inorder.

Week 12: Write a C program to perform the following:

a. Traverse a given graph using DFS algorithm.

b. Traverse a given graph using BFS algorithm.

Text Books:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Data structures using C, 2nd Edition, Oxford higher education.
2. A. S. Tanenbaum, Y. Langsam and M.J. Augenstein, Data Structures using C, PHI/Pearson Education.
3. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
4. D. Malhotra, N. Malhotra, Data Structures and Program Design Using C: A Self-Teaching Introduction, Mercury Learning and Information.
5. D. Samanta, Classic Data Structures, 2nd Edition, PHI.

Online Resources:

1. www.geeksforgeeks.org/data-structures
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Outcomes:

After completion of the course, students will be able to

1. Use arrays, structures and pointers for implementing various data structures.
2. Implement various kinds of searching algorithms.
3. Implement various internal and external sorting algorithms.
4. Develop the programs for various linear data structures like stack, queue and linked list.
5. Implement non-linear data structures like graphs and trees.
6. Choose the appropriate data structure for solving real world problems.

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I Year B.Tech. CST II-Semester **L T P C**

Course Code: 12203 **0 0 3 1.5**

BASIC ELECTRICAL ENGINEERING LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

1. To verify the Network Theorems and understand the usage of common electrical measuring instruments.
2. To understand the basic characteristics of Transformers and Electrical Machines.
3. To understand the VI characteristics of various Electronic components like Diode, BJT and SCR.

PART-A (Compulsory)

1. Verification of KCL&KVL.
2. Verification of Superposition theorem with DC excitation.
3. Verification of Thevenin's & Norton's theorems with DC excitation.
4. Direct Load Test on Single Phase Transformer
5. OCC Test on DC Shunt Generator
6. Torque-Speed characteristics of a 3 -φ Induction Motor by conducting Load Test.
7. V-I Characteristics of PN Junction Diode and Zener Diode.
8. V-I Characteristics of SCR.

PART-B (Any two experiments)

1. Study of different types of batteries.
2. Determination of Resonant frequency & Bandwidth for a series RLC resonance circuit.
3. Output waveforms of Half wave and full wave bridge Rectifiers.
4. Static output and input characteristics of BJT.

Text Books:

1. T.K.Nagasarkar and M.S.Sukhija, Basic Electrical Engineering, Oxford University Press, 3rd Edition, 2018.
2. D.P.Kothari and I.J.Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 3rd Edition, 2010.
3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, 2001.
4. D.P.Kothari and I.J.Nagrath Theory and problems of Basic Electrical Engineering, PHI, 2016.

Reference Books:

1. P. S. Bimbhra, Power Electronics, Khanna Publications, 2018.
2. D.C.Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 1st Edition, 2009.
3. Jimmie J. Cathey, Syed A. Nasar, Basic Electrical Engineering, Schaum's Outline.
4. Huges, Electrical and Electronic Technology, Person, 2010.

Online Resources:

1. https://nptel.ac.in/courses/108108076

Course Outcomes:

After completion of the course, students should be able to

1. Analyze and solve circuits using Kirchoff's Laws.
2. Apply network theorems to analyze and solve D.C circuits.
3. Comprehend the OCC test on Separately excited DC Generator.
4. Analyze the performance of a 3ϕ Induction motor and Transformer.
5. Analyze and interpret VI characteristics of a Diode & SCR.
6. Identify and compare the characteristics of different types of Batteries.

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I Year B.Tech. CST II-Semester	**L**	**T**	**P**	**C**
Course Code: 122AD	**2**	**0**	**0**	**2**

DESIGN THINKING

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: The main objectives of this course are

1. To inculcate attitude to solve societal problems using design thinking tools.
2. To come-up with proper design which further leads to successful products or enterprises.
3. To instill a sense of significance towards applying creativity to product and service design.

UNIT 1: (~6 Lecture Hours)

Introduction to Design Thinking: Origin of Design thinking, Importance of Design thinking, Understanding Design thinking: A non- linear process - 5-stage d.school process model, Application of design thinking.

UNIT 2: (~7 Lecture Hours)

Empathy: Difference between Empathy and Sympathy, Role of Empathy in design thinking, Empathy mapping, Understanding empathy tools: Customer Journey map, Persona; Importance of Empathizing before Ideating.

Define: Explore define phase in Design Thinking, Methods of Define phase.

UNIT 3: (~6 Lecture Hours)

Ideation: Introduction, Types of Thinking- convergent, divergent, critical and creative thinking; Ideation Methods- Brainstorming, Storyboarding, Bingo Selection, Six Thinking Hats, Mind mapping.

UNIT 4: (~6 Lecture Hours)

Prototyping and Testing: Prototyping and methods of prototyping. User testing methods, Advantages and disadvantages of user Testing/ Validation. Iteration and Pitching.

UNIT 5: (~7 Lecture Hours)

Innovation: Definition, Innovation and creativity, Innovation Triangle- Desirability, Feasibility and Viability; Types of Innovation – Product Innovation, Process Innovation and Business Model Innovation.

Design thinking in various sectors: Design thinking to meet corporate needs. Case studies in Information Technology, Finance, Education, Management, Health care and Retail sector.

Text Books:

1. Daniel Ling, Complete Design Thinking Guide for Successful Professionals, Create Space Independent Publishing, 2015.
2. Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, Routledge Taylor and Francis group, 2019.

Reference Books:

1. Idris Mootee, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design school, John Wiley & Sons, 2013.
2. Tim Brown, Change by Design_ How Design Thinking Transforms Organizations and Inspires Innovation, Harper Bollins, 2009.
3. George E Dieter, Engineering Design, 5th Edition, The McGraw-Hill Companies, 2013.

Online Resources:

1. https://www.interaction-design.org/
2. https://designthinking.ideo.com/
3. https://www.innovationtraining.org/design-thinking-mindsets/
4. https://onlinecourses.nptel.ac.in/noc20_mg38/preview
5. https://www.ideou.com/blogs/inspiration/what-is-design-thinking

Course Outcomes:

After completion of the course, students will be able to

1. Understand the importance of various phases of Design Thinking.
2. Empathize with the customers and formulate specific problem statement.
3. Generate an idea through ideation techniques.
4. Understand various prototyping methods and Iterate solutions.
5. Understand innovation, and application of design thinking in various sectors.

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I Year B.Tech. CST II-Semester **L T P C**
Course Code: 12206 **2 0 0 -**

ENVIRONMENTAL SCIENCE AND TECHNOLOGY
(Common to EEE, ECE, ETE & CST)

Prerequisites: Knowledge on Environmental Issues, natural resources, biodiversity, sustainable development.

Course Objectives:

1. To imbibe the importance of ecological balance for sustainable development.
2. To acquire the knowledge on the impacts of developmental activities and mitigation measures.
3. To study the international and national environmental policies and regulations.

UNIT 1: (~ 6 Lecture Hours)

Ecosystems: Definition, Scope, and Importance of ecosystem (ecosystem value, services and carrying capacity), Classification, Structure and functions of an ecosystem (Food chains, food webs, and ecological pyramids. Flow of energy, Bio Geo Chemical Cycles), Bioaccumulation, Bio-magnification, Field visits.

UNIT 2: (~ 6 Lecture Hours)

Natural Resources: Classification of Natural Resources and their uses: Living and Non-Living resources, **Water resources:** use and over utilization of surface and ground water, floods and droughts, Dams benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources: Forest resources**, **Energy resources:** growing energy needs, renewable and non- renewable energy sources, use of alternate energy source, case studies.

UNIT 3: (~ 6 Lecture Hours)

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; (consumptive se, productive use, social, ethical, aesthetic and optional values). India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: (habitat loss, poaching of wildlife, man-wildlife conflicts);conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act, Field Trip to nearby lake.

UNIT 4: (~ 7 Lecture Hours)

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Causes, Effects and control methods of **Air Pollution, Water Pollution, Soil Pollution and Noise Pollution: Solid**

Waste and its Management: and characteristics of e-Waste and its management. Swach Bharat Mission – Save Soil Campaign

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone Depleting Substances (ODS). International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives. Environmental control of Epidemics and Pandemics

UNIT 5: (~ 7 Lecture Hours)

Environmental Policy, Legislation & EIA: Salient Features of Environmental Protection act, Air Act-1981, Water Act, Forest Act, Wild life Act National Green Tribunal Act, 2010 Municipal Solid Waste Management and Handling rules, Biomedical Waste Management and Handling Rules, Hazardous Waste Management and Handling Rules, e-Waste Management and Handling Rules. EIA: Concept of EIA and Importance of EIA.

Towards Sustainable Future: Concept of Sustainable Development Goals, Crazy Consumerism, Urban Sprawl, Human health, Concept of Green Building, Ecological Foot Print, Life Cycle Assessment (LCA),Low Carbon Life Style. Environmental Ethics and Economics.

Text Books:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Grants Commission.
2. R.Rajagopalan, Environmental Studies, Oxford University Press.

Reference Books:

1. Richard T. Wright., Environmental Science: towards a sustainable future, PHL Learning Private Ltd. New Delhi, 2008.
2. Gilbert M. Masters and Wendell P. Ela., Environmental Engineering and science PHI Learning Pvt.Ltd., 2008.
3. Daniel B. Botkin & Edward A.Keller, Environmental Science, Wiley INDIA Edition.
4. Anubha Kaushik, Environmental Studies, 4th Edition, Newage international publishers.
5. Dr. M. Anji Reddy, Text book of Environmental Science and Technology, BS Publications, 2007.
6. Y. Anjaneyulu, Introduction to Environmental Science, BS.Publication.

Online Resources:

1. https://www.epa.gov/students/lesson-plans-teacher-guides-and-online-environmental-resources-educators.
2. https://onlinecourses.swayam2.ac.in/cec20_hs10/preview
3. https://open.ed.ac.uk/environment-sustainability-resources/
4. https://onlinepublichealth.gwu.edu/resources/sources-for-climate-news/

Course Outcomes:

After completion of the course, students will be able to

1. Based on this course, the Engineering graduate will understand/evaluate/ develop technologies based on ecological principles and environmental regulations, which in turn helps in sustainable development.
2. Acquire the knowledge on ecological principles and functions of eco systems and their importance for survival.
3. Develop the knowledge on role of natural resources for sustenance of life.
4. Analyze the concepts of bio - diversity and its role in the maintenance of ecological balance.
5. Evaluate the various causes, effects, control/mitigation of environmental pollution on man and environment.
6. Follow the environmental legislations in their daily life and professional practice to protect the environment.

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II Year B.Tech. CST I-Semester **L T P C**
Course Code: 123AU **3 0 0 3**

PROBABILITY AND STATISTICS

(Common to CSE, IT, CST, CSE (AI&ML) & CSE(Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn the Random variables and theoretical Probability distributions.
2. To study the Sampling Distribution of mean and Testing of hypothesis.
3. To learn the concepts of confidence interval for proportions and small sample tests.
4. To check and determine the relation between two variables/attributes.

UNIT 1: Random Variables (~10 Lecture Hours)

Introduction to Random Variables, Discrete Random Variable, Continuous Random Variable, Probability Distributions and Cumulative Distribution functions, Properties, Mathematical Expectation.

UNIT 2: Probability Distributions (~10 Lecture Hours)

Binomial Distribution, Poisson Distribution, Normal Distribution, Exponential Distribution Sampling Distribution of means. (σ known and unknown).

UNIT 3: Estimation and Inference Theory (~10 Lecture Hours)

Estimation - Point Estimation, Interval Estimation, confidence interval for mean.

Inference Theory (Large Samples): Null hypothesis, Alternate hypothesis, Type I and Type II errors, Critical region, Test of significance for single mean, Test of significance for difference of means.

UNIT 4: Testing of Hypothesis (~10 Lecture Hours)

Confidence interval for proportions, Test of significance for single and difference of proportions.

Small sample tests:t, F and Chi-Square Distributions.

UNIT 5: Correlation and Regression (~8 Lecture Hours)

Coefficient of correlation, Rank correlation, Regression coefficient, Lines of regression, Multiple correlation and regression.

Text Books:

1. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons.
2. Jay L. Devore, Probability and Statistics for Engineering and Sciences, 9th Edition, Cengage Publications

Reference Books:

1. S.P.Gupta, Statistical Methods, 33^{rd} Edition, Sultan Chand & Sons.
2. Miller and John E Freund, Probability and Statistics for Engineers, 5^{th} Edition.

Online Resources:

1. https://nptel.ac.in/courses/111105090/
2. https://nptel.ac.in/courses/111106112/

Course Outcomes:

After completion of the course, students will be able to

1. Differentiate among the random variables involved in the probability models which are useful for all branches of Engineering.
2. Understand probability distributions such as Binomial, Poisson and Normal distributions.
3. Analyze data and draw conclusion about collection of data under study using theory of estimation.
4. Apply testing of hypothesis for large sample.
5. Apply testing of hypothesis for small sample.
6. Estimate and establish relation between variables using correlation and regression analysis.

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II Year B.Tech. CST I-Semester	**L**	**T**	**P**	**C**
Course Code: 123AN	**3**	**1**	**0**	**4**

DESIGN AND ANALYSIS OF ALGORITHMS

(Common to CSE, IT, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving, Data Structures

Course Objectives:

1. Analyze the asymptotic performance of algorithms.
2. Apply important algorithmic design paradigms and methods of analysis.
3. Synthesize efficient algorithms in common engineering design situations.
4. Classify and categorize the problems into P and NP.

UNIT 1: (~8 Lecture Hours)

Introduction: Characteristics of algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, Performance measurements of Algorithm- Time and space trade-offs, Analysis of recursive algorithms through recurrence relations- Substitution method and Masters method, Fundamental Algorithmic strategies – General Methods.

Divide and conquer- Binary search, Merge sort, Quick sort, Strassen's Matrix Multiplication.

UNIT 2: (~10 Lecture Hours)

Disjoint Sets: Disjoint set operations, union and find algorithms, connected components and bi-connected components.

Greedy method- Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees: Prim's and Kruskal's, Huffman Coding.

UNIT 3: (~10 Lecture Hours)

Dynamic Programming: Chained matrix multiplication, All pairs shortest path problem, Optimal binary search trees, 0/1 knapsack problem, Reliability design, Traveling salesperson problem.

UNIT 4: (~10 Lecture Hours)

Backtracking: The n-queens problem, Sum of Subsets problem, Graph Coloring, Hamiltonian cycles.

Branch and Bound: 0/1 Knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling salesperson problem.

UNIT 5: (~8 Lecture Hours)

NP-Hard and NP-Complete problems: Basic concepts, Non-deterministic algorithms, NP - Hard and NP- Complete classes, Cook's theorem.

Approximation Algorithms: The vertex-cover problem, Travelling salesperson problem, the subset-sum problem.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, Fundamentals of Computer Algorithms, 2^{nd} Edition, Universities Press.
2. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4^{th} Edition, MIT Press/McGraw-Hill.

Reference Books:

1. M. T. Goodrich and R.Tomassia, Algorithm Design: Foundations, Analysis and Internet examples, John Wiley and sons.
2. Aho, Ullman and Hopcroft, Design and Analysis of Algorithms, Pearson Education.

Online Resources:

1. https://web.stanford.edu/class/archive/cs/cs161/cs161.1138/
2. https://nptel.ac.in/courses/106101060
3. https://onlinecourses.swayam2.ac.in/cec20_cs03/preview
4. https://www.udemy.com/course/design-and-analysis-of-algorithms/

Course Outcomes:

After completion of the course, students will be able to

1. Apply design principles and concepts to algorithms.
2. Evaluate asymptotic run-time complexity of algorithms and recurrence relations.
3. Design algorithms for realistic problems such as divide and conquer, greedy, non-deterministic and approximation problems.
4. Develop dynamic programming algorithms and analyze their computational complexity.
5. Use Backtracking and Branch & Bound techniques to solve real world problems.
6. Formulate approximation algorithms for finding optimal solutions.

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II Year B.Tech. CST I-Semester	**L T P C**
Course Code: 123AM	**3 1 0 4**

DATABASE MANAGEMENT SYSTEMS

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Data Structures

Course Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Understand the relational database design principles.
4. To familiarize with the basic issues of transaction processing and concurrency control.
5. To familiarize with database storage structure, indexing and recovery mechanisms.

UNIT 1: (~10 Lecture Hours)

Introduction: History of Database System, Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational schemas, Entity-Relationship Design Issues, Extended E-R Features.

UNIT 2: (~9 Lecture Hours)

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Schema Diagrams, The Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries.

UNIT 3: (~ 10 Lecture Hours)

Advanced SQL: Join Expressions, Views, Integrity Constraints and Triggers.

Normalization: Introduction to Schema Refinement, Functional dependency theory,1NF, 2NF, 3NF, Dependency Preservation, BCNF, Multi -valued dependencies, 4NF, Join Dependencies, 5NF.

UNIT 4: (~10 Lecture Hours)

Transaction Management: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels.

Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation- Based Protocols.

UNIT 5: (~ 9 Lecture Hours)

Recovery System: Failure Classification, Storage, Recovery andAtomicity, Recovery Algorithm, Failure with loss of non-volatile storage, Remote Backup systems.

Indexing: Ordered Indices, B+ Tree Index files.

Text Books:

1. A. Silberschatz, Henry. F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.

Reference Books:

1. C.J. Date, A.Kannan and S.Swami Nadhan, An Introduction to Database systems, 8th Edition, Pearson Education.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 6th Edition, Pearson Education.

Online Resources:

1. https://www.tutorialspoint.com/dbms/index.htm
2. https://beginnersbook.com/2015/04/dbms-tutorial
3. https://nptel.ac.in/courses/106/105/106105175

Course Outcomes:

After completion of the course, students will be able to

1. Understand concepts and the applications of database systems and implement in real time applications.
2. Construct an Entity-Relationship (E-R) model from specifications and transform to relational model.
3. Demonstrate the basic concepts of relational database management system and construct unary/binary/set/ aggregate queries in Relational Algebra and in SQL.
4. Apply normalization on database.
5. Understand the principles of database transaction management.
6. Understand the storage and recovery of database.

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II Year B.Tech. CST I-Semester **L T P C**

Course Code: 123AP **3 0 0 3**

DIGITAL LOGIC DESIGN

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Understand basic number systems, codes and logical gates.
2. Know the concepts of Boolean algebra and minimization logic.
3. Learn the design of combinational and sequential circuits.
4. Know the basics of various types of memories.
5. Study the hardware implementation using Programmable Logic Devices.

UNIT 1: (~10 Lecture Hours)

Fundamentals of Digital Design: Digital Systems, Binary Numbers, Number Base Conversions, Octal, Hexadecimal and other Base numbers, Complements, Signed Binary Numbers, Binary Codes, Error Detection and Correction, Binary Logic, Boolean Algebra: Basic theorems and properties of Boolean Algebra, Boolean functions, Digital Logic Gates.

UNIT 2: (~7 Lecture Hours)

Minimization of Logic Functions: Standard representation for logic functions, K-Map representation, Simplifications of logic functions using K-Map, Sum of products, Product of sums simplification, Don't care conditions, NAND and NOR implementations.

UNIT 3: (~10 Lecture Hours)

Combinational Digital Circuits: Combinational Circuits(CC), Design Procedure, Combinational circuit for different code converters and Parity generator/Checker, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, De-multiplexers, ALU: Micro-operations, Arithmetic Logic Shift Unit.

UNIT 4: (~10 Lecture Hours)

Sequential Circuits and Systems: Synchronous Sequential Circuits, Latches, Flip-flops, Analysis of clocked sequential circuits, Registers, Shift registers, Ripple counters, Synchronous counters, other counters and Applications of counters.

Asynchronous Sequential Circuits -Introduction, Analysis procedure.

UNIT 5: (~8 Lecture Hours)

Semiconductor Memories and Programmable Logic Devices: Memory: Introduction, Read-Write Memory (RAM), Read Only Memory (ROM), Memory decoding, Programmable Logic Array, Programmable Array Logic, Sequential programmable devices: SPLD, CPLD, FPGA. Digital Integrated Circuits.

Text Books:

1. M. Morris Mano and M.D.Ciletti, Digital Design, 6th Edition, Pearson.
2. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill Education, 2010.

Reference Books:

1. A. Kumar, Fundamentals of Digital Circuits, Prentice Hall India, 2016.
2. M.Morris Mano, Computer System Architecture, 3rd Edition, Pearson.

Online Resources:

1. www.tutorialspoint.com/digital_circuits/index.htm
2. https://nptel.ac.in/courses/108105132

Course Outcomes:

After completion of the course, students will be able to

1. Interpret different Number systems, Binary codes and Boolean algebra.
2. Solve Boolean expressions using minimization methods.
3. Using the concepts of combinational circuits, design simple applications.
4. Design Hardware that suits various Micro-Operations.
5. Distinguish different types of Sequential circuits.
6. Describe functionality of memory devices.

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II Year B.Tech. CST I-Semester **L T P C**
Course Code: 123AV **2 0 0 2**

PYTHON PROGRAMMING

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Learn syntax and semantics and create functions in Python.
2. Facilitate learning to use lists, tuples, strings and dictionaries in Python programs.
3. Impart knowledge on files and exception handling in Python.
4. Introduce GUI programming and data handling.

UNIT 1: (~5 Lecture Hours)

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input, Processing and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More about Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

UNIT 2: (~5 Lecture Hours)

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops. **Functions:** Introduction, Defining and Calling a Function, designing a Program to use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions: Generating Random Numbers, Writing Our Own Value-Returning Functions, Recursion.

UNIT 3: (~6 Lecture Hours)

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

UNIT 4: (~6 Lecture Hours)

Files and Exception: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.

Modules: Namespaces, Importing Modules, Importing Module attributes, Module built-in functions, Packages, other features of Module.

Regular Expressions: Introduction, Special Symbols and Characters, REs and Python.

UNIT 5: (~ 6 Lecture Hours)

GUI Programming: Graphical User Interfaces, Using the tkinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Introduction to Plotting in Python – Basic Plots- Line and Scatter Plot, box plot, bar plots, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, Starting Out with Python, 3rd Edition, Pearson, 2015.
2. Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Python Programming, Oxford Press, 2017.
2. Allen Downe, Think Python: How to Think like Computer Scientist, 2nd Edition, O'Reilly publications.

Online Resources:

1. https://www.python.org/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.digimat.in/nptel/courses/video/106106182/L01.html
5. https://www.geeksforgeeks.org/simple-plot-in-python-using-matplotlib/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts of Python Programming.
2. Apply the concepts of control structures and usage of functions in Python Programming.
3. Design Python programs using data structures like List, Tuple, Strings and Dictionaries.
4. Develop proficiency in handling files, exceptions and modules.
5. Construct regular expressions and design GUI based applications using Python.
6. Interpret various data visualization techniques.

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II Year B.Tech. CST I-Semester **L T P C**
Course Code: 12313 **0 0 3 1.5**

DATABASE MANAGEMENT SYSTEMS LAB

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Understand the different issues involved in the design and implementation of a database system.
2. Learn and practice data modeling using the entity-relationship and developing database designs.
3. Understand and use data manipulation language to query, update, and manage a database.
4. Understand the significance of integrity constraints, triggers, views, procedures and cursors.

List of Experiments:

Week 1: Practicing Data Definition Language commands.

Week 2: Practicing Data Manipulation Language commands.

Week 3: Implementation of Integrity Constraints (Table Level and Column Level).

Week 4: Practicing Data Retrieval Language commands.

Week 5: Practicing queries using Aggregate Operations, **groupby** and **having**, Set Operations.

Week 6: Practicing Sub Queries and Correlated Nested Queries using **in, any, all, exists** etc.

Week 7: Practicing queries using **join** expressions, creating and querying on views.

Week 8: Basic PL/SQL Programs. (PL/SQL Environment)

Week 9: Implementation of Triggers and Functions.

Week 10: Implementation of Procedures and Cursors.

Week 11-12: **A Case Study on any one real time database application**
Objective: To enable the students to practice the concepts learnt in the course "DBMS" by developing a database using Oracle SQL. The student is expected to practice designing, developing and querying a database by using both SQL and PL/SQL concepts.

a) E-R Modeling of the case study chosen.
b) Normalization of tables.
c) Creation of relations as per the case study.

d) Inserting data into the tables.
e) Practice the Queries by using SQL Concepts.
f) Design and develop the following on the case study.
   i. Triggers   ii. Cursors

Text Books:

1. S. Shah and V.Shah, Oracle for Professionals:1 (X-Team), 1st Edition, Shroff Publishers & Distributers Private Limited.
2. Joan Casteel, Oracle 10 g: SQL, 1st Edition, Thomson Course Technology.

Reference Books:

1. A.Silberschatz, Henry. F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.

Online Resources:

1. https://dev.mysql.com/doc/
2. https://docs.oracle.com/en/database/
3. https://www.w3schools.in/

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the requirements of database application.
2. Design ER model for the given problem.
3. Convert ER diagram to relational database schema.
4. Apply normalization techniques for development of application software to realistic problems.
5. Formulate queries using SQL DML/DDL/DCL commands.
6. Demonstrate Triggers, Cursors and Stored Procedures on Database.

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II Year B.Tech. CST I-Semester **L T P C**
Course Code: 12317 **0 0 2 1**

PYTHON PROGRAMMING LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) &
CSE (Data Science))

Prerequisites: Programming for Problem Solving.

Course Objectives:

1. Describe the core syntax and semantics of Python Programming Language.
2. Learn the fundamental sequence types like lists, dictionaries, tuples, sets.
3. Handle files and modules in python.
4. Learn how to write string, Exception Handling programs in python.

List of Experiments:

Week 1:

a. Write a program to demonstrate different number data types in Python.
b. Write a program to illustrate various types of operations in Python.

Week 2:

a. Write a Python program to find largest of three numbers.
b. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]
c. Write a Python program that prints prime numbers less than 20(using for-else).
d. Write a Python program to construct the following pattern, using a nested for loop.

```
1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
4 4 4 4
3 3 3
2 2
1
```

e. Write a program to get the binary form of a given number.

Week 3:

a. Write a program to demonstrate various list methods in Python.
b. Write a program to get a list of even numbers from a given list of numbers. (use only list comprehensions).

Week 4:

a. Write a program to add an item in a tuple without converting into a list.

b. Write a program to count the elements in a list until an element is a tuple.

c. Write a Python program to demonstrate set operations.

Week 5:

a. Write a program to access a sub string from a given string (Use slicing)
   - Get the first 5 characters of a string.
   - Get a substring of length 4 from the 3rd character of the string.
   - Get the last 5 characters of a string.
   - Get a substring which contains all characters except the last 4 characters and the 1st character.
   - Get every other character from a string.

b. Get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself

   Eg: restart output: resta$t

c. Write a program to sort a dictionary by a value.

d. Write a program to display the count of individual vowels in the input string-using dictionary. (Ex: Input String: "welcome" Output: {'a':0,'e':2,'i':0,'o':1,'u':0})

Week 6:

a. Write a Python program to find N largest element from given list of integers using functions.

b. Write a Python program to find sum of elements of nested list using recursion. (Input: [9, 1, [3,4], [5,2]], Output:24)

c. Write a Python program to define a module to find Fibonacci Numbers and import the module to another program.

d. Define a module that consist of factorial and sum of individual digits of a number as functions.

e. Write a program to find ncr by importing only factorial function from the above module.

Week 7:

a. Write a program to handle exceptions using try..except..finally…else

b. Write a program to sort words in a file and put them in another file. The output file should have only lower- case words, so any upper-case words from source must be lowered. (Handle exceptions)

c. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

Week 8: Write a Python application to create basic calculator to demonstrate following GUI components.

i) Button ii) Text box iii) Text area

Week 9: Write a Python application to create basic Registration form to demonstrate following GUI components.

i) Text box ii) Button iii) Submit button iv) Combo box

v) Check button vi) Text widget vii) Radio button viii)Scrolled Text

Week 10: Write a Python program to draw following plots

i) Bar graph. ii) Scatter plot. iii) Box plot.

Text Books

1. Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson.
2. Gowrishankar S, Veena A, Introduction to Python Programming, 1st Edition, CRC Press/Taylor Francis, 2018. ISBN-13: 978-0815394372.

Reference Books:

1. Y Daniel Liang, Introduction to Programming Using Python, 1st Edition, Pearson India, 2017.

Online Resources:

1. www.w3schools.org.in
2. https://www.sgul.ac.uk/about/ourprofessionalservices/information services/library/documents/training-manuals/ExcelFundamentals-Manual.pdf
3. www.lynda.com
4. www.coursera.org

Course Outcomes:

After completion of the course, students will be able to

1. Understand and Apply basic concepts of Python.
2. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
3. Determine the methods to create Python programs by utilizing lists, dictionaries, tuples, sets and strings.
4. Develop the proficiency in handling of files and modules.
5. Implement the concept of Exception handling using Python.
6. Utilize Python libraries for data visualization.

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II Year B.Tech. CST I-Semester **L T P C**

Course Code: 12316 **0 0 3 1.5**

IT WORKSHOP LAB

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Introduction to a personal computer and its basic peripherals, the process of disassembling and assembling a personal computer.
2. Bring in the usage of productivity tools using open office tools and LaTeX.
3. To introduce HTML for developing web pages.
4. To introduce PHP language for Server Side Scripting.

List of Experiments:

- **Note:** Week - 2 to Week - 7 Experiments to be done using MS Office / Open Office.

Week 1:

a. Identification of the peripherals of a computer, components in a CPU and its functions.

b. Draw the block diagram of the CPU along with the configuration of each peripheral.

c. Disassembling and assembling the PC back to working condition.

d. Installation of Operating System.

Week 2:

a. Creating a Resume: Features to be covered: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

b. Creating a newsletter: Features to be covered: Table of Content, Newspaper columns, Inserting Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs in word.

Week 3:

a. Create Letters using Mail Merge: Features to be covered: Date and Time option, Greeting Line, Inserting Table and database.

b. Creating a Scheduler: Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text, Freezing Rows and Columns, Selecting Ranges.

Week 4:

Calculation of Grade Point Average: Features to be covered: Cell Referencing, Formulae in spreadsheet - Average, Standard Deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, Sorting, Conditional Formatting.

Data Processing: Features to be covered, Importing data from different files and database.

Week 5: Data Analyzing and Visualizing: Features to be covered: Pivot Tables, Slicers, Pivot Charts.

Week 6: Creating Databases: Features to be covered: Creating database using templates, Object types – Tables, Queries etc.

Week 7: Features to be covered: Creating Reports using Report wizard.

Week 8:

a. **Creating a Report in LaTeX**: Features to be covered: Newspaper columns, Inserting Images from files, Formatting Images, Inserting tables, Graphs and References.
b. **Creating Slides in LaTeX**: Features to be covered: Inserting Text, Formatting Text, Text color, Bullets and Numbering.

Week 9: Develop a webpage using HTML consisting of Text, Images, Tables, Lists, Hyperlinks.

Week 10: Develop Web page using HTML Frames and Style Sheets.

Week 11: Installation of XAMPP.

Week 12: Develop a Web Application in PHP to read data from web form controls like text boxes, radio buttons, lists etc.

Text Books:

1. Jennifer Sargunar, Introduction to Information Technology, ITL Education Solutions Limited, 7th Edition, Pearson Education.
2. Frank Mittelbach and Michel Goossens, LaTeX Companion, 2nd Edition, PHI/Pearson.
3. Steven Holzner, PHP: The Complete Reference, 5th Edition, Tata McGraw-Hill Education, 2007.

Reference Books:

1. Vikas Gupta, Comdex Information Technology Course Tool Kit, WILEY Dreamtech, 2005.
2. David Anfinson and Ken Quamme, IT Essentials PC Hardware and Software Companion Guide 3rd Edition, CISCO Press, Pearson Education.
3. Chris Bates, Web Programming. Building Internet Applications, 3rd Edition, Wiley, 2006.

Online Resources:

1. www.w3schools.org.in
2. https://en.wikibooks.org/wiki/LaTeX

Course Outcomes:

After completion of the course, students will be able to

1. Recognizing basic peripherals of computer and perform Computer Disassembling / Assembling.
2. Understanding the installation of OS and server side scripting with PHP language.
3. Apply the office tools for preparing documents, Data Analyzing and Visualizing.
4. Creating the database, importing & exporting databases and generating reports.
5. Preparing documents and slides using LaTeX.
6. Develop static Web Pages using HTML.

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II Year B.Tech. CST I-Semester **L T P C**

Course Code: 12312 **2 0 0 -**

CONSTITUTION OF INDIA

(Mandatory Course)

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML)& CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To realise the significance of constitution of India from all walks of life and to understand the basic concepts of Indian constitution.

UNIT 1: (~8 Lecture Hours)

History of Making of The Indian Constitution & Philosophy of The Indian Constitution History of Making Of The Indian Constitution: History, Drafting Committee (Composition & Working) **Philosophy of the Indian Constitution**: Preamble, Salient Features.

UNIT 2: (~6 Lecture Hours)

Contours of Constitutional Rights and Duties

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT 3: (~6 Lecture Hours)

Organs of Governance:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions- Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT 4: (~6 Lecture Hours)

Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati Raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role, Block Level:

Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 5: (~6 Lecture Hours)

Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, Government Publication, 1950(Bare Act).

Reference Books:

1. Dr.S.N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
2. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.

Online Resources:

1. https://nptel.ac.in/courses/129106003 [Constitutional Studies by Prof. Sudhir Krishna Swami, IIT Madras]
2. https://onlinecourses.swayam2.ac.in/cec20_hs38/preview [Indian Government and Politics by Dr.Aijaz Ashraf Wani, University of Kashmir,Srinagar]

Course Outcomes:

After completion of the course, students will be able to

1. Tell about function of Indian constitution with clarity and understanding.
2. Identify the Rights of equality, the Right of freedom and the Right to constitutional remedies
3. Mark the knowledge of union government & their powers and function.
4. Define the state and central policies, fundamental duties.
5. Explain the powers and functions of Municipalities, Panchayats and Co-operative Societies.
6. Discuss the Electoral Process, special provisions.

Assessment Criteria:

SATISFACTORY PARTICIPATION CERTIFICATE shall be issued onlyafter securing greater than or equivalent to **75%** of the attendance in the course along with the active Classroom interaction and participation by the students.

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II Year B.Tech. CST II-Semester **L T P C**

Course Code: 124BG **3 0 0 3**

DISCRETE MATHEMATICS

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Introduce the concepts of mathematical logic.
2. Gain knowledge in sets, relations and functions.
3. Solve problems using counting techniques and combinatorics.
4. Introduce generating functions and recurrence relations.
5. Use Graph Theory for solving real world problems.

UNIT 1: (~10 Lecture Hours)

Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for the Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference theory of the Predicate Calculus.

UNIT 2: (~10 Lecture Hours)

Set Theory: Basic concepts of Set Theory, Operations on Sets, Relations and Ordering: Properties, Relation Matrix and the Graph of a Relation, Partition and Covering, Equivalence, Compatibility, Composition of Binary relations, Transitive Closure, Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Recursive Functions, Lattice and its Properties.

Algebraic Structures: Algebraic Systems, General Properties, Semi Groups and Monoids, Group, Subgroup, Homomorphism, Isomorphism, Abelian Group.

UNIT 3: (~9 Lecture Hours)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion-Exclusion, Pigeon hole principle and its application.

UNIT 4: (~8 Lecture Hours)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving

Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of non-homogeneous Recurrence Relations.

UNIT 5: (~8 Lecture Hours)

Graph Theory: Basic Concepts, Isomorphism and Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Bipartite and Planar Graphs, Euler's formula, Multigraphs and Euler's circuit, Hamiltonian Graphs. **Trees:** Basic Concepts, properties, Directed trees, Binary trees, Spanning Trees - BFS and DFS Spanning trees, Minimal spanning trees-Prim's and Kruskal's Algorithms, Graph Coloring, Chromatic Number, the Four Color problem.

Text Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.
2. Joe L.Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Thomas Koshy, Discrete Mathematics with Applications, Elsevier Academic Press, 2012.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs33/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs04/preview

Course Outcomes:

After completion of the course, students will be able to

1. Apply mathematical logic to solve problems.
2. Understand the concepts and perform the operations related to sets, relations and functions.
3. Acquire the conceptual background needed and identify structures of algebraic nature.
4. Apply basic counting techniques to solve combinatorial problems.
5. Formulate problems and solve recurrence relations.
6. Apply Graph Theory in solving computer science problems.

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II Year B.Tech. CST II-Semester **L T P C**
Course Code: 124BK **3 0 0 3**

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Learn the concepts of object-oriented programming.
2. Introduce the implementation of inheritance, packages and interfaces.
3. Understand the concepts of exception handling and multithreading.
4. Introduce the java collection framework and I/O classes.
5. Gain knowledge of swing controls and connecting to database using JDBC.

UNIT 1: (~9 Lecture Hours)

OOP Concepts: Data Abstraction, Encapsulation, Inheritance, Polymorphism, Classes and Objects, Procedural and Object Oriented Programming Paradigms.

JAVA Basics: History of Java, Java Buzzwords, Data Types, Variables, Arrays, Operators, Expressions, Control Statements, Introducing Classes, Methods, Constructors, Inner Classes, Anonymous Inner Classes, String Handling, Random, Scanner.

UNIT 2: (~10 Lecture Hours)

Inheritance: Inheritance Concepts, Member Access, Creating Multilevel Hierarchy, using super, using final with Inheritance, Forms of Inheritance, Benefits of Inheritance, Costs of Inheritance, Polymorphism - Adhoc Polymorphism, Pure Polymorphism, Method Overriding, Abstract Classes, Object Class.

Packages: Defining a Package, Classpath, Access Protection, Importing Packages.

Interfaces: Defining an Interface, Implementing Interfaces, Nested Interfaces, Variables in Interfaces and Extending Interfaces.

UNIT 3: (~10 Lecture Hours)

Exception handling: Fundamentals of Exception Handling, Exception Types, using try and catch, Multiple catch clauses, nested try statements, throw, throws and finally, Built-In Exceptions, Creating Own Exception Subclasses.

Multithreading: Differences between Thread-Based Multitasking and Process-Based Multitasking, Java Thread Model, Creating Threads, Thread Priorities, Synchronizing Threads, Inter Thread Communication.

JDBC: Introduction to JDBC drivers, Types of Drivers, java.sql package, Connecting to a Database using JDBC, Manipulating data in Database.

UNIT 4: (~10 Lecture Hours)

Event Handling: The Delegation Event Model - Events, Event Sources, Event Listeners, Event Classes, Handling Mouse and Keyboard Events, Adapter Classes, Regular Expressions - Regular Expression Processing.

GUI Programming with Swing: Introduction, Limitations of AWT, MVC Architecture, Swing Components, Swing Containers, Swing Controls - JLabel, JTextField, JButton, JToggleButton, JCheckBox, JRadioButton, JTabbedPane, JScrollPane, JList, JComboBox, Swing Menus, Dialogs. Layout Managers-FlowLayout, BorderLayout, GridLayout, CardLayout, GridBagLayout.

UNIT 5: (~ 9 Lecture Hours)

Stream based I/O (java.io): The Stream Classes - Byte Streams and Character Streams, Reading Console Input and Writing Console Output, File class, Reading and Writing files, Random Access File operations, Generics, Enumerations, Lamda Expressions- Lamda Expression Fundamentals, Functional Interfaces, Lamda Expression examples.

The Collections Framework (java.util): Collections Overview, Collection Interfaces, The Collection Classes

- ArrayList, LinkedList, Iterator, The For-Each alternative, HashTable, Stack, StringTokenizer, Calendar.

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 10^{th} Edition, McGraw Hill Education (India) Pvt. Ltd.
2. Herbert Schildt and Dale Skrien, Java Fundamentals - A Comprehensive Introduction, McGraw Hill Education (India) Pvt. Ltd., 2013.
3. Jim Keogh, J2EE: The Complete Reference, McGraw Hill Education (India) Pvt. Ltd., 2017.

Reference Books:

1. Jaime Nino and Frederick. A. Hosch, An Introduction to Programming and Object Oriented Design using Java, John Wiley & sons, 2013.
2. Timothy Budd, Understanding Object-Oriented Programming with Java, updated Edition, Pearson Education.
3. Y. Daniel Liang, Introduction to Java Programming, Comprehensive Version, 7^{th} Edition, Pearson Education.
4. H.M. Dietel and Dietel, Java – How to Program, 6^{th} Edition, Pearson Education/PHI.
5. Cay Horstmann, Big Java, 4^{nd} Edition, John Wiley and Sons Publisher, 2009.

Online Resources:

1. https://docs.oracle.com/javase/tutorial/java/TOC.html
2. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
3. www.javatpoint.com/java-tutorial

Course Outcomes:

After completion of the course, students will be able to

1. Understand the Object Oriented Programming concepts and solve real world problems.
2. Understand the concepts of Exception Handling and Event Handling.
3. Recognize the importance of multithread with Synchronization.
4. Demonstrate the use of Inheritance and Packages.
5. Solve problems using Java Collection Framework and I/O classes.
6. Design GUI using Swing Controls and connecting to Database.

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II Year B.Tech. CST II-Semester	**L**	**T**	**P**	**C**
Course Code: 124BL	**3**	**0**	**0**	**3**

OPERATING SYSTEMS

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Data Structures

Course Objectives:

1. Interpret the role of an Operating System in the overall computer system and study the operations performed by it as a resource manager.
2. Understand the scheduling policies and different memory management techniques for different Operating Systems.
3. Examine process concurrency, synchronization and deadlock situation.
4. Assess the concepts of I/O, storage and file management and introduce system call interface for file and process management.
5. Outline the goals and principles of protection.

UNIT 1: (~10 Lecture Hours)

Introduction: Overview-Introduction-Operating System objectives and functions, User view, System view, Operating System definition, Evolution of Operating System- Simple Batch systems, Multiprogrammed, Time-Sharing Systems, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments.

Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT 2: (~9 Lecture Hours)

Process: Process concepts-The Process, Process State, Process State transitions, Process Control Block, Context Switch.

Threads: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms, Multiprocessor Scheduling. Case Studies: Linux, Windows.

UNIT 3: (~10 Lecture Hours)

Process Synchronization: Inter-process Communication - Background, The Critical Section Problem, Race Conditions, Mutual Exclusion, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization - Bounded Buffer Problem, The Producer/ Consumer Problem, Reader's & Writer's Problem, Dinning Philosopher Problem, Event counters, Monitors, Message passing.

Deadlocks: Deadlocks - System Model, Deadlock Characterization - Necessary and sufficient conditions for Deadlock, Methods for Handling Deadlocks - Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT 4: (~10 Lecture Hours)

Memory Management: Basic Hardware, Address Binding, Logical and physical address space, Dynamic loading, linking and shared libraries, Swapping, Contiguous Memory Allocation - Fixed and variable partition - Internal and External fragmentation and Compaction, Segmentation, Paging - Hardware support for paging, Protection, shared pages, Structure of Page Table, Case Studies - Linux, Windows.

Virtual Memory Management: Background, Demand Paging - locality of reference, Page fault, Copy-on- Write, Page replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT 5: (~9 Lecture Hours)

File Management: Concept of File - Attributes, operations, file types, internal structure, access methods, Directory structure, file protection, file system structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk formatting - Boot- block, Bad blocks.

Protection: System Protection, Goals of Protection, Principles of Protection.

Text Books:

1. Abraham Silberschatz, Peter B.Galvin and Greg Gagne, Operating System Concepts, 9th Edition, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India.

Reference Books:

1. Charles Crowley, Operating System: A Design-oriented Approach, 1st Edition, Irwin Publishing.
2. Gary J. Nutt and Addison, Operating Systems: A Modern Perspective, 2nd Edition, Wesley.
3. Maurice Bach, Design of the UNIX Operating Systems, 8th Edition, Prentice Hall of India.
4. Daniel P. Bovet and Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Online Resources:

1. https://www.docdroid.net/vp5Cfdg/abraham-silberschatz-operating-system-concepts-9th201212-pdf
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

Course Outcomes:

After completion of the course, students will be able to

1. Understand fundamentals of Operating System.
2. Demonstrate the concepts of process, thread and scheduling algorithms.
3. Apply process synchronization methods to solve critical section problem.
4. Solve deadlock problems using various deadlock management techniques.
5. Compare the different memory management techniques.
6. Summarize file & disk management, protection & security concepts and evaluate the performance of disk scheduling algorithms.

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II Year B.Tech. CST II-Semester	**L**	**T**	**P**	**C**
Course Code: 124BB	**3**	**0**	**0**	**3**

COMPUTER ORGANIZATION AND ARCHITECTURE

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Digital Logic Design

Course Objectives:

1. Know the basic components of Computers.
2. Understand the Architecture of 8086 Processor.
3. Learn the instruction sets, instruction formats and various addressing modes of 8086.
4. Understand the Memory and I/O organization.
5. Understand the Parallelism both in terms of Single and Multiple Processors.

UNIT 1: (~10 Lecture Hours)

Functional Blocks of a Computer: Introduction, Block diagram of Digital Computer, Instruction Codes, Computer Registers, Common Bus System, Computer Instructions, Instruction Cycle and Instruction Set. Register Transfer Language.

Data Representation: Fixed and Floating-Point Arithmetic-Addition, Subtraction, Multiplication and Division. **Control unit Design:** Hardwired Control Unit, Control Memory, Address Sequencing, Micro-Programmed Control Unit Design, Hardwired vs Micro- Programmed Design.

UNIT 2: (~10 Lecture Hours)

The 8086 Microprocessor: Architecture,Register Organization, Addressing Modes, 8086 Instruction Set and Assembler Directives, 8086 Signal Description, Physical Memory Organization, Assembly Language example programs, Stack Structure of 8086, Interrupt Structure of 8086, Interrupt Vector Table, Procedures and Macros.

UNIT 3: (~7 Lecture Hours)

Peripheral Devices and their characteristics: Introduction, Input- Output Interface, Modes of Transfer- Programmed I/O, Priority Interrupt, Direct Memory Access, Input – Output Processor (IOP), Intel 8089 IOP, Standard I/O interfaces – PCI, USB, SCSI.

UNIT 4: (~8 Lecture Hours)

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory - Mapping Functions, Replacement Algorithms, Write Policies.

UNIT 5: (~10 Lecture Hours)

Parallel Processing: Introduction, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Hazards, Vector Processing, Array Processors.

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration, Inter Processor Communication and Synchronization, Cache Coherence.

Text Books:

1. M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson.
2. K. M. Bhurchandi and A.K Ray, Advanced Microprocessors and Peripherals, 3rd Edition, Tata McGraw- Hill Education.
3. Douglas V. Hall, Microprocessor and Interfacing, 2nd Edition, Tata McGraw-Hill Education.

Reference Books:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition, Elsevier.
2. Carl Hamacher, Computer Organization and Embedded Systems, 6th Edition, McGraw Hill Higher Education.
3. William Stallings, Computer Organization and Architecture: Designing for Performance, 10th Edition, Pearson Education.

Online Resources:

1. http://nptel.ac.in/courses/106103068/pdf/coa.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Recognize the basic components and the design of CPU, ALU and Control Unit.
2. Know the Architecture of 8086. Realize the Instruction Set, Addressing Modes and Assembler Directives of 8086 and Write ALP for problem solving.
3. Understand the I/O organization and its connection to CPU.
4. Understand the Memory Hierarchy and their importance.
5. Comprehend the advantage of Instruction Level Parallelism, Pipelining.
6. Understand the characteristics of Multi-Processor architecture for high performance Processor design.

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II Year B.Tech. CST II-Semester	**L**	**T**	**P**	**C**
Course Code: 124BP	**3**	**0**	**0**	**3**

SOFTWARE ENGINEERING
(Common to CSE, IT & CST)

Prerequisites: -Nil-

Course Objectives:
1. Understand the software life cycle models.
2. Understand the importance of the software development process.
3. Understand the importance of modeling and modeling languages.
4. Design and develop correct and robust software product.

UNIT 1: (~10 Lecture Hours)

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic view of process: Software engineering- a layered technology, A process framework, The capability maturity model integration (CMMI), Process patterns, Process assessment, Personal and team process models. **Process models:** The Waterfall model, Incremental process models, Evolutionary process models, The unified process.

UNIT 2: (~9 Lecture Hours)

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. **System models:** Context models, Behavioural models, Data models, Object models, Structured methods.

UNIT 3: (~9 Lecture Hours)

Design Engineering: Design process and design quality, Design concepts, The design model.

Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural design, Conceptual model of UML, Basic structural modeling, Class diagrams, Sequence diagrams, Collaboration diagrams, Use case diagrams, Component diagrams.

Performing user interface design: Golden rules, User interface analysis and design, Interface analysis, Interface design steps, Design evaluation.

UNIT 4: (~9 Lecture Hours)

Testing Strategies: A strategic approach to software testing, Test strategies for conventional software, Black- box and white-box testing, Validation testing, System testing, The art of debugging.

Product metrics: Software quality, Metrics for analysis model, Metrics for design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

UNIT 5: (~8 Lecture Hours)

Metrics for Process and Products: Software measurement, Metrics for software quality.

Risk management: Reactive Vs proactive risk strategies, Software risks, Risk identification, Risk Projection, Risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, Software quality assurance, Software reviews, Formal technical reviews, Statistical software quality assurance, Software reliability, The ISO 9000 quality standards.

Text Books:

1. Roger S. Pressman, Software Engineering- A Practitioner's Approach, 6th Edition, McGraw Hill Companies, Inc.
2. Sommerville, Software Engineering, 7th Edition, Pearson Education.

Reference Books:

1. Grady Booch, James Rambaugh and Ivar Jacobson, The Unified Modeling Language User Guide, 2nd Edition, Pearson Education.
2. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies, 2004.

Online Resources:

1. https://alison.com/courses/software-engineering.
2. https://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic software engineering methods along with practices, process framework and process models.
2. Analyze software requirements, SRS documents and Project Management.
3. Develop different system models that describe the functionality of the system.
4. Design and maintain efficient, reliable and cost effective software solutions and suitable software metrics.
5. Understand various software testing approaches and techniques used for software assessment.
6. Interpret the significance of Software measurement, software risks and quality control.

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II Year B.Tech. CST II-Semester **L T P C**

Course Code: 12425 **0 0 3 1.5**

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Develop skills to apply object oriented programming in problem solving.
2. Demonstrate the use of inheritance and interfaces.
3. Implement the concepts of exception handling and multithreading.
4. Solve problems using java collection framework and I/O classes.
5. Gain knowledge of swing controls and connecting to database using JDBC.

Note: Use Linux/Windows for Lab Experiments. Though not mandatory, encourage the use of the Eclipse platform.

List of Experiments:

Week 1:

Write a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula. If the discriminant b^2-4ac is negative, display a message stating that there are no real solutions.

Week 2:

a. Write a Java program that checks whether the given string is a palindrome or not.
b. Write a Java program to multiply given 3X3 matrices.

Week 3:

a. Write a Java program that accepts a number from the end-user and then prints all prime numbers up to a given number.
b. Write a Java program to create a Box class with properties like length, breadth, width, and volume. Display the volume of 2 different boxes by using objects.

Week 4:

a. Write a Java program that demonstrates constructor overloading.
b. Write a Java program to implement the use of inner classes.

Week 5:

a. Write a Java program that demonstrates the following:
   i. Method overloading
   ii. Method overriding.
b. Write a Java program to create an abstract class named ‘Shape’ that contains two integers and an empty method named printArea ( ). Provide

three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.

c. Write a Java program that implements multiple inheritance.

Week 6:

a. Write a Java program that implements a multi-threaded application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

b. Write a Java program that implements producer – consumer problem using the concept of Inter thread communication.

Week 7:

Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use Adapter classes).

Week 8:

Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 are not integers, the program would throw a Number Format Exception. If Num2 is Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

Week 9:

Write a Java program that works as a simple calculator. Use a GridLayout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

Week 10:

Write a Java program to connect to database and display Employee details (eid,ename,dept and salary).

Week 11:

a. Write a Java program to list all the files in a directory including the files present in all its subdirectories.

b. Write a Java program for the following:

   i) Create a doubly linked list of elements.

   ii) Delete a given element from the above list.

   iii) Display the contents of the list after deletion.

Week 12:

Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record is separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 10th Edition, McGraw Hill Education (India) Pvt. Ltd.
2. Jim Keogh, J2EE: The Complete Reference, McGraw Hill Education (India) Pvt. Ltd., 2017.

Reference Books:

1. Timothy Budd, Understanding Object-Oriented Programming with Java, updated Edition, Pearson Education.
2. Y. Daniel Liang, Introduction to Java Programming, Comprehensive Version, 7th Edition, Pearson Education.
3. H.M. Dietel and Dietel, Java – How to Program, 6th Edition, Pearson Education/PHI.

Online Resources:

1. https://docs.oracle.com/javase/tutorial/java/TOC.html
2. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
3. www.javatpoint.com/java-tutorial

Course Outcomes:

After completion of the course, students will be able to

1. Implement the object oriented programming concepts and solve real-world problems.
2. Develop programs using inheritance, interface and packages.
3. Demonstrate the concepts of exception handling and Event Handling.
4. Implement real-time applications using Multithread with Synchronization.
5. Solve problems using java collection framework and I/O classes.
6. Design GUI using Swing controls and connecting to Database.

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II Year B.Tech. CST II-Semester **L T P C**

Course Code: 12423 **0 0 3 1.5**

LOGIC CIRCUITS AND MICROPROCESSOR LAB

Prerequisites: Digital Logic Design

Course Objectives:

1. Design and implement combinational circuits using logic gates.
2. Analyze and design sequential circuits using logic gates.
3. Develop programs in Assembly Language to solve the problems.
4. Understand the storage allocation of data and programs in memory and registers.

List of Experiments:

Week 1: Implement the following experiments using Logic gates and IC's

a. Logic gates using universal gates. b. Design a Full adder.

Week 2: Implement the following experiments using Logic gates and IC's

a. Design a 2x4 and 3x8 decoder b. Design 4x1 and 8x1 MUX.

Week 3: Implement the following experiments using Logic gates and IC's

a. Design a 3 to 8 decoder. b. Design a 4-bit comparator.

Week 4: Implement the following experiments using Flip-flops

a. Design a 4-bit shift register. b. Design a decade counter.

Week 5: Write an Assembly Language Program (ALP) to evaluate the expressions a=b+c-d*e and z=x*y+w- v+u/k. Considering 8-bit and 16-bit binary numbers as b, c, d, e, k, u, v, w, x and y.

Week 6: Write an ALP of 8086 to take N numbers as input and arrange them in ascending and descending order.

Week 7: Write an ALP of 8086 to take N numbers as input and do the following operations on them a. Find max and minimum. b. Find average

Week 8: Write an ALP of 8086 to take a string as input and do the following operations on it

a. Find the length. b. Find whether it is Palindrome or not.

Week 9: Write an ALP of 8086 to take a string as input and find whether given string is substring or not.

Week 10: Write an ALP of 8086 to take a number as input and find the factorial using a procedure call.

Week 11: Write an ALP of 8086 to take a number as input and find the Fibonacci series up to n terms using a procedure call.

Week 12: Write an ALP of 8086 to take a number as input and say whether it is an Armstrong number or not using procedure call.

Text Books:

1. M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson.
2. K. M Bhurchandi and A.K Ray, Advanced Microprocessors and Peripherals, 3rd Edition, Tata McGraw- Hill Education.

Reference Books:

1. Anand Kumar, Switching theory and logic design, PHI, 2013.
2. Douglas V. Hall, Microprocessor and Interfacing, 2nd Edition, Tata McGraw-Hill Education.

Online Resources:

1. http://nptel.ac.in/courses/106103068/pdf/coa.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Design combinational circuits using logic gates.
2. Design sequential circuits using logic gates.
3. Create programs in Assembly language to solve the problems using 8-bit & 16-bit numbers.
4. Understand the importance of processor registers, memory allocation.
5. Recognize the representation of data and addressing modes.

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II Year B.Tech. CST II-Semester **L T P C**

Course Code: 12422 **2 0 0 -**

HUMAN VALUES AND PROFESSIONAL ETHICS

(Mandatory Course)

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To instill among the Engineering professionals, the need to follow ethical principles in life.
2. To stimulate thinking and help internalize the value systems and ethical behavior.
3. To enable the students to understand the need for value based education.
4. To inculcate a sense of moral responsibility and professional ethics as Engineers.
5. To understand the impact of ethical perspectives globally.

UNIT 1: (~7 Lecture Hours)

Understanding Value Education:

Basic Concepts: Moral and Morality, Ethics, Values, Principles – Thoughts of Ethics: Indian Thought versus Global Thought – Objectives of Value Education – Importance of Value Education – Personal Ethics – Professional Ethics.

UNIT 2: (~7 Lecture Hours)

Understanding the Harmony at Various Levels:

Harmony in the Self – Harmony in the Family – Harmony in the Society – Harmony in the Nature – Harmony in Existence – Understanding the Interconnectedness and Mutual fulfilment – Understanding Existence as Co-existence – CASE STUDIES.

UNIT 3: (~6 Lecture Hours)

Ethical Theories:

Utilitarian Ethics – Kant's deontological Theory – Virtue Ethics – Kohlberg's Levels of Moral Development – Gilligen's Theory - CASE STUDIES.

UNIT 4: (~6 Lecture Hours)

Professional Ethics:

Profession and Professionalism – Ethics in Engineering – Role of Engineers – Responsibilities of Engineers – Engineering Code of Ethics – Ethical Dilemmas– CASE STUDIES.

UNIT 5: (~6 Lecture Hours)

Global Issues and Ethical Perspectives:

Business Ethics – Environment Ethics – Computer Ethics – Media Ethics – Research Ethics – Intellectual Property Rights – Social Responsibility – CASE STUDIES.

Text Books:

1. A foundation course in Human Values and Professional Ethics by RR Gaur, R.Sangal and G.P.Bargaria, Excel Books, 2011.
2. Human Values and Professional Ethics by Tanu Shukla, Anupam Yadav, Gajendra Singh Chauhan, Cengage Publications, 2018.

Reference Books:

1. Fundamentals of Ethics for Scientists and Engineers by Edmund G, SeeBauer, Robert L, Barry Oxford University Press, 2015.
2. Professional Ethics by R.Subramanian, Oxford University Press, 2013.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_mg54/preview [Ethics in Engineering Practice by Prof.Susmita Mukhopadhyay, IITKharagpur]
2. https://nptel.ac.in/courses/109104068 [Exploring Human Values byProf.A.K.Sharma, IIT Kanpur]

Course Outcomes:

After completion of the course, students will be able to

1. Understand the importance of imbibing and inhering Ethics and values as an individual and professional.
2. Relate the need for establishing harmony at various levels.
3. Evaluate the relevance of ethical values in their academic and professional environment.
4. Develop right understanding about oneself and the rest of reality through self-exploration.
5. Identify the basis for universal human values based on right understanding providing the vision for the holistic way of living.
6. Value oneself as professionals with professional ethics and right code ofconduct and behaviour in the working environment.

Assessment Criteria:

SATISFACTORY PARTICIPATION CERTIFICATE shall be issued onlyafter securing greater than or equivalent to **75%** of the attendance in the course along with the active Classroom interaction and participation by the students.

III Year B.Tech. CST I-Semester	**L T P C**
Course Code: 125CN	**3 1 0 4**

FULL STACK DEVELOPMENT

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Object Oriented Programming through JAVA

Course Objectives:

1. To gain knowledge on basic building blocks of Full Stack Development.
2. To understand technologies to design Front-End of the application.
3. To introduce Back-End technologies of the application along with database connection.
4. To develop the applications using frameworks.

UNIT 1: (~9 Lecture Hours)

Building Blocks of Full Stack Development: Introduction, Front-End Technologies, Back-End Technologies, MVC, Web Services, Communication between Front-End and Back-End, JSON - Syntax, Parsing and Serialization. **HTML 5.0**: Components of HTML, Text Formatting tags, Quotations, Links, Images, **CSS**: syntax, Box Model, CSS outline, Links in CSS, Responsiveness, Position Property, Navigation Bars, Dropdown, Forms.

UNIT 2: (~9 Lecture Hours)

JavaScript: Introduction, variables, functions, Event handling, DOM, Form validation, **JQuery** - Syntax, Selectors, Events.

React: Introduction, Components - React Classes, Composing Components, passing data using Properties & Children, Dynamic Composition, React State - Initial State, Async State Initialization, Updating State, Event Handling, Stateless Components, Designing Components.

UNIT 3: (~10 Lecture Hours)

More about React: React Router - Simple Routing, Route Parameters, Query Parameters, Links, Nested Routes, React Forms - Controlled Components, Filters, Typed Input, Edit Form, Number Input, Date Input, Text Input, Update API, Delete API.

Servlet: Lifecycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, Connecting to database.

UNIT 4: (~10 Lecture Hours)

JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, implicit objects, Java Bean, Connecting to database.

Spring Framework: Introduction, Architecture, MVC, Interception, Chain of Resolvers, View Resolution, Multiple View Pages, Multiple Controllers, Model Interface, RequestParam, Form Tag Library, Form Text Field, CRUD example, File Upload, Validations.

UNIT 5: (~10 Lecture Hours)

Hibernate: Introduction, Architecture, Installation and Configuration, Java Objects, Inheritance Mapping, Collection Mapping, Mapping with Map, Hibernate Query Language, Caching, Spring Integration.

Web Services: Introduction, types of web services, Building RESTful Web Services with JAX-RS.

Text Books:

1. Mayur Ramgir, FullStack Development with Spring MVC, Hibernate, jquery and BootStrap, WILEY Publications, 2020.
2. Uttam K. Roy, Web Technologies, OXFORD University press, 2010.
3. Vasan Subramanian, Pro MERN Stack, APress, second Edition, 2019.

Reference Books:

1. Matt Frisbie, Professional JavaScript for Web Developers, WILEY Publications, 2020.
2. Terry Ann Felke-Morris, Basics of Web Design, Pearson, Fifth Edition.
3. Alex Banks and Eve Porcello, Learning React, O'Reilly, 2017.

Online Resources:

1. https://docs.oracle.com/javaee/6/tutorial/doc/bnayk.html
2. https://www.w3schools.com/html/default.asp
3. https://www.w3schools.com/css/default.asp
4. https://www.w3schools.com/REACT/DEFAULT.ASP

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate knowledge on the building blocks of Full Stack Development and its Front-End designing using HTML, CSS.
2. Understand the concepts of JavaScript and JQuery.
3. Design interactive UI with React JS.
4. Implement Back-End using Java technologies like Servlets and JSP.
5. Develop the applications with Spring framework and hibernate.
6. Build a web service with JAX-RS.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125CD **3 0 0 3**

COMPUTER NETWORKS

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Computer Organization and Architecture

Course Objectives:

1. Introduce the fundamental types of computer networks.
2. Demonstrate the TCP/IP and OSI models with merits and demerits.
3. Develop an understanding of modern network architecture from a design and performance perspective.
4. Introduce UDP and TCP Models along with application layer protocols.

UNIT 1: (~9 Lecture Hours)

Introduction: Uses of Computer Networks and Applications, Network hardware, Network software, Reference models.

Physical Layer: Guided Transmission Media: Twisted Pairs, Coaxial Cable, Fiber Optics, Wireless Transmission, Digital Modulation and Multiplexing: FDM, TDM, CDM.

UNIT 2: (~9 Lecture Hours)

Data Link Layer: Design issues, Framing, Error detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.

Medium Access sub layer: The Channel Allocation Problem, Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols, Collision Free Protocols, Ethernet, Data Link Layer Switching, WLANs – IEEE 802.11 Architecture.

UNIT 3: (~9 Lecture Hours)

Network Layer: Design issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broad Cast Routing, Multicast Routing.

Congestion Control Algorithms: Approaches to Congestion Control, Traffic-Aware Routing, Admission Control, Quality of Service: Application Requirements, Traffic Shaping.

UNIT 4: (~10 Lecture Hours)

Internetworking: Tunneling, The Network layer in the Internet: The IP Version 4 Protocol, IP Addresses, IP Versions 6, Internet Control Protocols.

Transport Layer: The Transport Service: Services provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols: Addressing, The Internet Transport protocols: UDP and TCP protocols.

UNIT 5: (~8 Lecture Hours)

Application Layer: Domain Name System: The DNS Name Space, Domain Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, WWW: Architectural Overview, Static Web Pages, Dynamic Web Pages and Web Applications, HTTP.

Network Security: Cryptography – Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, One-Time Pads, Two fundamental Cryptographic Principles.

Text Books:

1. Andrew S Tanenbaum, David. J. Wetherall, Computer Networks, 5th Edition, Pearson Education/PHI.

Reference Books:

1. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson Education.
2. Behrouz A.Forouzan, Data Communications and Networking, 5th Edition, TMH.

Online Resources:

1. https://www.mheducation.com/highered/product/data-communications-networking- forouzan/M9780073376226.html
2. NPTEL: Computer Science and Engineering - NOC:Computer Networks and Internet Protocol
3. https://a.impartus.com/ilc/#/course/612379/990
4. e-PGPathshala (inflibnet.ac.in)
5. Fundamentals of Network Communication Course (CU System) | Coursera

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basics of computer networks, networking devices and protocols.
2. Examine the functionalities of different layers of OSI and TCP/IP reference models.
3. Analyze the performance of data link layer and MAC layer protocols.
4. Acquire the knowledge of network layer services and apply the same for different applications.
5. Interpret the services offered by transport entities and transport protocols.
6. Determine various application layer protocols in real time and to understand basics of Network Security.

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III Year B.Tech. CST I-Semester **L T P C**
Course Code: 125BW **3 0 0 3**

AUTOMATA AND COMPILER DESIGN

Prerequisites: Discrete Mathematics, Computer Organization and Architecture.

Course Objectives:

1. Understanding finite Automata and its application in phases of compilation.
2. Describe the steps and algorithms used by language translators.
3. Enumerating top down and bottom up parsing techniques used in the compilation process.
4. Learning the effectiveness of optimization.
5. Introducing the syntax directed translation and type checking.
6. Understanding intermediate code generation.

UNIT 1: (~10 Lecture Hours)

Formal Languages and regular expressions: The central concepts of Automata Theory- Alphabets, Strings, Languages, Finite Automata-NFA, NFA with epsilon transitions, DFA, Regular Expressions, Conversion of regular expression to NFA, NFA to DFA.

Chomsky hierarchy of languages and Recognizers, Context Free Grammars, Derivations, Parse trees, Ambiguity.

UNIT 2: (~8 Lecture Hours)

Introduction to Compilers: Translators, Compilers and Interpreters, Structure of a compiler, Retargeting, Bootstrapping, Cross compiler, Compiler construction tools.

Lexical Analysis –The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator LEX. Symbol Table: Introduction, Symbol Table Entries, Operations on the Symbol Table, Symbol table organization.

UNIT 3: (~9 Lecture Hours)

Syntax Analysis: Role of Parser, Top Down Parsing: Recursive Descent Parsing, Predictive Parsing, LL(1) parsing, LL(k) Grammars.

Bottom Up Parsing: Reductions, Handle pruning, Shift Reduce Parsing, Conflicts during Shift-Reduce parsing, Introduction to LR Parsing SLR, More Powerful LR Parsers CLR and LALR, The Parser Generator YACC.

UNIT 4: (~9 Lecture Hours)

Semantic Analysis: Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Types and Declarations: Type expressions, Type equivalence, Type checking: Rules for Type checking, Type conversions, Translation of Expressions: Operations with Expressions, Control flow.

Intermediate Code Generation: Syntax Trees, DAG, Polish notation, Three Address Code.

Run Time Environments: Storage Organization, Stack Allocation of Space, Heap Management.

UNIT 5: (~9 Lecture Hours)

Code Optimization: Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Machine Independent Optimizations-The Principal Sources of Optimizations, Loops Optimization, Machine dependent optimization: Peephole optimization.

Code Generation: Issues in the Design of a Code Generator, The target language, A Simple Code Generator, Register Allocation and Assignment.

Text Books:

1. Aho, Ullman, Monica S.Lam, Ravisethi, Compilers Principles,Techniques and Tools Pearson Eductaion.
2. Sipser, Introduction to Theory of computation. 2nd Edition, Thomson

Reference Books:

1. K.V.N. Sunitha, Compiler Construction, Pearson India.
2. K.V.N. Sunitha and N. Kalyani, Formal Languages and Automata Theory,Pearson India.
3. Jean-Paul Tremblay and Paul G Sorenson, The Theory & Practice of Compiler Writing.
4. Andrew W.Appel, Modern Compiler Construction in C, CambridgeUniversity Press.
5. V.Raghavan, Principles of Compiler Design, TMH.

Online Resources:

1. https://nptel.ac.in/courses/106108113
2. https://onlinecourses.nptel.ac.in/noc23_cs57/preview
3. https://www.mooc-list.com/course/compilers-theory-and-practice-udacity
4. https://www.coursera.org/learn/compiler-design
5. https://iitd.github.io/col728/

Course Outcomes:

After completion of the course, students will be able to

1. Illustrate the concept of abstract machines and their power to recognize the languages.
2. Gain the knowledge of tools for different phases of compiler.
3. Demonstrate different parsing methods typically used in compilers.
4. Describe language translation techniques and their applications.
5. Analyze different storage allocation strategies.
6. Understand techniques to improve the efficiency of a compiler and generate code for target machine.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125BA **3 0 0 3**

ARTIFICIAL INTELLIGENCE

(Professional Elective – 1)

(Common to ECE, CSE, IT, ETE, CST & CSE (Data Science))

Prerequisites: Data Structures, Discrete Mathematics

Course Objectives:

1. To learn the difference between optimal reasoning vs human-like reasoning.
2. To understand the notions of state space representation, exhaustive search, heuristic search.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI like Game Playing and Expert Systems.
5. To introduce the concept of Machine Learning.

UNIT 1: (~ 10 Lecture Hours)

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI & Applications. Problem Solving - State-Space Search and Control Strategies, General Problem Solving Techniques, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.

UNIT 2: (~ 10 Lecture Hours)

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Algorithm, Predicate Logic, Logic Programming.

UNIT 3: (~ 10 Lecture Hours)

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.

UNIT 4: (~ 8 Lecture Hours)

Uncertainty Measure - Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory. Introduction to Machine Learning: Machine Learning Systems, Supervised and unsupervised learning.

UNIT 5: (~ 10 Lecture Hours)

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Rule based Expert Systems, Truth Maintenance Systems, Applications of Expert Systems, List of Shells and Tools.

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

Reference Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, 3rd Edition, 2009.
2. Eugene Charniak, Introduction to Artificial Intelligence, Pearson, 2007.
3. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 1990.
4. George Fluger, Artificial Intelligence, 5th Edition, Pearson.

Online Resources:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
2. http://nptel.ac.in/courses/106105077/
3. https://onlinecourses.nptel.ac.in/noc18_cs18/preview
4. https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basics of AI and to formulate efficient problem space and select a search algorithm for a problem.
2. Apply AI techniques to solve problems related to Game playing, Expert systems.
3. Understand and apply Logic programming in problem solving.
4. Represent knowledge using appropriate techniques.
5. Interpretation of probabilistic and logical reasoning in knowledge base.
6. Understand the concepts of machine learning.

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III Year B.Tech. CST I-Semester	**L**	**T**	**P**	**C**
Course Code: 125CJ	**3**	**0**	**0**	**3**

DISTRIBUTED SYSTEMS
(Professional Elective – 1)
(Common to CSE, IT & CST)

Prerequisites: Operating Systems, Database Management Systems.

Course Objectives:
1. To understand what is a distributed system and why it is used.
2. To understand IPC, Group Communication & RPC Concepts.
3. To understand the DFS and different Name Services.
4. To understand concepts like virtual time, agreement and consensus protocols.
5. To understand the concepts of replication and transaction in distributed environments and associated concepts, namely, concurrency control, deadlocks and error recovery.

UNIT 1: (~9 Lecture Hours)

Characterization of Distributed Systems- Introduction, Examples of Distributed systems, Trends in distributed Systems, Focus on resource sharing, Challenges, Case study: The World Wide Web.

System models- Introduction, Physical models, Architectural models, Fundamental models.

UNIT 2: (~9 Lecture Hours)

Inter Process Communication- Introduction, The API for the Internet Protocols, External data representation and Marshalling, Multicast communication.

Remote Invocation- Introduction, Request-reply protocols, Remote Procedure Call, Remote method invocation, Case study: Java RMI.

UNIT 3: (~8 Lecture Hours)

Distributed File Systems- Introduction, File Service architecture, Case study: SUN network file system.

Name Services- Introduction, Name Services and the Domain Name System, Directory Services, Case study: The Global Name Service.

UNIT 4: (~10 Lecture Hours)

Time and Global States- Introduction, Synchronizing physical clocks, Logical time and logical clocks, Global states.

Coordination and Agreement- Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems.

UNIT 5: (~10 Lecture Hours)

Distributed Transactions- Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

Replication- Introduction, System model and the role of group communication, Fault-tolerant services, Case study: The gossip architecture.

Text Books:

1. George Coulouris, J Dollimore, Tim Kindberg and G Blair, Distributed Systems, Concepts and Design, 5th Edition, Pearson Education, 2012.

Reference Books:

1. Andrew S.Tanenbaum, Maarten VanSteen, Distributed systems, Principles and Paradigms, 2nd Edition, PHI.
2. Sukumar Ghosh, Chapman & Hall/CRC, Taylor & Fransis Group, Distributed Systems, An Algorithm Approach, 2007.

Online Resources:

1. https://www.smartzworld.com/notes/distributed-systems-notes-pdf-ds
2. nptel.ac.in/courses/106106107
3. https://edutainmentzone.blogspot.com › Home › DS › Education
4. https://swayam.gov.in/course/3946-distributed-systems
5. https://www.coursera.org/courses?languages=en & query=distributed systems
6. https://onlinecourses.nptel.ac.in/noc17_cs42

Course Outcomes:

After completion of the course, students will be able to

1. Understand the concepts, challenges of distributed systems and various system models.
2. Analyze the establishment of Inter process communication and remote invocation between distributed systems.
3. Comprehend a distributed system with the features that support distributed file systems and name services.
4. Relate virtual time, agreement and consensus protocols in distributed systems.
5. Apply and analyze the knowledge of distributed transactions and replication.
6. Demonstrate the design, implementation and other issues of distributed systems.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125DG **3 0 0 3**

REAL-TIME SYSTEMS

(Professional Elective – 1)

Prerequisites: Computer Organization and Architecture, Operating Systems

Course Objectives:

1. To provide broad understanding of the requirements of Real Time Operating Systems.
2. To make the student understand, applications of these Real Time features using case studies.
3. To formally specify and verify of timing constraints and properties.
4. To understand scheduling policies, process concurrency and synchronization

UNIT 1: (~ 8 Lecture Hours)

Introduction, File I/O, Process control: Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT 2: (~ 10 Lecture Hours)

Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS.

Tasks: Defining a Task, Asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency.

Semaphores: Defining Semaphores, Operations and Use.

UNIT 3: (~ 9 Lecture Hours)

Message Queues: Defining Message Queue, States, Content, Storage, Operations and Use.

Kernel Objects, RTOS Services and I/O Subsystem: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem.

UNIT 4: (~ 10 Lecture Hours)

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT 5: (~ 8 Lecture Hours)

Case Studies of RTOS: RT Linux, MicroC/OS-II, Vx Works, Embedded Linux.

Text Books:

1. Qing Li, Real Time Concepts for Embedded Systems, Elsevier, 2011.
2. W. Richard Stevens and Stephen A. Rago, Advanced Programming in the Unix Environment, 3rd Edition, Addison- Wesley, 2013.

Reference Books:

1. Rajkamal, Embedded Systems- Architecture, Programming and Design, TMH, 2007.
2. Dr. Craig Hollabaugh, Embedded Linux: Hardware, Software and Interfacing, Addison- Wesley, 2002.

Online Resources:

1. http://www.nptelvideos.in/2012/11/real-time-systems.html
2. https://books.google.co.in/books?id=pWlbvW0H3IAC& printsec= frontcover&dq=EMBEDDED% 20SYSTEMS%20RAJ% 20KAMAL&hl=en&sa=X &redir_esc=y#v=onepage &q=EMBEDDED%2 0SYSTEMS%20RAJ%20KAMAL&f=true

Course Outcomes:

After completion of the course, students will be able to

1. Understand real-time concepts such as pre-emptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time and semaphores.
2. Describe how a real-time operating system kernel is implemented.
3. Understand how tasks are managed.
4. Discuss how tasks can communicate using semaphores, mailboxes, and queues.
5. Implement a real-time system on an embedded processor.
6. Gain knowledge to work with any real time operating system.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125BR **3 0 0 3**

ADVANCED COMPUTER ARCHITECTURE

(Professional Elective – 1)

(Common to CSE, IT & CST)

Prerequisites: Computer Organization and Architecture, Operating Systems

Course Objectives:

1. To impart the concepts and principles of parallel and advanced computer architectures.
2. To develop the design techniques of Scalable and multithreaded Architectures.
3. To Apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems.

UNIT 1: (~8 Lecture Hours)

Theory of Parallelism Parallel computer models: The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks.

Program and network properties: Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT 2: (~10 Lecture Hours)

Principles of Scalable performance: Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, **Hardware Technologies: Processes and Memory Hierarchy:** Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

UNIT 3: (~9 Lecture Hours)

Bus Cache and Shared memory: Backplane bus systems, Cache Memory organizations, Shared Memory Organizations, Sequential and weak consistency models.

Pipelining and super scalar techniques: Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar superpipeline design.

UNIT 4: (~10 Lecture Hours)

Parallel and Scalable Architectures: Multiprocessors and Multicomputers: Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputer, Message-passing Mechanisms.

Multivector and SIMD computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

UNIT 5: (~8 Lecture Hours)

Scalable, Multithreaded and Data Flow Architectures: Latency-hiding techniques, Principles of Multithreading, Fine-Grain multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures.

Text Books:

1. Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

Reference Books:

1. Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER.
2. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. David E. Culler and Jaswinder Pal singh with Anoop Gupta, Parallel Computer Architecture, A Hardware / Software Approach, Elsevier.

Online Resources:

1. http://acs.pub.ro/~cpop/SMPA/Computer%20Architecture%20A%20Quantitative%20Approach%20(5th%20edition).pdfhttp://courses.cs.tamu.edu/ejkim/614/
2. https://www.cs.ucf.edu/~dcm/Teaching/CDA5106-Fall2015/Slides/
3. https://onlinecourses.nptel.ac.in/noc23_cs07/preview
4. www.coursera.org

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basic principles of computer design.
2. Identify the various computational models and computer architectures.
3. Gain knowledge on concepts of parallel computer models.
4. Predict the challenges of realizing different kinds of parallelism and leverage them for performance advancement
5. Apply the concept of memory hierarchy for efficient memory design.
6. Analyze the Scalable Architectures, Pipelining, Superscalar processors, multiprocessors.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125CE **3 0 0 3**

DATA MINING

(Professional Elective – 2)

(Common to CSE & CST)

Prerequisites: Probability and Statistics, Database Management Systems.

Course Objectives:

1. Learn data mining concepts and understand association rules mining.
2. Discuss classification algorithms learn how data is grouped using clustering techniques.
3. To develop the abilities of critical analysis to data mining systems and applications.
4. To implement practical and theoretical understanding of the technologies for data mining.
5. To understand the strengths and limitations of various data mining models.

UNIT 1: (~9 Lecture Hours)

Introduction to Data Mining: What is Data Mining, Definition, KDD, Data Mining Architecture, Challenges, Data Mining Functionalities, Data Mining Task Primitives, and Major Issues in Data Mining?

Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction: Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Measures of Similarity and Dissimilarity – Basics, Similarities and dissimilarities between Simple Attributes and Data Objects.

UNIT 2: (~9 Lecture Hours)

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Algorithm, Support and Confidence Measures, Association Rule Generation, FP- Growth Algorithm, Mining various kinds of Association rules, Compact Representation of Frequent Item sets: Maximal Frequent Item Sets, Closed Frequent Item Sets.

UNIT 3: (~9 Lecture Hours)

Classification and Prediction: Problem Definition, General Approaches to solving a classification problem, Evaluation of classifiers, Classification Techniques, Decision Tree Induction, Naive Bayes Classifier, Bayesian Belief Networks, K–Nearest neighbor classification– Algorithm and Characteristics, Prediction: Linear, Logistic Regressions.

UNIT 4: (~9 Lecture Hours)

Clustering: Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Clustering - K-Means Algorithm, K- Means Additional issues, PAM Algorithm, Hierarchical Clustering : Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Specific techniques: MIN, MAX, Group Average, Ward's method and Centroid methods Key Issues in Hierarchical clustering, Strengths and Weakness, Outlier Detection.

UNIT 5: (~9 Lecture Hours)

Mining Time Series and Sequence Data: Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases.

Mining Multimedia, Text and Web Data: Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Text Books:

1. Jiawei Han and Michelinen Kamber, Data Mining-Concepts and Techniques, 2012, 3rd Edition, Morgan Kaufmann Publishers, Elsevier.
2. Pang-Ning Tan, Vipin Kumar and Michael Steinbanch, Introduction to Data Mining, Pearson Education.

Reference Books:

1. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press.
2. Pualraj Ponnaiah, Data Warehouse Fundamentals by Wiley- Interscience Publication.
3. VikaramPudi and P Radha Krishna, Data Mining by Oxford University Press.

Online Resources:

1. https://www.kdnuggets.com/websites/index.html
2. https://www.ngdata.com/data-mining-resources.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts and tasks of data mining.
2. Perform the pre-processing of data.
3. Formulate the association rules using different algorithms.
4. Evaluate various classifiers.
5. Analyze different clustering techniques.
6. Understand the mining of temporal and multimedia data.

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III Year B.Tech. CST I-Semester **L T P C**
Course Code: 125CC **3 0 0 3**

COMPUTER GRAPHICS

(Professional Elective – 2)

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. To understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. To analyze various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. To apply the concepts of clipping, shading to view data with pictorial representation.
4. Explore projections, visible surface detection techniques for display of 2D and 3D scene.
5. Apply Rendering on projected objects in 2D, use of illumination models, geometric transformations and animation techniques.

UNIT 1: (~12 Lecture Hours)

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices.

Output primitives: Points and lines, line drawing algorithms, mid-point circle. Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood-fill algorithms.

UNIT 2: (~10 Lecture Hours)

2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

2-D 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.

UNIT 3: (~10 Lecture Hours)

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.

3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT 4: (~8 Lecture Hours)

3-D Object representation: Polygon surfaces, quadric surfaces, Basic illumination models, polygon rendering methods: Constant Intensity shading, Gouraud Shading, Phong shading, Fast phong shading. **Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

UNIT 5: (~5 Lecture Hours)

Computer Animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Text Books:

1. Donald Hearn and M. Pauline Baker, Computer Graphics C version, 2nd Edition, Pearson Education.
2. VanDam, Feiner and Hughes, Computer Graphics Principles & practice, Foley, 2nd Edition, Pearson Education.

Reference Books:

1. Zhigand xiang, Roy Plastock and Schaum's outlines, Computer Graphics, 2nd Edition, Tata Mc- Graw hill.
2. David F Rogers, Procedural elements for Computer Graphics, 2nd Edition, Tata Mc Graw hill.
3. Neuman and Sproul, Principles of Interactive Computer Graphics, TMH.
4. Shalini Govil and Pai, Principles of Computer Graphics, Springer, 2005.

Online Resources:

1. http://www.svecw.edu.in/Docs%5CCSECGLNotes2013.pdf
2. http://www.jimssouthdelhi.com/studymaterial/BCA5/BCA-503.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Learn the basics of computer graphics and graphics display devices.
2. Understand different types of graphics drawing algorithms and two dimensional transformations.
3. Familiarize the techniques of clipping, three dimensional graphics and three dimensional transformations.
4. Design, develop and test various techniques which includes modelling, rendering and shading.
5. Apply the basic techniques of animation.
6. Work in computer aided design for content presentation.

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III Year B.Tech. CST I-Semester **L T P C**
Course Code: 125CY **3 0 0 3**

MICROPROCESSORS AND MICROCONTROLLERS

(Professional Elective – 2)

(Common to EEE, ECE, ETE & CST)

Prerequisites: Digital System Design.

Course Objectives:

1. Describe the architecture of Microprocessor and Microcontrollers.
2. Understand and apply the fundamentals of assembly language and C programming of Microprocessors and Microcontrollers.
3. Experimenting with memory and I/O interfacing of Microcontroller.
4. Study the basic concepts of ARM Cortex-M3 architecture.

UNIT 1: (~ 10 Lecture Hours)

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

UNIT 2: (~ 8 Lecture Hours)

Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros, and simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT 3: (~ 8 Lecture Hours)

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes, and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication, Interrupts, Programming 8051 Timers, and Counters.

UNIT 4: (~ 10 Lecture Hours)

I/O and Memory Interface: LCD, Keyboard, ADC, DAC Interface, External Memory RAM, ROM Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces- RS232, USB.

UNIT 5: (~ 10 Lecture Hours)

ARM Cortex-M3 processor: Introduction, Applications, The Cortex-M3 Processor System Block Diagram, Programming model – Registers, Special Registers, Operation modes, Instruction set, Exceptions and Interrupts, Vector

Tables, Reset Sequence, Unified Assembler Language, Memory Maps, Pipeline.

Text Books:

1. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals", TMH, 2nd Edition, 2006.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller ad Embedded. Systems Using Assembly and C". Pearson, 2nd Edition, 2008.
3. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd Edition, 2011.

Reference Books:

1. D.V. Hall, Microprocessors and Interfacing, 2nd Edition, TMGH, 2006.
2. K.Uma Rao, Andhe Pallavi, The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.
3. Kenneth. J. Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning, 2006.
4. Shibu K.V, Introduction to Embedded Systems, Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
5. Dr. K.V.K.K. Prasad, -Embedded / Real-Time Systems: Concepts, Design & Programming, Dreamtech publishers, 1st Edition, 2003.
6. Mazidi M., "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson, 200.

Online Resources:

1. https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-mpmc
2. NPTEL Material on Microprocessors by Dr. Pramod Agarwal, IIT Roorkee http://nptel.ac.in/courses/108107029/

Course Outcomes:

After completion of the course, students will be able to

1. Familiarize with the internal architecture and organization of 8086/8051/ARM Cortex-M3.
2. Write assembly language programs using 8086/8051.
3. Design and develop micro controller based systems using 8051 interfacing
4. Apply the knowledge of 8051 micro controller in real time applications.
5. Relate the memory organization and memory interface to 8086/8051/ARM Cortex-M3.
6. Discuss various serial communication interface standards.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 125BT **3 0 0 3**

ADVANCED OPERATING SYSTEMS

(Professional Elective – 2)

Prerequisites: Operating Systems, Computer Organization.

Course Objectives:

1. To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems)
2. Hardware and software features that support these systems.

UNIT 1: (~ 9 Lecture Hours)

Architectures of Distributed Systems: System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

UNIT 2: (~ 9 Lecture Hours)

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, Non-Token – Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heurisric Algorithm, Raymond's Heuristic Algorithm.

UNIT 3: (~ 9 Lecture Hours)

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms.

UNIT 4: (~ 9 Lecture Hours)

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling.

Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues.

UNIT 5: (~ 9 Lecture Hours)

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration.

Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues.

Text Books:

1. M Singhal and NG Sivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc., 2001.

Reference Books:

1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

Online Resources:

1. https://www.udacity.com/course/advanced-operating-systems—ud189
2. https://nptel.ac.in/courses/106106168
3. https://alexnguyen.github.io/vinhtngu/CSCourses/Spring2020/CS5352/Distributed_Systems_3- 200225.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the design approaches of advanced operating systems.
2. Analyze the design issues of distributed operating systems.
3. Examine the issues of mutual exclusion and deadlock detection.
4. Evaluate design issues of multi-processor operating systems.
5. Identify the requirements Distributed File System and Distributed Shared Memory.
6. Formulate the solutions to schedule the real time applications.

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III Year B.Tech. IT I-Semester **L T P C**

Course Code: 12533 **0 0 3 1.5**

FULL STACK DEVELOPMENT LAB

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Object Oriented Programming through JAVA

Course Objectives:

1. To gain the knowledge of various Front-End technologies.
2. To Design Front-End of the full stack applications.
3. To understand and develop Back-End applications to connect to databases.
4. To work with different case studies by using frameworks.

List of Experiments:

Week 1:

a) Create a Web Page using HTML which contains a Heading, Image and 2 hyperlinks. Each hyperlink opens a new page in the same web browser. New page contains "Go Back" link that takes you to the main page.

b) Write a HTML program to create a Registration form, which contains User Name, Password, Date of Birth, Gender, Mail-id, Contact number, Address and submit button.

Week 2:

a) Create a web page to demonstrate Position Property in CSS.

b) Create a Newspaper Style Design to print minimum 2 articles using HTML and CSS.

Week 3:

a) Write a JavaScript program to change the background color after clicking "change color" button.

b) Write a JavaScript program to validate registration page using regular expression.

Week 4:

a) Write a code to hide and show an element in a periodic interval without any action from the user using JQuery.

b) Write a program to create and Build a star rating system using JQuery.

Week 5:

a) Write a program to demonstrate ReactJS Class and Instance.

b) Write a program to create a basic calculator to perform arithmetic operations using ReactJS.

Week 6:

a) Demonstrate simple event handling examples using ReactJS.

b) Write a program to create a simple voting application system using ReactJS.

Week 7:

a) Create a webpage to display “Hello World” using SERVLET.

b) Implement a web application using SERVLET, which takes a name as input and on submitting it, shows a hello <name> page. It shows start time at the right top comer of the page and provides a logout button. On clicking logout button, it should show a logout page with Thank You <name> message with the duration of usage (hint: Use session to store name and time).

Week 8:

a) Write a JSP program to find a factorial of the given number.

b) Create a user validation web application using JSP, where the user submits the login name and password to the server. The name and password are checked against the data already available in database and if the data matches, a successful login page is returned. Otherwise show a failure message to the user.

Week 9:

a) Demonstrate a simple example of Spring web MVC framework.

b) Illustrate how the database is connected in Spring Framework by using a simple CRUD application.

Week 10:

a) Create a simple example of a hibernate application using eclipse IDE.

b) Create an application to demonstrate Hibernate Query Language.

Week 11 and 12:

CASE STUDY-1: Create a Chat module/Interface using HTML CSS and JavaScript. The chat interface primarily consists of two segments: the message header and the chat box.

Message-Header- The message header resides at the top of the chat box. It includes the user’s name, avatar or profile image, and the user’s last seen. Last seen is the last time the user was active.

The Chat-Box- The chat box consists of the message page and the message bottom sections.

- Message page-The message page consists of incoming and outgoing messages, as well as the avatars of the senders. It also displays the time at which each message is sent.

- The Message-Bottom-This section contains an input field where the user can type in the messages and a send button to send them.

Week 13 and 14:

CASE STUDY-2: Create an online learning platform that uses React JS for its frontend development. Reacts modular architecture allows it to build reusable UI components for course listings, interactive quizzes, and user dashboards. MySQL serves as the database system for storing user profiles, course data, and learning progress. On the backend, the Spring Framework, specifically Spring MVC architecture, to handle server-side logic, user authentication, and course enrollment management.

Text Book:

1. Mayur Ramgir, FullStack Development with Spring MVC, Hibernate, jquery and BootStrap, Wiley Publications,2020.
2. Uttam K. Roy, Web Technologies, OXFORD University press, 2010.
3. Vasan Subramanian, Pro MERN Stack, APress, second Edition, 2019.

Reference Book:

1. Matt Frisbie, Professional JavaScript for Web Developers, WILEY Publications, 2020.
2. Terry Ann Felke-Morris, Basics of Web Design, Pearson, Fifth Edition.
3. Alex Banks and Eve Porcello, Learning React, O'Reilly, 2017.

Online Resources:

1. https://docs.oracle.com/javaee/6/tutorial/doc/bnayk.html
2. https://www.w3schools.com/html/default.asp
3. https://www.w3schools.com/css/default.asp
4. https://www.w3schools.com/REACT/DEFAULT.ASP

Course Outcomes:

After completion of the course, students will be able to

1. Design Front-End of the Full Stack Applications by using HTML and CSS.
2. Create dynamic web pages with the help of JavaScript and JQuery.
3. Develop interactive User Interfaces with React JS.
4. Implement Back-End programs using Servlets and JSP.
5. Connect databases with server-side applications.
6. Implement the case studies with Spring framework and hibernate.

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III Year B.Tech. CST I-Semester **L T P C**

Course Code: 12531 **0 0 3 1.5**

COMPUTER NETWORKS LAB

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Understand the functionalities of various layers of OSI model.
2. Analyze flow control mechanisms for the data link layer.
3. Implement various routing algorithms to compute the shortest distance.
4. Understand the network simulator environment.

List of Experiments:

Week 1:

Implement the data link layer framing methods such as character count and bit stuffing.

Week 2:

Implement the data link layer framing methods such as character stuffing.

Week 3:

Write a program to compute CRC code for the polynomial CRC-12.

Week 4:

Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.

Week 5:

Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using Selective Repeat mechanism.

Week 6:

Implement Dijsktra's algorithm to compute the shortest path through a network.

Week 7:

Implement distance vector routing algorithm for obtaining routing tables at each node.

Week 8:

Implementation of Networking commands like ping, ipconfig, traceroute, TELNET, nslookup, ARP, RARP etc.

Week 9:

Implement Linux Network Configuration Commands.

a. Configuring NIC's IP address.
b. Determining IP address and MAC address using if-config command.
c. Changing IP address using if-config command.

Week 10:

Write a program for congestion control using Leaky bucket algorithm.

Week 11:

Install Wireshark and perform the following using Wireshark.

a. Packet Capture Using Wire shark.
b. Starting Wire shark.
c. Viewing Captured Traffic.
d. Analysis and Statistics & Filters.

Week 12:

a. How to run Nmap scan.
b. Operating System Detection using Nmap.

Week 13:

Do the following using NS2 Simulator:

a. NS2 Simulator-Introduction.
b. Simulate to find the Number of Packets Dropped.
c. Simulate to find the Number of Packets Dropped by TCP/UDP.

Week 14:

a. Simulate to Find the Number of Packets Dropped due to Congestion.
b. Simulate to Compare Data Rate & Throughput.
c. Simulate to Plot Congestion for Different Source/Destination.
d. Simulate to Determine the Performance with respect to Transmission of Packets.

Text Book:

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

Reference Book:

1. Behrouz A.Forouzan, Data Communications and Networking, 5th Edition, TMH, 2013.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs23/preview
2. https://www.varonis.com/blog/how-to-use-wireshark/
3. https://tools.kali.org/information-gathering/nmap
4. http://intronetworks.cs.luc.edu/current/html/ns2.html

Course Outcomes:

After completion of the course, students will be able to

1. Implement data link layer functions such as framing methods.
2. Demonstrate error detection at the data link layer.
3. Apply an appropriate algorithm for finding the shortest route in a network.
4. Execute Network Configuration Commands.
5. Implement the congestion control mechanisms.
6. Evaluate the network performance by using different network tools

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III Year B.Tech. CST I-Semester **L T P C**
Course Code: 12528 **0 0 2 1**

ADVANCED COMMUNICATION SKILLS LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

1. To address various challenges of communication as well as personality traits faced by individuals at workplace and organizations through case studies and interactions.
2. To help the students engage with each other's confidently through various discussions and presentations.
3. To help the students write business documents and generate content effectively.
4. To enhance soft skills among the students and to enable them to understand its impact on employability.
5. To equip the students with career planning and employability.

1. Fundamentals of Interpersonal Communication Skills (ICS):

Definition of ICS – Types of ICS: Verbal, Written and Non-verbal - Forms of ICS: Face-to- face conversation: Phone calls, E-mails and Video conference – Stages of ICS: Acquaintance, Build-up, continuation, bringing to a close, ending – Principles of ICS – a sender, a receiver, medium, encoding, decoding and feedback – Strategies for effective ICS – Objectives of ICS - Barriers to ICS.

Activities:

- Role plays on Conflict management, Negotiation, Problem solving, Assertiveness
- Conducting a meeting
- E-mail etiquette and netiquette
- Scenario based Role-plays
- Case study based Role-plays

2. Reading Comprehension Skills (RCS):

Importance of RCS: Understanding grammar, vocabulary and semantics – Benefits of RCS – strategies to improve RCS: Skimming, Scanning, Visualization, Summarizing, Questioning, predicting – Essential skills for RCS: Decoding, Fluency, Vocabulary, Coherence – Schema in reading through – stories, poetry and dramas.

Activities:

- Paraphrasing the Reading passage.
- Critical Analysis of the Reading passage.
- Vocabulary and Grammar Quizzes/Exercises.

3. Writing Skills (WS):

Importance of WS : The message with clarity and ease to larger audience – Basic elements of writing : Spelling, Capitalization, Punctuation, Sentence structure, handwriting – Essential steps of writing : Planning, Drafting, Sharing, Evaluating, Revising, Editing and Publishing – Types of writing : Essays-Expository, Descriptive, Persuasive and Narrative; Journal Writing, reflective Writing – Structure of writing : Process writing : Paragraph writing, Essay writing; Product writing: Report writing, Resume writing and SOP writing.

Activities:

- Drafting a Report.
- Building a Resume.
- Writing Statement of Purpose (SOP)

4. Presentation Skills (PS):

Definition of PS – Types of presentation: Informative, Instructional and persuasive – Stages of oral presentation: Identifying purpose, planning, preparation, presenting, concluding and handling Q & A's – Guidelines for Power Point presentation:

Content on each slide, font sizes, visual images, number of slides, tools used for PPT.

Activities:

- Poster Presentation.
- Pecha Kucha Presentation.
- Field Research Project Presentation.
- Project elevator pitch

5. Personal Branding and Self Development (PB&SD):

Definition of Personal Branding – Importance of PB – Self assessment based on purpose, values, authenticity, strengths achievements and credentials – ways to create personal branding – Understanding the importance of soft skills for self-development and professional development: Communication, being engaged, ability to participate fully, to think critically, to demonstrate leadership, to develop team building.

Activities:

- Self-Introduction. (personal elevator pitch)
- Mock Interviews.
- Group Discussions.

Reference Books:

1. T.M. Farhathullah, Communication Skills for Technical Students, Orient BlackSwan Pvt. Ltd., (2002).
2. Sangeetha Sharma and Binod Mishra, Communication Skills for Engineers and Scientists, PH1 Learning Pvt.Ltd., (2011).
3. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford Higher Education, 2nd Education (2015).

Online Resources:

1. https://onlinecourses.swayam2.ac.in/ntr23_ed43/preview
2. https://onlinecourses.swayam2.ac.in/nou23_cm21/preview
3. https://onlinecourses.nptel.ac.in/noc23_hs146/preview
4. https://onlinecourses.nptel.ac.in/noc23_hs115/preview

Course Outcomes:

After the completion of the course, the students will be able to

1. Apply basic communication skills (LSRW) in work-related situations.
2. Acquire, organize, interpret and evaluate information for effective communications within a group.
3. Demonstrate the ability to combine ideas or information in new ways and present information on guided and structured format.
4. Make decisions and solve problems by specifying goals, identifying resources and constraints and evaluating results.
5. Display personal qualities such as responsibility, self-management, self-confidence, ethical behaviour and respect for self and others.
6. Learn to work cooperatively with people of diverse backgrounds and abilities, identify group's goals and values and contribute to a group process with ideas, suggestions and efforts.

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III Year B.Tech. CST II-Semester **L T P C**

Course Code: 126EG **3 0 0 3**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Provide the basic concepts of Managerial economics.
2. Interlink the concepts of Managerial economics for effective business decision making.
3. Provide Fundamental knowledge in accounting and interpretation of the statements.

UNIT 1: (~10 Lecture Hours)

Managerial Economics and Demand Analysis:

Managerial Economics: Introduction to Economics - Definition of Managerial Economics - Nature and Scope of Managerial Economics - Multidisciplinary Nature of Managerial Economics.

Demand Analysis: Introduction to Demand - Determinants of demand - Law of demand, and its Exceptions - Types & Nature of demand - Movement and Shift of demand curve.

Elasticity of demand: Concept of Elasticity of demand - Types of Elasticity-Price, Income, Cross and Advertising.

Demand Forecasting: Need for Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting (Survey methods and Statistical methods.)

UNIT 2: (~8 Lecture Hours)

Production and Cost Analysis:

Production Analysis: Factors of Production - Production Function - Production function with one variable input - two variable inputs using Isoquant and Isocosts - Optimal combination of Resources using Isoquants and Isocosts - Laws of returns.

Cost Analysis: Cost classification - Cost concepts relevant for Managerial decision making – Cost relationship – Determinants of cost.

UNIT 3: (~10 Lecture Hours)

Break Even Analysis, Market Structures and Pricing:

Break Even Analysis: Need - Scope and Significance – Assumptions - Advantages and Limitations - Practical Applications (with simple problems).

Market Structures: Classification of Markets - Features of Perfect Competition – Monopoly- Monopolistic - Oligopoly and Duopoly.

Pricing: Pricing Objectives - Methods of Pricing and Pricing strategies.

UNIT 4: (~10 Lecture Hours)

Introduction to Financial Accounting:

Financial Accounting: Introduction to Accounting - Double Entry Book-Keeping - Accounting Concepts and Conventions - Accounting Terminology. Journal - Ledger - Trial Balance - Final Accounts with Adjustments (Simple Problems).

UNIT 5: (~10 Lecture Hours)

Financial Analysis and Interpretation:

Ratio Analysis: Need and importance - significance of Ratio Analysis - Liquidity Ratios - Profitability Ratios - Activity Ratios - Solvency Ratios - Interpretation of Ratios for decision making (Simple Problems).

Text Books:

1. P L Mehta (2016) Managerial Economics- Analysis, Problems & Cases, 21st Edition, Sultan Chand & Sons.
2. T.S.Grewal (2006) Double Entry Bookkeeping, Sultan Chand & Sons.

Reference Books:

1. D.N.Dwivedi (2016), Managerial Economics, 8th Edition, Vikas Publishing House Pvt. Ltd.
2. S.N. Maheshwari, Suneel K Maheshwari and Sharad K. Maheshwari (2018), Financial Accounting, 6th Edition, Vikas Publishing House Pvt. Ltd.
3. I.M.Pandey (2021), Financial Management, 12th Edition, Pearson.
4. R.L.Varshney and K.L Maheshwari (2004) Managerial Economics, 22nd Revised Edition, Sultan Chand & Sons.

Online Resources:

1. Managerial Economics https://onlinecourses.nptel.ac.in/noc20_mg67/preview
2. Financial Accounting http://nptel.ac.in/courses/110107073/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the Basic Concepts of Managerial Economics.
2. Demonstrate the significance of demand, its analysis and forecasting for decision making.
3. Apply the theory of production function and Cost concepts for problem solving and decision making.
4. Analyze different market structures & pricing strategies for business decision making.
5. Evaluate the concepts of Accounting for Business decision making.
6. Interpret the Financial Statements for management decision making.

III Year B.Tech. CST II-Semester **L T P C**

Course Code: 126EC **3 1 0 4**

INFORMATION SECURITY

Prerequisites: Computer Networks.

Course Objectives:

1. Understand the basic concepts of Information Security.
2. Protect the data over insecure channel by various means.
3. Discover the most prevalent algorithms used to provide authenticity, integrity, and confidentiality.
4. Understand the issues involved in key distribution and management schemes.
5. Present an overview of IP Security, Network Security and Email Security.
6. Understand the Security Standards of Web.

UNIT 1: (~ 9 Lecture Hours)

Computer and Network Security Concepts: Computer Security Concepts, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Models, Substitution and Transposition Techniques, Steganography.

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, Block cipher design principles, DES, Strength of DES.

UNIT 2: (~ 9 Lecture Hours)

Advanced Encryption Standard: AES structure, AES Transformation Functions, AES Key expansion. **Computer-based Symmetric Key Cryptographic Algorithms:** International Data Encryption Algorithm (IDEA), RC4, Blowfish.

Block Cipher Operations: Multiple Encryption and Triple DES, Electronic Code book mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode and Counter Mode.

Asymmetric Ciphers: Principles of Public key Cryptosystems, RSA Algorithm, Diffie-Hellman Key exchange, Elgamal Cryptographic System.

UNIT 3: (~ 9 Lecture Hours)

Cryptographic Data Integrity Algorithms:

Cryptographic Hash functions: Applications of Cryptographic Hash functions, Two simple Hash functions, Requirements and Security, SHA.

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, HMAC, CMAC.

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Digital Signature Algorithm.

UNIT 4: (~ 9 Lecture Hours)

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Kerberos.

Transport-Level Security: Web Security Considerations, Transport Layer Security, HTTPs.

UNIT 5: (~ 9 Lecture Hours)

Electronic Mail Security: Internet Mail Architecture, Pretty Good Privacy: Notion, Operational Description, Transmission and Reception of Messages, S/MIME.

Network Security, Firewalls and Virtual Private Network (VPN): Firewalls, IP Security, Virtual Private Networks(VPNs), Intrusion.

Case Studies on Cryptography: Denial of Service Attacks, Virtual Elections, Single Sign On.

Text Books:

1. William Stallings, 7th Edition, Cryptography and Network Security.
2. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill.

Reference Books:

1. William Stallings, Network Security Essentials (Applications and Standards), 4th Edition, Pearson Education.
2. C K Shyamala, N Harini and Dr T Padmanabhan, Cryptography and Network Security, 1st Edition, Wiley India.
3. Bernard Menezes, Network Security and Cryptography, CENGAGE Learning.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs03/course
2. https://www.coursera.org/browse/computer-science/computer-security-and-networks?languages=en
3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08t==
4. https://www .edx.or g/course/network-security- 2?index=product&query ID= 71cd7a02f725bb5dc7103bc35b8eae60 &position=4&linked_from =auto complete&c=autocomplete
5. https://www.udemy.com/course/learn-cryptography-basics-in-python/

Course Outcomes:

After completion of the course, students will be able to

1. Identify threats to network security and suggest appropriate measures.
2. Apply and analyse various cryptographic algorithms.
3. Introduce the working of MAC, Hash functions and Digital Signatures.
4. Illustrate IPSec and email security solutions.
5. Understand the solutions developed for web and network security.
6. Analyse Network vulnerabilities using different case studies.

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III Year B.Tech. CST II-Semester	**L T P C**
Course Code: 126ED	**3 0 0 3**

INTERNET OF THINGS

Prerequisites: Programming for Problem Solving, Digital Logic Design and Computer Networks.

Course Objectives:

1. To introduce the terminology, technology and its applications.
2. To introduce the concept of M2M (machine to machine) with necessary protocols.
3. To introduce the Python Scripting Language which is used in many IoT devices.
4. To introduce the Raspberry Pi platform, that is widely used in IoT applications.
5. To introduce the implementation of web based services on IoT devices.

UNIT 1: (~ 9 Lecture Hours)

Introduction to Internet of Things-Definition and Characteristics of IoT, Physical Design of IoT-IoT Protocols, IoT Communication Models, IoT Communication APIs. IoT enabled Technologies- Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs-Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT 2: (~ 9 Lecture Hours)

IoT and M2M-Software Defined Networks, Network Function Virtualization, Difference between SDN and NFV for IoT Basics of IoT System Management with NETCONF, YANG-NETCONF, YANG, and SNMP NETOPEER.

UNIT 3: (~ 9 Lecture Hours)

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, Modules, packaging, File Handling, Date/Time Operations, Classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT 4: (~ 9 Lecture Hours)

IoT Physical Devices and Endpoints-Introduction to Raspberry Pi- Interfaces (serial, SPI, I2C) Programming-Python program with Raspberry Pi with focus of interfacing external gadgets, Controlling Output and Reading input from pins.

UNIT 5: (~ 9 Lecture Hours)

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson and Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Reference Books:

1. David, Hanes and Salgueiro Gonzalo, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Pearson 2017.
2. Dirk Slama and Frank Puhlmann, Enterprise IoT: Strategies and Best Practices for Connected Products and Servicesby 2015.

Online Resources:

1. https://www.tutorialspoint.com
2. https://www.edureka.co
3. https://www.onlinecourses.nptel.ac.in

Course Outcomes:

After completion of the course, students will be able to

1. Understand the IoT Systems.
2. Apply the concept of M2M (machine to machine) with necessary protocols.
3. Create programs using python scripting language in IoT devices.
4. Build programs for Raspberry Pi interfaces.
5. Choose to communicate with IoT Systems through web-interface.
6. Apply IoT principles for domain specific applications.

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III Year B.Tech. CST II-Semester **L T P C**

Course Code: 126CA **3 0 0 3**

CLOUD COMPUTING

(Professional Elective – 3)

(Common to ETE & CST)

Prerequisites: Operating Systems and Computer Networks.

Course Objectives:

1. To explain evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects of cloud.

UNIT 1: (~ 9 Lecture Hours)

Introduction- Cloud computing at a glance, Historical developments, Building cloud computing environments.

Cloud Computing Architecture - The cloud reference model, Types of clouds, Economics of the cloud, Open challenges.

UNIT 2: (~ 8 Lecture Hours)

Virtualization - Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples- Xen, VMware, Microsoft Hyper-V. Migrating into a Cloud, Virtual Machines Provisioning and Migration Services.

UNIT 3: (~ 10 Lecture Hours)

Cloud Platforms in Industry: Amazon web services, Google App Engine, Microsoft Azure, Aneka- Integration of private and public cloud.

Cloud Programming and Software Environments: Programming Support for Google App Engine: Programming the Google App Engine, Google File System(GFS), BigTable, Google's NOSQL System, Chubby, Google's Distributed Lock Service, Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service(S3), Amazon Elastic Block Store(EBS) and SimpleDB, Microsoft Azure Programming Support.

UNIT 4: (~ 9 Lecture Hours)

Security in the Cloud- Cloud Security Challenges, Software-as-a-Service Security.

Secure Distributed Data Storage in Cloud Computing - Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing.

Data Security in the Cloud- The Current State of Data Security in the Cloud, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security-Pros and Cons.

UNIT 5: (~ 9 Lecture Hours)

SLA Management - Traditional Approaches to SLO Management, Types of

SLA, Life Cycle of SLA, SLAManagement in Cloud, Automated Policy-based Management.

Advanced Topics in Cloud Computing – Energy Efficiency in Clouds: Energy-Efficient and Green Cloud Computing Architecture, Market Based Management of Clouds: Market-Oriented Cloud Computing, A Reference Model for MOCC, Technologies and initiatives Supporting MOCC, Federated Clouds/InterCloud: Characteristics and Definition, Cloud Federation Stack.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S.Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill Education, 2013.
2. Rajkumar Buyya, James Broberg and Andrzej, Cloud Computing: Principles and paradigms Wiley, 2011.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security by CRC, 2010.

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, Jack J Dongarra and Elsevier, Distributed and cloud computing, 2012.
2. A. Kannammal, Fundamentals of Cloud Computing, CL India, 2015.
3. Tim Mather, Subra Kumaraswamy and Shahed Latif, Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance. By Publisher: O'Reilly Media 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs42
2. https://aws.amazon.com/
3. https://azure.microsoft.com/en-in
4. https://cloud.google.com/

Course Outcomes:

After completion of the course, students will be able to

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and Illustrate the broad perceptive of cloud architecture and model.
2. Apply and design suitable Virtualization concept.
3. Explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and design other web cloud applications.
4. Assess Cloud storage systems and Cloud security, the risks involved, its impact and develop cloud application.
5. Devise performance negotiations between cloud service providers and consumers through SLAs.
6. Interpret enterprise level requirements by learning Energy efficient, Market ready, Federated cloud systems.

III Year B.Tech. CST II-Semester **L T P C**

Course Code: 126EP **3 0 0 3**

SOFTWARE PROJECT MANAGEMENT

(Professional Elective – 3)

Prerequisites: Software Engineering, Software Testing Methodologies.

Course Objectives:

1. Create a Software System with a predetermined functionality and quality in a given time frame and with given costs.
2. Focusing on principles, techniques, methods applicable for various software projects.
3. To analyze different types of tools for Model Based Management of Software Projects.

UNIT 1: (~ 9 Lecture Hours)

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

UNIT 2: (~ 10 Lecture Hours)

The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process.

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT 3: (~ 9 Lecture Hours)

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments.

UNIT 4: (~ 10 Lecture Hours)

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. Project **Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building Blocks, The Project Environment.

UNIT 5: (~ 10 Lecture Hours)

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation.

Tailoring the Process: Process discriminants, Example.

Future Software Project Management: Modern Project Profiles Next Generation Software economics, modern Process transitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)

Text Books:

1. Walker Royce, Software Project Management, Pearson Education, 1998.
2. Bob Hughes and Mike Cotterell, Software Project Management, 4th Edition, Tata Mc-Graw Hill, 2006.

Reference Books:

1. Andrew Stellman & Jennifer Greene, Applied Software Project Management, O'Reilly, 2006.
2. Jennifer Greene & Andrew Stellman, Head First PMP, O'Reilly, 2007.
3. Richard H. Thayer & Edward Yourdon, Software Engineering Project Managent, 2nd Edition, Wiley India, 2004.
4. Jim Highsmith, Agile Project Management, Pearson education, 2004.
5. Scott Berkun, The art of Project management, O'Reilly, 2005.
6. Pankaj Jalote, Software Project Management in Practice, Pearson Education, 2002.

Online Resources:

1. https://www.projectmanager.com/resources
2. https:// www. pcmag.com/ roundup/ 260751 / the- best- project-management-software
3. http://www.onlinecourses.nptel.in
4. http://www.coursera.org/

Course Outcomes:

After completion of the course, students will be able to

1. Differentiate Conventional Software Management with respect to Modern Practices.
2. Determine the various lifecycles of a Software Project.
3. Understand the specific roles with in a Software Organization as related to Project and Process Management.
4. Analyse the basic infrastructure competences like Process Modeling and Measurement.
5. Remember the basic steps of Project Planning and Project Management.
6. Assess the Quality Assurance, Process Management and their relationships along with the Case Study.

III Year B.Tech. CST II-Semester **L T P C**
Course Code: 126CX **3 0 0 3**

MACHINE LEARNING
(Professional Elective – 3)

Prerequisites: Probability and Statistics

Course Objectives:

1. To be able to identify machine learning problems corresponding to different applications.
2. To understand various machine learning algorithms along with their strengths and weaknesses.
3. To understand the basic theory underlying machine learning.
4. To introduce Decision Tree learning, Instance Based Learning techniques.

UNIT 1: (~10 Lecture Hours)

Introduction: Well posed learning problems, designing a learning system Perspectives and issues in machine learning, Types of learning.

Concept Learning: Concept learning task, Concept Learning as search through a hypothesis space, Finding maximally specific hypotheses, Version spaces and the candidate elimination algorithm, Remarks on them, Inductive Bias.

UNIT 2: (~10 Lecture Hours)

Decision Tree Learning: Decision Tree representation and learning algorithm, appropriate problems for Decision Tree Learning, Hypothesis space search in Decision Tree Learning, Inductive bias in Decision Tree Learning: Occam's razor, Issues in Decision Tree Learning.

Artificial Neural Networks: Introduction, The Neuron Model, Activation Functions, Neural Network Architecture: Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks.

UNIT 3: (~9 Lecture Hours)

Support Vector Machines: Introduction, Linear Classifier, Non-linear Classifier, Training SVM, Support Vector Regression.

Bayesian Learning: Bayes theorem and concept learning, Minimum Description Length Principle, Bayes optimal classifier, Gibbs Algorithm, Naïve Bayes Classifier, The EM algorithm.

UNIT 4: (~8 Lecture Hours)

Computational Learning Theory: PAC Hypothesis, Sample complexity for finite and infinite hypothesis spaces, Mistake bound model.

Instance – Based Techniques: K-nearest neighbor Learning, Locally Weighted Regression, Radial Basis Function, Case Based reasoning, Remarks on Lazy vs Eager learning.

UNIT-5: (~8 Lecture Hours)

Genetic Algorithm: Biological motivation, Representing Hypothesis, Genetic Operators, Fitness function and selection, Hypothesis space search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, Edition 2013

Reference Books:

1. Saroj Kaushik, Artificial Intelligence, CENGAGE Learning, 2011.
2. Trevor Hasti, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, 2nd Edition, Springer Series in Statistics, 2001.
3. William W Hsieh, Machine Learning Methods in the Environmental Sciences, Neural Networks and Kernels,Cambridge University Press.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Online Resources:

1. http://www.cs.cmu.edu/~tom/
2. http://www.holehouse.org/mlclass/

Course Outcomes:

After completion of the course, students will be able to

1. Gain knowledge on the basic theory in machine learning.
2. Understand machine learning problems corresponding to different applications.
3. Create solutions with Decision trees and Bayesian classifiers for various business problems.
4. Implement the instance-based learning and analytic learning for suitable applications.
5. Apply Genetic algorithms and Reinforcement learning on real-world applications
6. Design applications using real datasets and evaluate the performance of the different algorithms.

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III Year B.Tech. CST II-Semester **L T P C**
Course Code: 126EA **3 0 0 3**

IMAGE PROCESSING

(Professional Elective – 3)

(Common to IT, CST & CSE(Data Science))

Prerequisites: Linear Algebra and Calculus.

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To learn different image enhancement, segmentation and restoration techniques.
3. To understand the basics of color image processing.
4. To apply various image morphological and compression techniques.
5. To understand the basic concepts of Representation and Description of objects.

UNIT 1: (~ 10 Lecture Hours)

Introduction: Fundamental steps in digital image processing, components of an image processing system. Image sensing and acquisition, Image sampling and quantization, relationship between pixels, distance functions, scanner. Intensity functions transformations, histogram processing, smoothing & sharpening – spatial filters Frequency domain filters, homomorphic filtering.

UNIT 2: (~ 10 Lecture Hours)

Image restoration: A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Inverse filtering, Weiner filtering, constrained least squares filtering.

Morphological Image Processing: Morphological and other area operations, basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms.

UNIT 3: (~ 10 Lecture Hours)

Image Segmentation: Fundamentals, Point, Line, and Edge Detection: Background, Detection of Isolated Points, Line Detection, Basic Edge Detection, Thresholding: Basic Global Thresholding, Optimum Global Thresholding Using Otsu's Method Edge Models, Region-Based Segmentation.

Color Image Processing: Color fundamentals, Color models, Pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, Color edge detection.

UNIT 4: (~ 8 Lecture Hours)

Image compression: Fundamentals, Coding Redundancy, Spatial and

Temporal Redundancy, Irrelevant Information, Measuring Image Information, Fidelity Criteria, Image Compression Models.

Some Basic Compression Methods: Huffman Coding, Arithmetic Coding, LZW Coding, Run-Length Coding, Symbol-Based Coding, Bit- Plane Coding, Block Transform Coding, Predictive Coding, Digital Image Watermarking.

UNIT 5: (~ 7 Lecture Hours)

Representation and Description: Boundary (Border) Following, Chain codes, Polygonal approximation, Signature Boundary Segments, Skeletons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, Principal components for Description.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson Education, 2008

Reference Books:

1. M.Anji Reddy and Y.Hari Shankar, Digital Image Processing, BS Publications, 2006.
2. A.K. Jain, Fundamentals of Digital Image Processing, PHI, 1989.

Online Resources:

1. https://www.tutorialspoint.com/dip/index.htm
2. https://www.cs.nmt.edu/~ip/lectures.html
3. http://eeweb.poly.edu/~onur/lectures/lectures.html
4. http://nptel.ac.in/courses/117105079/
5. https://www.coursera.org/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts of a digital image processing system and analyze images in spatial domain and frequency domain using various transforms.
2. Apply techniques for image restoration.
3. Identify different image analysis techniques and concepts for morphological operators.
4. Interpret image segmentation techniques and understand the basic concepts of color image processing.
5. Evaluate various compression techniques.
6. Interpret image representation and description techniques.

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III Year B.Tech. CST II-Semester **L T P C**
Course Code: 12641 **0 0 2 1**

INFORMATION SECURITY LAB

Prerequisites: Computer Networks.

Course Objectives:

1. Understand various network security aspects.
2. Implement various cryptographic algorithms.
3. Implement authentication and digital signatures Algorithms.
4. Present the network-based tools for network analysis.

List of programs:

Week 1:

Implement encryption and decryption using following techniques.

a. Ceaser Cipher b. Playfair Cipher

Week 2:

Implement encryption and decryption using following techniques.

a. Hill Cipher b. Rail Fence, Row & Column Transformation.

Week 3:

Implement DES algorithm.

Week 4:

Implement AES algorithm.

Week 5:

Implement Cipher Block Modes of operation.

a. Electronic Code Book. b. Cipher Block Chaining.

Week 6:

Implement RC4 algorithm.

Week 7:

Implement RSA algorithm.

Week 8:

Implements the logic of the Blowfish algorithm.

Week 9:

Implement the Diffie-Hellman Key Exchange mechanism.

Week 10:

Calculate the message digest of a text using the SHA-512 algorithm.

Week 11:

Implement the Digital Signature for the given text.

Week 12 :

Analyse the security issues of any one web browser (Mozilla Firefox/Google Chrome).

Week 13:

Download and use the Nessus tool to scan the network for vulnerabilities.

Week 14:

Install IDS (e.g. SNORT) and study the logs.

Text Books:

1. William Stallings, Cryptography and Network Security, 7^{th} Edition, 2017 Pearson Education.

Reference Books:

1. Behrouz A.Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3^{rd} Edition, 2015 McGraw Hill Education.
2. Michael Gregg, Build your own Security Lab, Wiley India.

Online Resources:

1. https://www.cybrary.it/catalog
2. http://cse.iitd.ernet.in/~murali/crypt
3. https://csrc.nist.gov/projects/block-cipher-techniques
4. https://www.udemy.com/build-your-own-cyber-lab-at-home
5. https://www.cyderaces.org/tutorials

Course Outcomes:

After completion of the course, students will be able to

1. Design & Develop various Substitution and Transposition Techniques.
2. Implement Cryptographic Algorithms.
3. Analyze and implement Authentication Techniques.
4. Understand and implement Key Exchange Techniques.
5. Identify the Network vulnerabilities using tools like Nessus, Snort etc.

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III Year B.Tech. CST II-Semester **L T P C**
Course Code: 12658 **0 0 2 1**

INTERNET OF THINGS LAB

Prerequisites: Computer programming, Digital Logic Design & Computer Networks.

Course Objectives:

1. To impart necessary and practical knowledge of components of Internet of Things.
2. To introduce the Python Scripting Language which is used in many IoT devices.
3. To introduce the Raspberry Pi platform, that is widely used in IoT applications.
4. Develop the required skills to build real-life IoT based projects.

List of Experiments:

Implement and test the following experiments on a Raspberry Pi & Arduino UNO.

Week 1:

Familiarization of the Equipment used for IoT lab.

Week 2:

Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping.

Week 3:

a. Program to Read your name and print Hello message with name.
b. Program to Read two numbers and print their sum, difference, product and division.
c. Program to display Word and character count of a given string.
d. Program to calculate Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.

Week 4:

a. Program to print name ‘n’ times, where name and n are read from standard input, using for and while loops.
b. Program to Handle Divided by Zero Exception.
c. Program to print current time for 10 times with an interval of 10 seconds. Read a file line by line and print the word count of each line.

Week 5:

Installation of Raspbian Operating Systems in Raspberry Pi kit and assigning the static & Dynamic IP address.

Week 6:

a. Light an LED through Python program.

b. Program to get input from two switches and switch on corresponding LEDs.

c. Program to Flash an LED at a given on time and off time cycle, where the two times are taken from a file.

Week 7:

a. Write a program to detect the motion of an object using PIR and triggers with Buzzer using Raspberry Pi.

b. Write a program to calculate the distance of an object using Ultrasonic Sensor in Raspberry Pi.

Week 8:

a. Familiarization of Arduino UNO

b. Write a program on Simple LED Blink using Arduino UNO.

c. Write a program on Simple LED Blink using Switch in Arduino UNO.

Week 9:

a. Write a program to detect the motion of an object using PIR and triggers with Buzzer using Arduino UNO.

b. Write a program to calculate the distance of an object using Ultrasonic Sensor in Arduino UNO.

c. Write a program to measure to moisture level in soil using Soil Moisture Sensor in Arduino UNO.

Week 10:

a. Write a program to measure to smoke level in environment using MQ2 sensor in Arduino UNO.

b. Write a program to calculate the temperature using LM35 in Arduino UNO.

c. Write a program to calculate the Temperature and Humidity using DHT11 in Arduino UNO.

Week 11:

a. Write a program to detect rain water using Arduino UNO.

b. Write a program for finding the slope of an object using tilt sensor in Arduino UNO.

c. Write a program to calculate the force of an object using Force Sensor in Arduino UNO.

Week 12:

a. Program to Flash an LED based on cron output (acts as an alarm).
b. Program to switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
c. Program to get the status of a bulb at a remote place (on the LAN) through web.

Text Books:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things, A Hands on Approach, University Press.
2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, Introduction to Internet of Things: A practical Approach, ETI Labs.

Reference Books:

1. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, platforms, and Use Cases, CRC Press.
2. Jeeva Jose, Internet of Things, Khanna Publishing House, Delhi.
3. Adrian McEwen, Designing the Internet of Things, Wiley.
4. Raj Kamal, Internet of Things: Architecture and Design, McGraw Hill.
5. Cuno P fister, Getting Started with the Internet of Things, O Reilly Media.

Online Resources:

1. https://www.tutorialspoint.com.
2. https://www.edureka.co

Course Outcomes:

After completion of the course, students will be able to

1. Understand Internet of Things and its hardware and software components.
2. Inspect I/O devices and sensors.
3. Executing programs using Python scripting language in IoT devices.
4. Survey IoT communication modules.
5. Examine data remotely and control devices.
6. Develop real life IoT based projects.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 127FN **3 0 0 3**

FUNDAMENTALS OF MANAGEMENT

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: Managerial Economics and Financial Analysis.

Course Objectives:

1. Educate the importance of Management in Business Decision Making.
2. Inculcate the conceptual aspects required for Managerial Decision Making.
3. Outline the practical application of Management in Engineering Decision Making.

UNIT 1: (~09 Lecture Hours)

Introduction to Management :

Management: Definition - Nature and Scope – Functions - Managerial Roles - Levels of Management - Managerial Skills - Challenges of Management - Evolution of Management - Classical Approach- Scientific Management and Administrative Theory - The Behavioral approach - The Quantitative approach - The Systems Approach - Contingency Approach – Corporate Social Responsibility of Business.

UNIT 2: (~10 Lecture Hours)

Planning and Decision Making

Planning : Plans - Types of Plans - Planning – Features – Principles of Planning, Types of Planning – Concept of MBO - Development of Business Strategy – Steps of Strategic Planning Process.

Decision Making – Characteristics of Decision Making - Types of Decisions - Steps in Decision Making - Approaches to Decision Making – Techniques of Individual and Group Decision Making.

UNIT 3: (~10 Lecture Hours)

Organization and HRM

Organization: Principles of Organization - Organizational Design – Departmentation – Delegation – Centralization, Decentralization and Recentralization - Organizational Structures - Concept of Organizational Culture, Climate and Change.

Human Resource Management: Talent Management – Importance – HRM - Features – Principles – Job Analysis - Functions of HRM – Recruitment and Selection - Training and Development - Performance Appraisal.

UNIT 4: (~09 Lecture Hours)

Leading and Motivation

Leading: Leadership - Characteristics of a Leader - Power and Authority - Leadership Styles - Leadership Theories – Trait Theory - Behavioral Leadership Theories - Situational Leadership Theories (Fielders Contingency Theory – House path Goal Theory – Life Cycle Situational Theory – Leader as Mentor and Coach – Team Leadership.

Motivation - Types of Motivation - Relationship between Motivation and Performance - Motivational Theories – Abraham Maslow's Need Hierarchy Theory - Fredrick Herzberg's Two Factor Theory – Mc. Gregor Theory X and Y – Theory Z - ERG Theory - Mc. Clelland Theory of Motivation.

UNIT 5: (~09 Lecture Hours)

Communication and Controlling

Communication : Importance - Types - Process - Barriers.

Controlling - Principles of Controlling - Types and Strategies for Control – - Steps in Control Process - Methods of Budgetary and Non- Budgetary Controls - Characteristics of Effective Control System – Methods of Controlling (Traditional and Modern Techniques.)

Text Books:

1. Stephen P. Robbins (2016) Fundamentals of Management, 9th Edition, Pearson Education.
2. K. Aswathappa (2023) Organisational Behavior, 14th Edition, Himalaya Publishing House.

Reference Books:

1. Y K Bhushan (2016) Fundamentals of Business organization and Management, 20th Edition, Sultan Chand and Sons.
2. Andrew DuBrin (2012) Management Essentials, 9th Edition, Cengage Learning.
3. VSP Rao (2012) Management (Text & cases), 2nd Edition, Excel Books.
4. James A.F. Stoner, R. Edward Freeman, Danial R.Gilbert (2018) Management, 6th Edition, Prentice - Hall of India Pvt. Ltd.
5. L.M.Prasad (2019) Organisational Behavior, 6th Edition, Sultan Chand and Sons.

Online Resources:

1. Concept of Management and Evolution of Management Thought https://archive.nptel.ac.in/courses/122/108/122108038
2. Principles of Management : https://nptel.ac.in/courses/110107150

Course Outcomes:

After completion of the course, students will be able to

1. Understand the concept of Management in practical scenario for effective decision making.
2. Summarize the preparation of effective plans in strategizing the decision making process.
3. Identify the Organizational Structure and confine authority responsibility conduct in an organization.
4. Apprehend the human resource management in an organization for its effectiveness.
5. Assess the role of leader and build motivation to attain the objectives of an organization.
6. Communicate and Design techniques of controlling in the process of an organization.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 127EQ **3 0 0 3**

SOFTWARE TESTING METHODOLOGIES

Prerequisites: Software Engineering.

Course Objectives:

1. To understand and identify various software testing problems, and solve these problems by designing and selecting software test models.
2. To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
3. To gain the ability to apply software testing methods and software testing tools for software projects.
4. To develop skills in software test automation and management using the latest tools.

UNIT 1: (~ 10 Lecture Hours)

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation.

UNIT 2: (~ 10 Lecture Hours)

Transaction Flow Testing: transaction flows, transaction flow testing techniques. **Dataflow testing:**

Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domains andtestability.

UNIT 3: (~ 9 Lecture Hours)

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, KV charts, specifications.

UNIT 4: (~ 9 Lecture Hours)

State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips.

Implementation: Overview, Strategies for Programmers, Strategies for Independent Testers.

UNIT 5: (~ 8 Lecture Hours)

Graph Matrices and Application: Matrix of graph, relations, power of a matrix, node reduction algorithm, building tool (Student should be given an exposure to a tool like JMeter or Win-runner).

Text Books:

1. Boris Beizer, Software Testing Techniques, 2nd Edition, Dreamtech.
2. Dr. K. V. K. K. Prasad, Software Testing Tools, Dreamtech.

Reference Books:

1. Brian Marick, The craft of software testing, Pearson Education.
2. Oreille, Software Testing Techniques, SPD.
3. Edward Kit, Software Testing in the Real World, Pearson.
4. Perry, John Wiley, Effective methods of Software Testing.
5. Meyers, John Wiley, Art of Software Testing.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs81/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs91/preview
3. https://www.coursera.org/learn/introduction-software-testing#syllabus

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic terminology of software testing.
2. Acquire the knowledge of various software testing techniques.
3. Determine the Logic testing & Specifications to uncover anomaly detections as early as possible.
4. Gain insight on implementation of various testing strategies & tips along with graphs.
5. Ability to design and develop the test cases & test scripts for software projects with the help of software testing tools.
6. Gain proficient knowledge in software manual and test automation.

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IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 127EW **3 0 0 3**

BLOCKCHAIN TECHNOLOGIES

(Professional Elective – 4)

(Common to CSE & CST)

Prerequisites: Computer Networks

Course Objectives:

1. To enable students develop understanding on Blockchain Technology
2. To equip students with knowledge on cryptocurrencies working.
3. To empower students, gain knowledge on Blockchain implementation technologies.

UNIT 1: (~ 6 Lecture Hours)

Blockchain 101: The History of Blockchain and Bitcoin, Types of Blockchain, Consensus, CAP theorem and blockchain.

Decentralization: Decentralization using Blockchain, Methods of decentralization, Routes to decentralization Blockchain and Full Ecosystem, Smart contracts, Decentralized Organizations, Platforms for Decentralization.

UNIT 2: (~ 8 Lecture Hours)

Introducing Bitcoin: Bitcoin, Digital Keys and Addresses, Transactions, Mining.

Bitcoin Network and Payments: Wallets, Bitcoin payments, Innovation in Bitcoin Alternative Coins: – Theoretical Foundations, Bitcoin limitations, Namecoin, Primecoin,

Zcash Smart Contracts: Ricardian Contracts.

UNIT 3: (~ 10 Lecture Hours)

Ethereum 101: - The Ethereum network, Components of the Ethereum ecosystem.

Further Ethereum: - Programming Languages-Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols.

Development Tools and Frameworks: - Solidity Language.

UNIT 4: (~ 10 Lecture Hours)

Introducing Web3: - Web3 – Contract Deployment, POST Requests, Development frameworks.

Hyperledger: - Hyperledger as a protocol, The reference architecture, Fabric-Hyperledger Fabric–Distributed Ledger, Sawtooth Lake, Corda.

UNIT 5: (~ 10 Lecture Hours)

Alternative Blockchains: - Blockchains- Kadena, Ripple,Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigchainDB, Multichain, Tendermint, Platforms and Frameworks-Eris.

Scalability and Other Challenges: -Scalability, Privacy.

Current Landscape and What's Next: – Emerging trends,Other Challenges, Blockchain Research, Notable Projects, Miscellaneous Tools.

Text Book:

1. **Imran Bashir, Mastering Blockchain:** Distributed Ledger Technology, Decentralization and Smart Contracts Explained, 2nd Edition, Packt Publishing, 2018.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands On Approach, VPT, 2017.
2. Chandramouli Subramanian, Asha A George, Abilash KA and Meena Karthikeyan, Blockchain Technology, Universities Press, 2020.
3. Elad Elrom, The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing and Securing Distributed Blockchain-based projects, Springer Nature B.V, 2019.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105184/
2. https://github.com/rddill-IBM/ZeroToBlockchain
3. https://tech.seas.harvard.edu/free-blockchain
4. https://www.codecademy.com/learn/introduction-toblockchain/modules/fundamental- blockchain-concepts
5. The Basics of Blockchain & Bitcoin Fundamentals Course | Udemy

Course Outcomes:

After completion of the course, students will be able to

1. Acquire understanding on Blockchain Technology built-in way.
2. Interpret how various cryptocurrencies work.
3. Articulate Ethereum Blockchain for developing smart contracts.
4. Apprehend knowledge on Web3 and Hyperledger Fabric for decentralized apps.
5. Exemplifying different alternative and emerging Blockchains.
6. Discover real-time usage of Blockchain.

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IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 127FB **3 0 0 3**

DEVOPS

(Professional Elective-4)

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Object Oriented Programming through JAVA, Full Stack Development.

Course Objectives:

1. To Describe the agile relationship between development and IT operations.
2. To Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. To Implement automated system update and DevOps lifecycle.

UNIT 1: (~9 Lecture Hours)

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT 2: (~9 Lecture Hours)

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Micro services, and the data tier, DevOps, architecture, and resilience.

UNIT 3: (~9 Lecture Hours)

Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT 4: (~9 Lecture Hours)

Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT 5: (~9 Lecture Hours)

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing,

Testing backend integration points, Test-driven development, REPL-driven development.

Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker.

Text Books:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN- 10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.

Online Resources:

1. https://aws.amazon.com/training/
2. https://www.pluralsight.com/paths/devops
3. https://www.udemy.com/course/devops-bootcamp/
4. https://www.katacoda.com/

Course Outcomes:

After completion of the course, students will be able to

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess various Devops practices.
6. Collaborate and adopt Devops in real-time projects.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 127CZ **3 0 0 3**

MOBILE APPLICATION DEVELOPMENT

(Professional Elective – 4)

(Common to IT & CST)

Prerequisites: Object Oriented Programming through JAVA.

Course Objectives:

1. To understand the fundamentals of Android operating systems.
2. To inculcate working knowledge of Android Studio development tool
3. To demonstrate the ability to deploy software to mobile devices.
4. To understand persistent data management.

UNIT 1: (~ 9 Lecture Hours)

Introduction to Android Operating System: Android OS design and features – Android development framework, SDK features, Installing and running applications on the Eclipse platform, Creating AVDs, Types of Android applications, best practices in Android programming, and Android tools.

Android application components: Android Manifest file, Externalizing resources like values, Themes, Layouts, Menus, etc, Resources for different devices and languages, Runtime Configuration Changes.

Android Application Lifecycle: Activities, Activity lifecycle, Activity states, Monitoring state changes.

UNIT 2: (~ 9 Lecture Hours)

Android User Interface: Measurements - Device and pixel density independent measuring units, Layouts - Linear, Relative, Grid, and Table Layouts.

User Interface (UI) Components: Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog, and Pickers.

Event Handling: Handling clicks or changes of various UI components.

Fragments: Creating fragments, Lifecycle of fragments, Fragment states, adding fragments to Activity, adding, removing, and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT 3: (~ 9 Lecture Hours)

Intents and Broadcasts: Intent - Using intents to launch Activities, explicitly starting new Activities, Implicit Intents, passing data to Intents, getting results from Activities, Native Actions, using Intent to dial a number or to send an SMS.

Broadcast Receivers: Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity.

Notifications: Creating and Displaying notifications, Displaying Toasts.

UNIT 4: (~ 9 Lecture Hours)

Persistent Storage: Files - Using application-specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences - Creating shared preferences, saving and retrieving data using Shared Preference.

Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving, and deleting data, Registering Content Providers, and Using Content Providers (insert, delete, retrieve, and update).

UNIT 5: (~ 9 Lecture Hours)

Using Internet Resources: Connecting to internet resources, using download manager Location Based Services - Finding Current Location and showing location on the Map, updating location.

Bluetooth, Networks, And Wi-Fi: Using Bluetooth, Managing Network and Internet Connectivity, Managing Wi-Fi.

Text Books:

1. Reto Meier, Professional Android 4 Application Development, WileyIndia, (Wrox), 2012.
2. James C Sheusi, Android Application Development for JavaProgrammers, Cengage Learning, 2013.

Reference Books:

1. Wei-Meng Lee, Beginning Android 4 Application Development, WileyIndia (Wrox), 2013.

Online Resources:

1. https://developer.android.com/guide
2. https://developers.google.com/training/android/
3. https://www.technosip.com/mobile-application-development/
4. https://www.coursera.org/specializations/android-app-development

Course Outcomes:

After completion of the course, students will be able to

1. Understand Android application development components.
2. Demonstrate usage of user interface components, layouts, Fragments and Event Handling
3. Develop applications using Intents and broadcast
4. Apply file concepts to develop android applications
5. Create user interfaces with the support of persistent data management
6. Design User Interfaces with support for access to the internet.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 127CS **3 0 0 3**

INFORMATION RETRIEVAL SYSTEMS

(Professional Elective – 5)

(Common to IT & CST)

Prerequisites: Data Structures, Database Management Systems.

Course Objectives:

1. To learn the different strategies for information storage and retrieval.
2. To learn about the various retrieval utilities.
3. To understand indexing and querying in information retrieval systems.
4. To understand the notion of structured and semi structured data.
5. To learn about retrieval model.

UNIT 1: (~ 10 Lecture Hours)

Introduction, Retrieval strategies: Vector space model.

Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language Models.

UNIT 2: (~ 8 Lecture Hours)

Retrieval Utilities: Relevance feedback, Clustering: Result Set Clustering, Hierarchical Agglomerative clustering, Clustering Without a Precomputed Matrix, Querying Hierarchically Clustered Collections, Efficiency Issues, Regression analysis, Thesauri.

UNIT 3: (~ 9 Lecture Hours)

Retrieval Utilities: N-grams, Semantic networks, Parsing: Single terms, Simple Phrases, Complex Phrases. Cross-Language Information Retrieval: Introduction, Crossing the language barrier-Query Translation, Document Translation, Phrase Translation, Choosing Translations, Pruning Translations.

UNIT 4: (~ 9 Lecture Hours)

Efficiency: Inverted Index, Query Processing: Inverted Index Modifications, Partial Result Set Retrieval, Vector Space Simplifications, Signature Files, Duplicate Document Detection.

UNIT 5: (~ 9 Lecture Hours)

Integrating Structured Data and Text: A Historical Progression, Information Retrieval as relational application, Semi-structured search using a relational schema, Mediators.

Distributed Information Retrieval: A Theoretical model of distributed retrieval, Web Search.

Text Books:

1. David A. Grossman and Ophir Frieder, Information Retrieval-Algorithms and Heuristics, 2nd Edition, Springer.

Reference Books:

1. Gerald J Kowalski and Mark T Maybury, Information Retrieval Systems, Springer 2000.
2. Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan- Kaufmann Publishers, 2002.
3. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England, 2009.

Online Resources:

1. https://www.coursera.org/learn/text-retrieval
2. https://web.stanford.edu/class/cs276/
3. https://www.mooc-list.com/tags/information-retrieval
4. https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/

Course Outcomes:

After completion of the course, students will be able to

1. Acquire the knowledge to store and retrieve textual documents using appropriate strategies.
2. Interpret various retrieval utilities for improving search.
3. Understand the translation schemes of cross-language information retrieval.
4. Apply indexing and compression of documents to improve space and time efficiency.
5. Formulate SQL queries for unstructured data.
6. Analyze the concepts of distributed retrieval model.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 127GE **3 0 0 3**

WEARABLE TECHNOLOGIES

(Professional Elective – 5)

Prerequisites: Basics of Sensors.

Course Objectives:

1. Identify the need for development of wearable devices and its implications on various sectors.
2. Comprehend the design and development of various wearable inertial sensors and physiological activity monitoring devices for use in healthcare applications.
3. Use skills and techniques to solve contemporary problems in the field wearable technology.

UNIT 1: (~ 9 Lecture Hours)

Wearables Fundamentals - World of Wearables (WOW), Attributes of Wearables, Textiles and Clothing: The Meta-Wearable, Challenges and Opportunities, The Future of Wearables.

Electronic Textiles- Knitted Electronic Textiles - From Fibers to Textile Sensors, The Interlaced Network, Smart Fabrics. Flexible Electronics from Foils to Textiles: Thin-Film Transistors: Materials and Technologies, Thin-Film Transistors Based on a-IGZO, Plastic Electronics for Smart Textiles.

UNIT 2: (~ 9 Lecture Hours)

Wearable Bio and Chemical Sensors: Introduction, System Design, Challenges in Chemical Biochemical Sensing, Application Areas.

Wearable Inertial Sensors: Wearable Inertial Sensors, Obtained Parameters from Inertia Sensors, Applications for Wearable Motion Sensors, Practical Considerations for Wearable Inertial Sensor Applications in Clinical Practice and Future Research Directions.

UNIT 3: (~ 9 Lecture Hours)

Energy Expenditure: Background, Examples of Body-Worn Devices, Design Considerations

Energy Harvesting: Introduction, Energy Harvesting from Temperature Gradient at the Human Body, Energy Harvesting from Foot Motion, Wireless Energy Transmission, Energy Harvesting from Light, Energy and Power Consumption Issues, Future considerations.

UNIT 4: (~ 9 Lecture Hours)

Human Body Communication for Data Rate Sensor Network: Capacitive-Coupling Communication Through Human Body, Channel Properties of Human Body, Transmission Scheme of Human Body, Communication, Analog Front-End for Human Body Communication.

Wireless Body Area Networks: Evaluation Metrics, Technologies, Wearable Radios, WBAN Device Authentication Techniques, Secret Key Establishment in WBAN.

UNIT 5: (~ 9 Lecture Hours)

Wearable Algorithms – Need for Algorithms - What are Wearable Algorithms- State-of-the-Art and Emerging Techniques

Data Mining Techniques for Body Sensor Network - Machine Learning Approaches to Data Mining, Mining BSN Data, Data Representation, Comparison Metric, Classifier, Data-Mining Model.

Text Books:

1. "Wearable Sensors -Fundamentals, Implementation and Applications", by Edward Sazonov and Michael R. Neuman, Elsevier Inc., 2014.
2. "Wearable and Autonomous Biomedical Devices and Systems for Smart Environment", by Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, Springer 2010.

Reference Books:

1. "Wearable Electronics Sensors - For Safe and Healthy Living", Subhas Chandra Mukhopadhyay, Springer 2015.
2. "Environmental, Chemical and Medical Sensors", by Shantanu Bhattacharya, A K Agarwal, NripenChanda, Ashok Pandey and Ashis Kumar Sen, Springer Nature Singapore Pte Ltd. 2018
3. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.

Online Resources:

1. https://www.mooc-list.com/course/wearable-technologies-and-sports-analytics-coursera
2. https://www.coursera.org/lecture/rapid-prototyping-embedded-interface/designing-wearables- 50G1E

Course Outcomes:

After completion of the course, students will be able to

1. Identify and understand the need for development of wearable devices and its influence on various sectors.
2. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices and applications of various wearable inertial sensors for biomedical applications.
3. Understand the concepts of energy harvesting and energy expenditure in wearable devices.
4. Familiarize the concepts of wireless body area network and their communications
5. Analyze the wearable algorithms and the data mining techniques involved in body sensor networks.

IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 127FA **3 0 0 3**

DESIGN PATTERNS

(Professional Elective – 5)

Prerequisites: Object Oriented Analysis and Design, Data structures and algorithms, Programming Language (C++ or Java).

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.

UNIT 1: (~12 Lecture Hours)

What is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalogue of Design Patterns, Organizing The Cato log, How Design Patterns solve Design Problems, How to Select a Design pattern, How to Use a Design Pattern.

UNIT 2: (~ 10 Lecture Hours)

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, Summary, Creational Patterns, Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT 3: (~ 6 Lecture Hours)

Structural Pattern Part-I, Adapter, Bridge, Composite. Structural Pattern Part-II, Decorator, Facade, Flyweight, Proxy.

UNIT 4: (~ 10 Lecture Hours)

Behavioral Patterns Part: I, Chain of Responsibility, Command, Interpreter, Iterator. Behavioral Patterns Part: II, Mediator, Memento, Observer, Discussion of Behavioral Patterns.

UNIT 5: (~10 Lecture Hours)

Behavioral Patterns Part: III, 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.

Text Books:

1. Design Patterns By Erich Gamma, Pearson Education.

Reference Books:

1. Patterns in JAVA Vol-I (or) Vol-II By Mark Grand, Wiley Dream Tech.
2. Java Enterprise Design Patterns Vol-III By Mark Grand Wiley Dream Tech.

Online Resources:

1. https://www.tutorialspoint.com/design_pattern/design_pattern_overview.
2. https://courses.cs.washington.edu/courses/cse403/09sp/lectures/lecture09-design-patterns-1.pdf
3. https://www.coursera.org/learn/design-patterns
4. https://elearn.nptel.ac.in/shop/iit-workshops/completed/cloud-architecture-design-patterns-pc-on- cloud/

Course Outcomes:

After completion of the course, students will be able to

1. Construct a design consisting of a collection of modules.
2. Exploit well-known design patterns (such as Iterator, Observer, Factory and Visitor).
3. Distinguish between different categories of design patterns.
4. Understand and apply common design patterns to incremental/iterative development.
5. Identify appropriate patterns for design of given problem.
6. Design the software using Pattern Oriented Architectures.

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IV Year B.Tech. CST I-Semester	**L T P C**
Course Code: 127CL	**3 0 0 3**

EMBEDDED SYSTEMS

(Professional Elective–5)

Prerequisites:

1. A course on "Digital Logic Design and Microprocessors"
2. A course on "Computer Organization and Architecture"

Course Objectives:

1. To provide an overview of principles of Embedded System
2. To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.

UNIT 1: (~ 9 Lecture Hours)

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major application areas, Purpose of Embedded Systems, Characteristics and Quality attributes of Embedded Systems.

UNIT 2: (~ 8 Lecture Hours)

The Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System components.

UNIT 3: (~ 10 Lecture Hours)

Embedded Firmware Design and Development: Embedded Firmware Design approaches, Embedded Firmware Development Languages, Programming in Embedded C.

UNIT 4: (~ 9 Lecture Hours)

RTOS Based Embedded System Design: Operating System basics, Types of Operating Systems, Tasks, Process, Threads, Multiprocessing and Multi-tasking, Task Scheduling, Threads-Processes Scheduling: putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to choose an RTOS.

UNIT 5: (~ 9 Lecture Hours)

Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware and Firmware, Boards Bring up.

The Embedded System Development Environment: The Integrated Development Environment (IDE), Types of files generated on Cross-Compilation, Disassembler / Decompiler, Simulators, Emulators and Debugging, Target Hardware Debugging, Boundary Scan.

Text Books:

1. Shibu K V, "Introduction to Embedded Systems", Second Edition, Mc Graw Hill.

Reference Books:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill
2. Frank Vahid and Tony Givargis, "Embedded Systems Design" - A Unified ardware/Software Introduction, John Wiley
3. Lyla, "Embedded Systems" –Pearson
4. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

Online Resources:

1. http://www.intel.com/
2. http://www.atmel.com/
3. http://www.microchip.com/
4. http://www.embedded.com/
5. http://www.analog.com/
6. https://onlinecourses.nptel.ac.in/noc20_ee98/preview

Course Outcomes:

After completion of the course, students will be able to

1. Understand the selection procedure of processors in the embedded domain.
2. Understand about the components needed in an embedded system.
3. Understand design procedure of embedded firm ware.
4. Visualize the role of real time operating systems in embedded systems.
5. Evaluate the correlation between task synchronization and latency issues.
6. Understands the development environment.

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IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 12765 **0 0 2 1**

SOFTWARE TESTING METHODOLOGIES LAB

Prerequisites: Software Engineering.

Course Objectives:

1. To provide knowledge of Software Testing Methods.
2. To develop skills in software test automation and management using latest tools.
3. To study the fundamental concepts of software testing which includes objectives, process, criteria, strategies, and methods.

List of Experiments:

Implement and test the following experiments on a JMeter or Win-runner.

1. Recording in context sensitive mode and analog mode.
2. GUI checkpoint for single property.
3. GUI checkpoint for single object/window.
4. GUI checkpoint for multiple objects.
5. Write the test cases for any known application (e.g., Banking application)
6. Take any system (e.g., ATM SYSTEM) and study its system specifications and report the various bugs.
7. Write the test cases for GMAIL & other mail applications.
8. Write the test cases for INSTAGRAM, FACEBOOK, TWITTER etc.
9. Create a test plan document for any application (e.g., Library Management System)
10. Write Test cases for calculator in windows application
11. Write Test Cases for Mobile Application Testing
12. Study of any web testing tool (e.g., Selenium)
13. BUG TRACKING TOOL Study of bug tracking tool (e.g., Bugzilla).

Text Books:

1. Boris Beizer, Software Testing Techniques, 2nd Edition, Dreamtech.
2. Dr. K. V. K. K. Prasad, Software Testing Tools, Dreamtech.

Reference Books:

1. Brian Marick, The craft of software testing, Pearson Education.
2. Oreille, Software Testing Techniques, SPD.
3. Edward Kit, Software Testing in the Real World, Pearson.
4. Perry, John Wiley, Effective methods of Software Testing.
5. Meyers, John Wiley, Art of Software Testing.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs81/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs91/preview
3. https://www.coursera.org/learn/introduction-software-testing#syllabus

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic terminology & different modes of software testing.
2. Acquire the knowledge of writing and executing a program with the intent of finding an error.
3. Determine diverse testing strategies & tips along with graphs to uncover anomaly detections as early as possible.
4. Gain insight on Implementation of various bug tracking tools.
5. Ability to Design and Develop the test cases & test scripts for software projects with the help of software testing tools.
6. Gain proficient knowledge in software manual and test automation.

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IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 12750 **0 0 2 1**

BLOCKCHAIN TECHNOLOGIES LAB

(Professional Elective – 4)

Prerequisites: -Nil-

Course Objectives:

1. To provide conceptual understanding of blockchain technology.
2. To familiarize with blockchain based solutions to innovate and improve business processes.
3. To introduce design and architectural primitives of blockchain.
4. To present system and security aspects of blockchain.
5. To provide use cases from different application domains.

List of Experiments:

Week 1:
Introduction to Truffle, establishing local Blockchain using Truffle.

Week 2:
Solidity programming language for writing smart contracts in Blockchain.

Week 3:
Learning Java/JavaScript/Go languages chain code.

Week 4:
Deployment of an application on Truffle local Blockchain.

Week 5:
Exposure to Ethereum Ropsten/Gorelli/Rinkeby test networks.

Week 6:
Deployment on test networks and Web3.js/Web3.py for interaction with Ethereum smart contract.

Week 7:
Smart contract development and deployment using Metamask and Remix Design and develop Crypto currency.

Week 8:
Chain code deployment in Hyperledger fabric.

Week 9:
Design and Development of a DApps using Ethereum/Hyperledger Fabric.

Week 10:
Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

Week 11:

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

Week 12:

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

Text Books:

1. Ethereum Smart Contract Development, Mayukh Mukhopadhyay, Packt publication.
2. Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication.
3. Hands-on Smart Contract Development with Hyperledger Fabric V2, Matt Zand, Xun Wu and Mark Anthony Morris, O'Reilly.

Reference Books:

1. Mastering Blockchain, Imran Bashir, Packt Publishing
2. Introducing Ethereum and Solidity, Chris Dannen, APress.
3. Hands-on Blockchain with Hyperledger, Nitin Gaur, Packt Publishing.

Online Resources:

1. https://trufflesuite.com/
2. https://metamask.io/
3. https://remix.ethereum.org/
4. https://www.hyperledger.org/use/fabric

Course Outcomes:

After completion of the course, students will be able to

1. Understand blockchain technology.
2. Develop blockchain based solutions.
3. Model smart contract using Hyperledger Fabric and Ethereum frameworks.
4. Build and deploy blockchain applications for on-premise and cloud based architecture.
5. Develop blockchain based solutions for providing security for various application domains.

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IV Year B.Tech. CST I-Semester **L T P C**

Course Code: 12754 **0 0 2 1**

DEVOPS LAB

(Professional Elective – 4)

(Common to CSE, IT, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Object Oriented Programming through JAVA, Full Stack Development.

Course Objectives:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability
3. Implement automated system update and DevOps lifecycle.

List of Experiments:

Week 1:

Write code for a simple user registration form for an event.

Week 2:

Explore Git and GitHub commands.

Week 3:

Practice Source code management on GitHub. Experiment with the source code written in exercise 1.

Week 4:

Jenkins installation and setup, explore the environment.

Week 5:

Demonstrate continuous integration and development using Jenkins.

Week 6:

Explore Docker commands for content management.

Week 7:

Develop a simple containerized application using Docker.

Week 8:

Integrate Kubernetes and Docker.

Week 9:

Automate the process of running containerized application developed in exercise 7 using Kubernetes.

Week 10:

Install and Explore Selenium for automated testing.

Week 11:

Write a simple program in JavaScript and perform testing using Selenium.

Week 12:

Develop test cases for the above containerized application using selenium.

Text Books:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title, 2nd edition (2018). ISBN-10: 1788392574.
2. Deepak Gaikwad and Viral Thakkar, DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley
2. Edureka DevOps Full Course - https://youtu.be/S_0q75eD8Yc

Online Resources:

1. https://youtu.be/S_0q75eD8Yc
2. https://aws.amazon.com/training/
3. https://www.pluralsight.com/paths/devops
4. https://www.udemy.com/course/devops-bootcamp/
5. https://www.katacoda.com/

Course Outcomes:

After completion of the course, students will be able to

1. Identify components of Devops environment
2. Apply different project management, integration, testing and code deployment tool
3. Investigate different DevOps Software development, models
4. Demonstrate continuous integration and development using Jenkins
5. Develop a simple application using kubernetes and docker
6. Evaluate the effectiveness of test cases for the containerized application using selenium

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IV Year B.Tech. CST I-Semester **L T P C**
Course Code: 12760 **0 0 2 1**

MOBILE APPLICATION DEVELOPMENT LAB

(Professional Elective – 4)
(Common to IT & CST)

Prerequisites: Computer Programming, Objected-Oriented Programming through Java.

Co-requisites: Mobile Application Development.

Course Objectives:

1. Gain knowledge of installing Android Studio and Cross Platform Integrated Development Environment.
2. Learn designing of User Interface and Layouts for Android App.
3. Learn how to use intents to broadcast data within and between Applications.
4. To use Content providers and Handle Databases using SQLite.

List of Experiments:

Week 1:

1. Create an Android app to illustrate activity lifecycle
2. (a) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
   (b) Create an Android app to navigate between activities (Use Explicit Intent)

Week 2:

1. Create an Android app to perform mathematical operations (+, -,*,/, %).(Use buttons, edit text, toast controls)
2. Create an Android app to display text in bold, italic, normal style with left, right, center alignments (use Radio Button, Check Box controls)

Week 3:

1. Create an Android app design login control and validate login details
2. Create a screen that has input boxes for User Name, Password, and Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. Onclicking the submit button, print all the data below the Submit Button. Use (a)Linear Layout, (b) Relative Layout and (c) Grid Layout or Table Layout.

Week 4:

Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.

Week 5:

Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.

Week 6:

Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with the Login Failed message.

Week 7:

1. (a) Create an Android app to demonstrate Alert Dialog.
   (b) Create an Android app to demonstrate Web View control.
2. (a) Create an Android app to show Analog and Digital clocks.
   (b) Create an Android app to illustrate a progress bar.

Week 8:

Create an Android app to scroll the list of images and display details of images (name, size etc) using the Image Switcher control.

Week 9:

Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially.

Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

Week 10:

Create an Android app to show details of phone contacts and implement calling and receiving features.

Week 11:

(a) Create an Android app to store details of students in SQLite and display the details.

(b) Create an Android app to perform insert, update and delete operations on the Student database.

Week 12:

(a) Create an Android app to send or receive data between two different devices using Bluetooth.

(b) Creates an application that opens and closes wifi.

Text Books:

1. Professional Android 4 Application Development, Reto Meier, WileyIndia, (Wrox), 2012.
2. Android Application Development for JavaProgrammers, James CSheusi, Cengage Learning, 2013.

Reference Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

Online Resources:

1. https://developer.android.com/guide
2. https://developers.google.com/training/android/
3. https://www.coursera.org/specializations/android-app-development
4. https://www.udemy.com/course/become-an-android-developer-from-scratch/

Course Outcomes:

After completion of the course, students will be able to

1. Choose Integrated Development Environment for Android Application Development.
2. Design and Implement User Interfaces and Layouts of Android Apps.
3. Develop Android App Using Intents for activity and broadcasting data.
4. Design and Implement Database Application and processing messages.
5. Create User Interfaces with support for access to internet.
6. Deploy an Android application in mobiles.

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IV Year B.Tech. CST II-Semester **L T P C**
Course Code: 128GW **2 0 0 2**

ENTREPRENEURSHIP AND PROJECT MANAGEMENT

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: Fundamentals of Management.

Course Objectives:

1. Inculcate the entrepreneurial knowledge required to start and/or to run a business.
2. Hone entrepreneurial skills and create sensibility in entrepreneurial establishment.
3. Develop strategic skills in the project planning and implementation.

UNIT 1: (~05 Lecture Hours)

Introduction to Entrepreneurship

Entrepreneurship: Introduction to Entrepreneur - Characteristic and skills of an Entrepreneur – Functions and Types of Entrepreneurs – Theories of Entrepreneurship - Process of Entrepreneurship - Factors affecting Entrepreneurship development - Women Entrepreneurs - Growth and Problems – Importance of Entrepreneurial Marketing.

UNIT 2: (~06 Lecture Hours)

Entrepreneurial business selection

Entrepreneurial business selection: Criteria for selection of Business Structure - Types of Business Structures - Sole Proprietorship – Partnership - Limited Liability Partnership(LLP) - One-person company - Joint stock company – Features - Merits & Demerits – Suitability.

UNIT 3: (~07 Lecture Hours)

Project Finance for Entrepreneur: Introduction to Capital-Types of Capital-Factors affecting Fixed Capital and Working Capital requirements -Sources of raising Finance – Entrepreneurial Finance (Seed Funding, Business Angels, Venture Capital, Family Offices, Financial bootstrapping, Buyouts, Accelerators and Incubators, Crowdfunding, IP based Investment funds).

UNIT 4: (~07 Lecture Hours)

Project Appraisal/Evaluation Techniques

Capital Budgeting: Introduction - Need and Importance of Capital Budgeting -Traditional methods - Payback Period Method - ARR Method. Discounted Cash Flow Method – NPV - PI and IRR (simple problems).

Network Analysis - Introduction to Network analysis – PERT & CPM Analysis. Identification of Critical Path - Probability of Completing the Project within a given time - Calculation of Float/Slack - Importance of PERT & CPM in Decision Making – Project audit.

UNIT 5: (~07 Lecture Hours)

Entrepreneurial Business Plan:

Entrepreneurial Business Plan - Preparation – Aspects to be considered in preparing Business Plan – Objectives – Elements of Business Plan (Production plan and Operational Plan)- Understanding Risk assessment of Enterprise towards Entrepreneurial Success. India- Case Study.

Text Books:

1. Dr. S.S. Khanka (2021) Entrepreneurial Development, 4th Edition, S.Chand & Company.
2. L. S. Srinath (2012) PERT & CPM – Principles & Applications, 3rd Edition, EWP.

Reference Books:

1. Khan & Jain (2018) Financial Management, 8th Edition, TMH.
2. Robert.D.Hisrich, Mathew. J. Manimala, Michael. P. Peter, Dean A.Shepherd (2017) Entrepreneurship, 9th Edition, Mc. Graw Hill.
3. S. D. Sharma (2008) Operations Research, 15th Edition, Macmillan.
4. Tulsian (2002) Business organization & Management, 1st Edition, Pearson.

Online Resources:

1. Entrepreneurship Essentials https://onlinecourses.nptel.ac.in/noc21_ge06/preview
2. Project Management https://onlinecourses.nptel.ac.in/noc21_mg71/preview
3. Financial Management for Managers https://nptel.ac.in/courses/110107144

Course Outcomes:

After learning the contents of this course, the student must be able to

1. Summarize the entrepreneurial ingenuity and skills required for business functioning.
2. Relate the probable business structures for entrepreneurial decisions.
3. Identify the probable finance alternatives available for investment in the project.
4. Deduct the investment opportunities and resource allocation decisions.
5. Evaluate the time feasibility of entrepreneurial project implementation.
6. Integrate and formulate an entrepreneurial business plan.

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IV Year B.Tech. CST II-Semester
Course Code: 128GU

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E-COMMERCE

(Professional Elective – 6)

(Common to IT & CST)

Prerequisites: Network Security, Information Retrieval Systems.

Course Objectives:

1. Examine current and emerging issues of managing E-commerce.
2. Evaluate planning and frameworks required for E-commerce.
3. Distinguish the legal and ethical issues involved in E commerce.
4. Explain the marketing strategies aligned to E-commerce.

UNIT 1: (~ 12 Lecture Hours)

Electronic Commerce- Benefits and limitations of E-Commerce, Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications. Consumer Oriented Electronic commerce - Mercantile Process models.

UNIT 2: (~ 10 Lecture Hours)

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, UPI Payments, Risks in Electronic Payment systems. Inter Organizational Commerce - EDI, Applications – Security and Privacy Issues, EDI Implementation, and Value added networks.

UNIT 3: (~ 6 Lecture Hours)

Intra Organizational Commerce-work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT 4: (~ 10 Lecture Hours)

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT 5: (~ 10 Lecture Hours)

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering. Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Mobile Commerce Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application Protocols, WAP Technology, Mobile Information Devices,

Text Books:

1. Kalakata, Whinston, Frontiers of electronic commerce –Pearson.

Reference Books:

1. Hendry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, John Wiley E-Commerce fundamentals and applications.
2. S.Jaiswal, E-Commerce, Galgotia.
3. Efrain Turbon, Jae Lee, David King, H.Michael Chang. E-Commerce.
4. Brian Ernest Mennecke, Troy J. Strader M-Commerce.

Online Resources:

1. https://mbaexamnotes.com/e-commerce-notes.html
2. https://alison.com/course/e-commerce-and-selling-online
3. https://www.coursera.org/specializations/digital-marketing
4. https://www.coursera.org/learn/b2b-marketing

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic foundations, importance of E-commerce and infrastructure for E-commerce in retailing, pricing strategies.
2. Identify and access Electronic payment systems.
3. Understand Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
4. Evaluating the effectiveness of market research, Information retrieval, data ware housing and data mining.
5. Analyse the impact of E-commerce on business models and strategy.
6. Applying Multimedia in E-Commerce.

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IV Year B.Tech. CST II-Semester **L T P C**

Course Code: 128FZ **3 0 0 3**

SOFT COMPUTING

(Professional Elective – 6)

Prerequisites: Artificial Intelligence and Machine Learning.

Course Objectives:

1. Acquire the fundamental knowledge in soft computing.
2. Understand and analyze various searching and representations in logic.
3. Analyze the fundamentals of artificial neural network models.
4. Understand the basics of fuzzy sets and fuzzy logic rules.
5. Discuss the basics of genetic algorithms.

UNIT 1: (~8 Lecture Hours)

Introduction to Soft Computing: Introduction, Hard Computing vs Soft Computing, Soft Computing Constituents, Machine Learning Basics: Supervised, Unsupervised and Reinforcement Learning.

Introduction to Fuzzy Logic: Classical Sets (Crisp Sets) Theory: Basic Definitions and Terminology, Operations, Properties, Crisp Relations and Operations, Fuzzy Sets Theory: Operations, Fuzzy Relations and compositions, Types of Membership Functions, Features.

UNIT 2: (~10 Lecture Hours)

Fuzzy Logic and Inference rules: Introduction, Classical Logic, Multi-valued Logic, Fuzzy Logic, Fuzzy Propositions, Inference Rules for Fuzzy Propositions.

Fuzzy Inference Systems: Introduction, Fuzzy Inference System (Fuzzification, Defuzzification), Types of Fuzzy Inference Engines and its Implementation, Neuro Fuzzy System.

UNIT 3: (~10 Lecture Hours)

Single Layer Feed Forward Neural Networks: Introduction, Biological Neurons, Artificial Neural Networks, ANN Model, Single Layer Feed Forward Neural Network, Applications of NN.

Multi-Layer Feed Forward Neural Networks: Architecture, Learning Methods, Backpropagation Method, Design Issues of ANN, and Applications.

UNIT 4: (~10 Lecture Hours)

Radial Basis Function Neural Networks (RBNF): RBNF Introduction, Architecture, Learning, Comparison of RBNF and FFNN (Feed Forward Neural Networks), and Applications.

Recurrent Neural Networks: RNN Architecture and Training, Hopfield Networks, Self-Organizing Neural Networks.

UNIT 5: (~8 Lecture Hours)

Introduction to Evolutionary Computing: Biological Evolutionary Process, Paradigms, Strategies, Evolutionary Programming, Advantages and applications.

Genetic Algorithm Process: GA Introduction, Selection, Encoding of Genetic Operators, Classification of GA, Applications, Advantages and Disadvantages of GA.

Text Books:

1. Saroj Kaushik, Sunita Tiwari ,Soft Computing Fundamentals, Techniques and Applications, McGraw Hill, 2018.

Reference Books:

1. Elaine Rich, Kevin Knight and Shivashankar B.Nair, Artificial Intelligence, 3rd Edition TMH, 2009, rp2017
2. Jyh:Shing Roger Jang, Chuen:Tsai Sun and Eiji Mizutani, Neuro Fuzzy and Soft Computing, Prentice Hall of India/PHI, 2003.
3. Amit Konar, Artificial Intelligence and Soft Computing- Behavioural and Cognitive Modelling of the Human Brain, CRC press, 1st Edition, Taylor and Francis Group, 1999.
4. Hung T Nguyen and Elbert A Walker, A first course in Fuzzy Logic, CRC Press, 3rd Edition, Taylor and Francis Group, 2006.
5. Fakhreddine Karray and Clarence D Silva, Soft Computing and Intelligent System Design, Pearson Edition, 2004.

Online Resources:

1. https://drive.google.com/file/d/0B0z1V-RAPGVkT2MyTXlwdE9XWXc/view?usp= sharing
2. https://onlinecourses.nptel.ac.in.
3. http://www.myreaders.info/html/soft_computing.html.

Course Outcomes:

After completion of the course, students will be able to

1. Identify artificial intelligence and soft computing techniques in building intelligent machines.
2. Apply fuzzy logic and reasoning to handle uncertainty.
3. Understand the concept of artificial neural networks.
4. Analyze the various Supervised and Unsupervised learning networks.
5. Understand different operators and basic terminologies of genetic algorithms.
6. Evaluate different soft computing techniques for suitable applications.

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IV Year B.Tech. CST II-Semester	**L T P C**
Course Code: 128HC	**3 0 0 3**

HIGH PERFORMANCE COMPUTING

(Professional Elective – 6)

Prerequisites:

1. Computer Organization and Architecture.
2. Operating System Programming.

Course Objectives:

1. To Improve the system performance.
2. To learn various distributed and parallel computing architecture
3. To learn different computing technologies.

UNIT 1: (~ 9 Lecture Hours)

Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (IBM).

UNIT 2: (~ 11 Lecture Hours)

Cluster Computing at a Glance: Introduction, A Cluster Computer and its Architecture, Cluster Classifications, Commodity Components for clusters, Network Services/Communication SW, Cluster Middleware and SSI, RMS, Programming Environments and Tools, Cluster Applications.

Lightweight Messaging Systems: Introduction, Latency Bandwidth Evaluation of Communication performance, Traditional Communication Mechanisms for clusters, Lightweight Communication Mechanisms.

UNIT 3: (~ 9 Lecture Hours)

Job and Resource Management Systems: Need of Job management, Components and Architecture. **Scheduling Parallel Jobs on Clusters:** Introduction, Rigid Jobs with process migration, Malleable Jobs with Dynamic Parallelism, Communication-Based Co scheduling, Batch Scheduling.

Cluster Operating Systems: COMPaS.

UNIT 4: (~ 8 Lecture Hours)

Pervasive Computing Concepts & Scenarios: Hardware & Software; Human – Machine Interface.

Device Connectivity: Java For Pervasive Devices; Application Examples.

UNIT 5: (~ 8 Lecture Hours)

Classical Vs Quantum Logic Gates: One, Two & Three Qubit Quantum Gates; Fredkin & Toffoli Gates; Quantum Circuits; Quantum Algorithms.

Text Books:

1. Grid Computing, J. Joseph & C. Fellenstien, Pearson Education
2. High Performance Cluster Computing, Raj kumar Buyya, pearson Education.
3. Pervasive Computing, J. Burkhardt et.al, Pearson Education
4. Approaching Quantum Computing Marivesar, Pearson Education.

Reference Books:

1. The Grid 2: Blue Print for a New Computing Infrastructure, Ian Foster and Carl Kesselman, 2nd Edition, The Elsevier Series.
2. Quantum computing and Quantum Information, Neilsen & Chung L, Cambridge University Press.
3. A networking approach to Grid Computing, Minoli, Wiley.

Online Resources:

1. https://cloud.google.com/solutions/hpc
2. https://aws.amazon.com/hpc/
3. https://www.redhat.com/en/topics/high-performance-computing/what-is-high- performance- computing
4. https://nptel.ac.in/courses/106108055
5. https://www.coursera.org/learn/introduction-high-performance-computing

Course Outcomes:

After completion of the course, students will be able to

1. Understanding the concepts in grid computing
2. Ability to set up cluster and run parallel applications
3. Ability to demonstrate the cluster projects and cluster OS
4. Interpret the concepts of pervasive computing.
5. Understanding the concepts of quantum computing.

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IV Year B.Tech. CST II-Semester **L T P C**

Course Code: 128FS **3 0 0 3**

NATURAL LANGUAGE PROCESSING

(Professional Elective – 6)

(Common to CST & CSE(Data Science))

Prerequisites: Automata and Compiler Design.

Course Objectives:

1. To introduce the fundamental concepts and techniques of natural language processing.
2. To understand the role of syntax, semantics and pragmatics of Text processing.
3. To acquire knowledge on discourse processing and various approaches for generating text automatically.
4. To gain an in-depth understanding of the computational properties and commonly used algorithms for processing linguistic information.

UNIT 1: (~ 10 Lecture Hours)

Introduction: What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications **Finding the Structure of Words:** Words and their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of Approaches, Performances of the Approaches.

UNIT 2: (~ 9 Lecture Hours)

Syntax: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues: Tokenization, Case and Encoding, Word Segmentation, Morphology.

UNIT 3: (~ 9 Lecture Hours)

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word sense, Predicate- Argument Structure, Meaning Representation.

UNIT 4: (~ 9 Lecture Hours)

Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure **Natural Language Generation:** Introduction, Architectures of NLG Systems, Generation Tasks and Representations, Applications of NLG.

UNIT 5: (~ 8 Lecture Hours)

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models- Class-Based Language Models, Syntax-Based Language

Models, Neural Network Language Models, Language-Specific Modeling Problems.

Text Books:

1. Daniel M. Bikel and Imed Zitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, Pearson Publication, 2013.
2. Tanvier Siddiqui and U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford Higher Education, 2008.

Reference Books:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2011.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O Reilly, 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. Natural Language Processing Specialization (DeepLearning.AI) | Coursera
3. https://www.udemy.com/topic/natural-language-processing/
4. Stanford CS 224N | Natural Language Processing with Deep Learning
5. CS 626-460: Natural Language Processing (iitb.ac.in)

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate knowledge on the fundamental principles of Natural Language Processing and document structure.
2. Understand the syntax processing and multilingual issues of language processing.
3. Analyze semantic interpretation and system paradigms for semantic parsing.
4. Understand discourse processing and computational approaches to natural language generation.
5. Apply experimental methodology for training, evaluating and generating NLP systems.
6. Understand state of the art in the core areas of NLP.

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III Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: 126KF	**3**	**0**	**0**	**3**

FUNDAMENTALS OF DATA STRUCTURES

(Open Elective – 1)

Prerequisites: - Nil-

Course Objectives:

1. Understand the notations used to analyze the performance of algorithms.
2. Understand the basic concepts such as Linear and Non Linear Data structures.
3. Understand the behavior of data structures such as stacks, queues, trees, search trees, graphs and their representations.
4. Choose the appropriate data structure for a specified application.
5. Understand and analyze various searching and sorting algorithms.

UNIT 1: (~10 Lecture Hours)

Basic concepts- Algorithm Specification, Performance Analysis- Time Complexity and Space Complexity, Asymptotic Notation-Big O, Omega and Theta notations, Introduction to Linear and Non Linear data structures. Stacks, Queues, Circular queues, Applications of stacks: Infix to Postfix Conversion, Postfix Expression Evaluation.

UNIT 2: (~9 Lecture Hours)

Linked list: Singly Linked List, Doubly Linked List, Circular linked list working and representation. Implementation of stacks and queues using linked list.

UNIT 3: (~9 Lecture Hours)

Trees: Introduction, Basic Terminology, Binary trees, Sequential and Linked representation, Operations – Insertion, Deletion and Traversal.

Hashing: Introduction, Hash functions, Collision Resolution Techniques.

UNIT 4: (~9 Lecture Hours)

Searching: Linear and binary Search methods.

Sorting: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Time complexities.

UNIT 5: (~8 Lecture Hours)

Graphs: Terminology, Properties, Graph representations – Adjacency matrix, Adjacency list. Graph traversals: Depth First Search & Breadth First Search.

Search trees: Binary search trees, Definition, Operations – Insertion and Deletion, m-way search trees (Definition only).

Text Books:

1. R. Thareja, Data Structures using C, Oxford University Press, October 2015.
2. Horowitz, Sahni, and Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.

Reference Books:

1. R.F. Gilberg and B.A. Forouzan, Data structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. A.M. Tanenbaum, Y. Langsam and M.J. Augensrein, Data Structures using C, 2004, Pearson Education Asia.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/fdsc2ed/instruct/index.html
2. www.geeksforgeeks.org/data-structures
3. https://nptel.ac.in/courses/106102064
4. https://www.coursera.org/learn/data-structures
5. https://ict.iitk.ac.in/wp-content/uploads/CS210-Data-Structures-Module-1-Motivation.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the time and space complexities of algorithms.
2. Differentiate between linear and non-linear data structures.
3. Use basic data structures such as linked list, stack and queue for data representation.
4. Understand non linear data structures like binary trees, search trees and graphs.
5. Choose appropriate data structures as applied to specified problem definition.
6. Analyze various kinds of searching and sorting techniques.

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III Year B.Tech. II-Semester **L T P C**

Course Code: 126KG **3 0 0 3**

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Understand the relational database design principles.
3. Master the basics of SQL and construct queries using SQL.
4. Understand the design databases using data modelling and data normalization techniques.

UNIT 1: (~ 10 Lecture Hours)

Introduction: History of database system**,** Database-system applications, Purpose of database systems, View of data, Database languages, Relational databases, Data storage and querying, Transaction management, Database architecture, Database users and administrators.

UNIT 2: (~ 8 Lecture Hours)

Database Design and E-R Model: The Entity-Relationship model, Constrains, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity- Relationship Design issues, Extended E-R Features.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Schema Diagrams, Relational Query Languages, Relational Operations.

UNIT 3: (~ 9 Lecture Hours)

Relational Query Languages: The Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.

Introduction to SQL : Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub Queries, Modification of the Database.

UNIT 4: (~ 9 Lecture Hours)

Advanced SQL: Join Expressions, Views, Integrity Constraints, Accessing SQL from a Programming Language, Functions and procedures, Triggers.

UNIT 5: (~ 9 Lecture Hours)

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional Dependency Theory, Algorithms for

Decompositions, Decomposition using Multi Valued Dependencies, More Normal Forms.

Text Books:

1. A. Silberschatz, Henry.F. Korth and S. Sudharshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.

Reference Books:

1. C.J. Date, A.Kannan, and S.SwamiNadhan, An Introduction to Database systems, 8th Edition, Pearson Education.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.
3. R Elmasri and Shamkant B. Navathe, Database Systems, 6th Edition, Pearson Education.

Online Resources:

1. www.w3schools.in
2. https://beginnersbook.com/2015/04/dbms-tutorial/
3. https://www.coursera.org/courses?query=database
4. https://onlinecourses.nptel.ac.in/noc18_cs15

Course Outcomes:

After completion of the course, students will be able to

1. Understand concepts and the applications of database systems and implement in real time applications.
2. Design an Entity-Relationship (E-R) model from specifications and transform to relational model.
3. Demonstrate the basic concepts of relational database management system
4. Construct unary/binary/set/aggregate queries in Relational Algebra and in SQL.
5. Articulate the SQL commands for retrieval and management of data.
6. Apply normalization on database schema.

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III Year B.Tech. II-Semester **L T P C**

Course Code: 126KK **3 0 0 3**

OPERATING SYSTEMS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Interpret the role of an Operating System in the overall computer system and study the operations performed by it as a resource manager.
2. Understand the scheduling policies and different memory management techniques for different Operating Systems.
3. Examine process concurrency, synchronization and deadlock situation.
4. Assess the concepts of I/O, storage and file management and introduce system call interface for file and process management.
5. Outline the goals and principles of protection.

UNIT 1: (~10 Lecture Hours)

Introduction: Overview-Introduction-Operating System objectives and functions, User view, System view, Operating System definition, Evolution of Operating System- Simple Batch systems, Multiprogrammed, Time-Sharing Systems, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments. Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT 2: (~9 Lecture Hours)

Process: Process concepts-The Process, Process State, Process State transitions, Process Control Block, Context Switch.

Threads: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Process Scheduling:** Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms, Multiprocessor Scheduling. Case Studies: Linux, Windows.

UNIT 3: (~10 Lecture Hours)

Process Synchronization: Inter-process Communication - Background, The Critical Section Problem, Race Conditions, Mutual Exclusion, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization - Bounded Buffer Problem, The Producer/ Consumer Problem, Reader's & Writer's Problem, Dinning Philosopher Problem, Event counters, Monitors, Message passing.

Deadlocks: Deadlocks - System Model, Deadlock Characterization - Necessary and sufficient conditions for Deadlock, Methods for Handling

Deadlocks - Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT 4: (~10 Lecture Hours)

Memory Management: Basic Hardware, Address Binding, Logical and physical address space, Dynamic loading, linking and shared libraries, Swapping, Contiguous Memory Allocation - Fixed and variable partition - Internal and External fragmentation and Compaction, Segmentation, Paging - Hardware support for paging, Protection, shared pages, Structure of Page Table, Case Studies - Linux, Windows.

Virtual Memory Management: Background, Demand Paging - locality of reference, Page fault, Copy-on- Write, Page replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT 5: (~9 Lecture Hours)

File Management: Concept of File - Attributes, operations, file types, internal structure, access methods, Directory structure, file protection, file system structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk formatting - Boot-block, Bad blocks.

Protection: System Protection, Goals of Protection, Principles of Protection.

Text Books:

1. Abraham Silberschatz, Peter B.Galvin and Greg Gagne, Operating System Concepts, 9th Edition, Wiley Asia Student Edition.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India.

Reference Books:

1. Charles Crowley, Operating System: A Design-oriented Approach, 1st Edition, Irwin Publishing.
2. Gary J. Nutt and Addison, Operating Systems: A Modern Perspective, 2nd Edition, Wesley.
3. Maurice Bach, Design of the UNIX Operating Systems, 8th Edition, Prentice Hall of India.
4. Daniel P. Bovet and Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Online Resources:

1. https://www.docdroid.net/vp5Cfdg/abraham-silberschatz-operating-system-concepts-9th201212-pdf
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

Course Outcomes:

After completion of the course, students will be able to

1. Understand fundamentals of Operating System.
2. Demonstrate the concepts of process, thread and scheduling algorithms.
3. Apply process synchronization methods to solve critical section problem.
4. Solve deadlock problems using various deadlock management techniques.
5. Compare the different memory management techniques.
6. Summarize file & disk management, protection & security concepts and evaluate the performance of disk scheduling algorithms.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KQ **3 0 0 3**

SOFTWARE ENGINEERING
(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the software life cycle models.
2. Understand the importance of the software development process.
3. Understand the importance of modeling and modeling languages.
4. Design and develop correct and robust software products.

UNIT 1: (~10 Lecture Hours)

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic view of process: Software engineering- a layered technology, A process framework, The capability maturity model integration (CMMI), Process patterns, Process assessment, Personal and team process models.

Process models: The Waterfall model, Incremental process models, Evolutionary process models, The unified process.

UNIT 2: (~9 Lecture Hours)

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models: Context models, Behavioural models, Data models, Object models, Structured methods.

UNIT 3: (~9 Lecture Hours)

Design Engineering: Design process and design quality, Design concepts, The design model.

Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural design, Conceptual model of UML, Basic structural modelling, Class diagrams, Sequence diagrams, Collaboration diagrams, Use case diagrams, Component diagrams.

Performing user interface design: Golden rules, User interface analysis, and design, Interface analysis, Interface design steps, Design evaluation.

UNIT 4: (~9 Lecture Hours)

Testing Strategies: A strategic approach to software testing, Test strategies for conventional software, Black-box and white-box testing, Validation testing, System testing, The art of debugging.

Product metrics: Software quality, Metrics for analysis model, Metrics for design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

UNIT 5: (~8 Lecture Hours)

Metrics for Process and Products: Software measurement, Metrics for software quality.

Risk management: Reactive Vs proactive risk strategies, Software risks, Risk identification, Risk Projection, Risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, Software quality assurance, Software reviews, Formal technical reviews, Statistical software quality assurance, Software reliability, The ISO 9000 quality standards.

Text Books:

1. Roger S. Pressman, Software Engineering - A Practitioner's Approach, 6th Edition, McGraw Hill Companies, Inc.
2. Sommerville, Software Engineering, 7th Edition, Pearson Education.

Reference Books:

1. Grady Booch, James Rambaugh and Ivar Jacobson, The Unified Modeling Language User Guide, 2nd Edition, Pearson Education.
2. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies, 2004.

Online Resources:

1. https://alison.com/courses/software-engineering.
2. https://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic software engineering methods along with practices, process framework and process models.
2. Analyze software requirements, SRS documents and Project Management.
3. Develop different system models that describe the functionality of the system.
4. Design and maintain efficient, reliable and cost effective software solutions and suitable software metrics.
5. Understand various software testing approaches and techniques used for software assessment.
6. Interpret the significance of Software measurement, software risks and quality control.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KD **3 0 0 3**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE
(Open Elective – 1)

Prerequisites: -Nil**-**

Course Objectives:

1. To learn the difference between optimal reasoning vs human like reasoning.
2. To understand the notions of state space representation, exhaustive search, heuristic search.
3. To learn logic programming and different knowledge representation techniques.
4. To understand the applications of AI like Game Playing and Expert Systems.
5. To introduce the concept of Intelligent agents.

UNIT 1: (~10 Lecture Hours)

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI & Applications.

Problem Solving - State-Space Search and Control Strategies, General Problem

Solving Techniques, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.

UNIT 2: (~10 Lecture Hours)

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Algorithm, Predicate Logic, Logic Programming.

UNIT 3: (~10 Lecture Hours)

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR.

Uncertainty Measure - Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT 4: (~8 Lecture Hours)

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Rule based Expert Systems, Truth Maintenance Systems, Applications of Expert Systems, List of Shells and Tools.

UNIT 5: (~10 Lecture Hours)

Introduction to Intelligent Agents: Introduction, Agents vs software programs, Classification of agents, Working of an agent, Single-agent and Multi-agent systems, Performance Evaluation of agents, Applications, Multi-Agent Application.

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

Reference Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.
2. Eugene Charniak, Introduction to Artificial Intelligence, Pearson, 2007.
3. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 1990.
4. George Fluger, Artificial Intelligence, 5th Edition, Pearson.

Online Resources:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
2. http://nptel.ac.in/courses/106105077/
3. https://onlinecourses.nptel.ac.in/noc18_cs18/preview
4. https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basics of AI and to formulate efficient problem space and select a search algorithm for a problem.
2. Apply AI techniques to solve problems related to Game playing.
3. Understand and apply Logic programming in problem solving.
4. Represent knowledge and uncertainty measures using appropriate techniques.
5. Knowledge required for developing expert systems.
6. Understand the concepts of Intelligent systems.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KE **3 0 0 3**

FUNDAMENTALS OF DATA SCIENCE

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. To be exposed with basics of data science.
2. To understand data pre-processing and data visualization methods on real world data.
3. To understand machine learning methods to develop predictive model from pre-processed data.
4. To be exposed with the working methodology of various machine learning models.
5. To know the statistical performance metrics of machine learning methods.
6. To understand the ethical way of dealing with the data and its security.

UNIT 1:(~10 Lecture Hours)

Fundamentals of Data Science - Introduction to data science, Data analytics life cycle, Type of data analysis, Types of jobs in data analytics, Data science tools, Fundamental areas of study in data science, Role of SQL in data science, Pros and cons of data science.

UNIT 2: (~10 Lecture Hours)

Data Preprocessing, Plotting and Visualization- Data types and forms, Possible data error types, Various data preprocessing operations, Introduction to data visualization, Visual encoding, Data visualization libraries, Basic data visualization tools.

UNIT 3: (~9 Lecture Hours)

Statistical Data Analysis and Machine Learning-Role of statistics in data science, Descriptive statistics, Inferential statistics, Overview of machine learning, Supervised machine learning, Regression methods, Classification methods, Unsupervised machine learning, Clustering methods, Association analysis.

UNIT 4: (~ 8 Lecture Hours)

Time-series Analysis- Overview of time-series analysis, Components of time-series, Time-series forecasting models.

UNIT 5: (~ 8 Lecture Hours)

Ethics and Data Science- The Five Cs: Consent, Clarity, Consistency and Trust, Control and Transparency, Consequences, Implementing Five Cs, Data's Day of Reckoning, Ethics and Security Training, Developing Guiding

Principles, Building Ethics into Data-drive Culture, Regulation. Recent Trends in the Domain of Data Science.

Text Books:

1. Gypsi Nandi and Rupam Kumar Sharma, Data Science Fundamentals and Practical Approaches by 1st Edition, BPB Publications India.
2. Hilary Mason and D J Patil, Ethics and Data Science by Mike Loukides, 1st Edition, O'Reilly.

Reference Books:

1. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Introducing Data Science, Latest Edition, Manning.
2. Jesus Rogel-Salazar, Data Science and Analytics with Python Latest Edition, CRC Press Taylor & Francis Group.

Online Resources:

1. http://www.biomedicahelp.altervista.org/Magistrale/Clinics/BIC_PrimoAnno/IdentificazioneModelliDataMining/Business/Intelligence/Carlo/Vercellis.pdf
2. https://learning.oreilly.com/library/view/business-intelligence-2nd/9780123858894/xhtml/Title_page.html
3. https://learning.oreilly.com/library/view/successful-business-intelligence/9780071498517/title.html
4. https://www.youtube.com/watch?v=Hg8zBJ1DhLQ
5. https://nptel.ac.in/courses/110107092
6. https://www.udemy.com/course/introduction-to-intelligence/

Course Outcomes:

After completion of the course, students will be able to

1. Design and do analysis of an enterprise datasets.
2. Apply data pre-processing and data visualization methods on real world data.
3. Apply machine learning methods to develop predictive model from pre-processed data.
4. Analyze the working methodology of various machine learning models.
5. Evaluate the statistical metrics of machine learning methods using suitable performance metrics.
6. Inculcate the ethical way of dealing with the data in a secured manner.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KP **3 0 0 3**

R PROGRAMMING

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the fundamental knowledge of' 'R' programming.
2. Learn how to carry out a range of commonly used statistical methods including analysis of variance and linear regression.
3. Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
4. Analyze and evaluate different types of plots, graphs and scripts.

UNIT 1: (~9 Lecture Hours)

Introducing R: Getting the Hand of R, Running the R Program, Finding Your Way with R, Command Packages.

Becoming Familiar with R: Reading and Getting Data into R, Viewing Named Objects, Types of Data Items, The Structure of Data Items, Examining Data Structure Working with History Commands, Saving your Work in R.
Working with Objects: Manipulating Objects, Viewing Objects within Objects, Constructing Data Objects, Forms of Data Objects: Testing and Converting.

UNIT 2: (~9 Lecture Hours)

Data: Descriptive statistics and tabulation.

Distribution: Looking at the Distribution of Data.

Simple Hypothesis Testing: Using the Student's t-test, The Wilcoxon U-Test (Mann-Whitney), Paired t- and U-Tests, Correlation and Covariance, Tests for Association.

UNIT 3: (~9 Lecture Hours)

Introduction to Graphical Analysis: Box-whisker Plots, Scatter Plots, Pairs Plots (Multiple Correlation Plots) Line Charts, Pie Charts, Cleveland Dot Charts, Bar Charts, Copy Graphics to Other Applications.

Formula Notation and Complex Statistics: Examples of Using Formula Syntax for Basic tests, Formula Notation in Graphics, Analysis of Variance (ANOVA).

UNIT 4: (~9 Lecture Hours)

Manipulating Data and Extracting Components: Creating Data for Complex Analysis, Summarizing Data.

Regression (Linear Modeling): Simple Linear Regression, Multiple Regression, Curvilinear Regression, Plotting Linear Models and Curve Fitting, Summarizing Regression Models.

UNIT 5: (~9 Lecture Hours)

More about Graphs: Adding elements to existing plots, Matrix plots, multiple plots in one window, exporting graphs

Writing your own scripts: Beginning to Program: Copy and Paste Scripts, Creating Simple Functions, Making Source Code.

Text Books:

1. Dr. Mark Gardener, "Beginning R the statistical programming language", Wiley Publications, 2015.

References Books:

1. Grolemund, Hands-On Programming with R Paperback, Garrett, SPD, 2014.
2. Michael J. Crawley, The R Book, WILEY, 2012.

Online Resources:

1. https://www.udemy.com/r/online-course
2. https://www.courseera.org/learn/r-pragramming
3. https://www.codecademy.com/learn/ learn-r

Course Outcomes:

After completion of the course, students will be able to

1. Develop and implement R analytics to create business insights of real time projects.
2. Understand the relevant data descriptions and process in R language.
3. Learn a wide range of analytical methods and produce the quality graphics.
4. Solve various real time problems using formula notation and statistics in R.
5. Evaluate different data models and perform regression analysis.
6. Explore on various ways to display results through plots and scripts.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KA **3 0 0 3**

BIOMEDICAL ELECTRONICS AND APPLICATIONS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. To acquire knowledge on basics of human physiology.
2. To study different bio electrodes, biomedical transducers and measurements of physiological parameters.
3. To deal with ECG, EEG &EMG machines, recordings and their interpretations.
4. To learn how electronic instruments works in various departments and laboratories of a hospital and solve engineering problems related to medical field.

UNIT 1: (~10 Lecture Hours)

Recording Instruments

Electro Physiology and Bio potential Recording The Origin of Bio potentials Bio potential Electrodes Biological Amplifiers ECG, EEG, EMG, PCG, EOG Lead Systems and Recording Methods Typical Waveforms and Signal Characteristics.

UNIT 2: (~10 Lecture Hours)

Measurement and Analysis Technique

Measurement of Blood Flow Radiographic Indicator Dye Dilution Thermal Convection Magnetic Blood Flow Rate Ultrasonic Blood Flow meter, Sphygmomanometer, Blood Gas Analyzer, Oximeter, Auto Analyzers, Electrophoresis, Colorimeter, Spectrophotometer, Flame Photometer.

UNIT 3: (~10 Lecture Hours)

Therapeutic Equipment's and Patient Safety

Stimulators- Defibrillators, Pacemakers, Diathermy, Respirators, Blood Pumps, Ventilator, Haemodialysis Machine Role of Laser in Health Care, Patient Safety, Macro, Micro Shock Preventive Measures, Earth Free Patient Monitoring.

UNIT 4: (~10 Lecture Hours)

Medical Imaging

X Ray Imaging and CT scan Application and X Ray Therapy CAT Scan, MRI, PET, Physics of Ultrasound, Ultrasound Imaging A Scan and B Scan, Displays Multi Array Scanning, M Mode Scanning, Advantages and Disadvantages of Ultrasound Scanning, Thermal Imaging Systems.

UNIT 5: (~8 Lecture Hours)

Computer Applications in Medical Field

Computer Applications in Medicine, Patient Monitoring System, Endoscopy Unit, Radio pill, Telemedicine and Medical Informatics.

Text Books:

1. Dr. M. Arumugam, Biomedical Instrumentation, 2nd Edition, Anuradha Publications, 2007.
2. Leslie Cromwell, F.J.Weibell, E.A.Pfeiffer, Biomedical Instrumentation and Measurements, 2nd Edition, PHI, 2004.
3. John G. Webster, Medical Instrumentation, Application and Design, 3rd Edition, John Wiley, 2001.

Reference Books:

1. L.A. Geoddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, 3rd Edition, John Wiley and Sons, 1991.
2. R.S. Khandpur, Handbook of Biomedical Instrumentation, 2nd Edition, McGraw Hill, 2003.
3. A. M. Cook and J.G. Webster(eds.), Therapeutic Medical Devices: Application and Design, Prentice Hall, 1982.
4. Arun Ghosh, Introduction to measurements and instrumentation, 3rd Edition, PHI learning, 2010.
5. W. F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical, Publishers, 1977.
6. J.J. Karr & J.M. Brown, Introduction to Biomedical Technology, 4th Edition, Pearson Publications, 2001.

Online Resources:

1. Prof. Sudipta Mukhopadhyay, Lectures on Biomedical Signal Processing, IIT KGP. https://nptel.ac.in/courses/108105101/

Course Outcomes:

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

1. Describe the functioning and recording of human physiological parameters using ECG, EEG, EMG systems.
2. Understanding the measurement of Blood pressure and Blood Flow meters.
3. Explore the applications of the electronic systems as prosthetic devices in biological and medical applications pacemakers defibrillators, Heart lung machine etc.
4. Examine the various medical imaging techniques and discuss therapeutic and assist devices.
5. Evaluate the practical limitations on electronic components while handling bio substances.
6. Illustrate the various computer aided applications in the field of medical applications.

III Year B.Tech. II-Semester **L T P C**

Course Code: 126KN **3 0 0 3**

PRINCIPLES OF COMMUNICATION TECHNOLOGIES

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Develop knowledge and understanding of the Communication Technology components.
2. Build up capacity on wireless technologies.
3. Discuss the fundamental problems in wireless networking.
4. Provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks.

UNIT 1: (~9 Lecture Hours)

Basic Concepts of Communication Technology: Data communications system components, Data Representation, Data flow: simplex, half-duplex, or full–duplex, type of Connections: Point-to-Point, Multipoint, types of physical topology, Communication models: OSI model and the TCP/IP model.

UNIT 2: (~10 Lecture Hours)

Overview of Wireless n/w. and Technologies: Introduction, Different generations. Introduction to 1G, 2G, 3G, 4G and 5G, Bluetooth, Radio frequency identification (Rfid), Wireless Broadband, Wireless network topologies, Cell fundamentals and topologies, Global system for mobile communication, GSM architecture, network aspects in GSM, GPRS network architecture, GPRS network operation.

UNIT 3: (~9 Lecture Hours)

Mobile Computing: Architecture for mobile computing, Three tier architecture, design considerations for mobile computing, mobile computing through internet, Wireless network architecture, Applications, Security, Concerns and Standards, Benefits, Future evolution of mobile computing.

UNIT 4: (~9 Lecture Hours)

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a, b, g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

UNIT 5: (~9 Lecture Hours)

Telecommunication Systems: Telephone system, difference between wireless and fixed telephone nwtworks, Paging systems, Internet Telephony. Wireless Application Protocol(WAP), 3G Spread-spectrum Technology, FHSS, DSSS, CDMA versus GSM, applications in 3G Wireless LAN, WiFi v/s 3G Voice over Internet protocol.

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, 5th Edition TMH, 2013.
2. Mobile Computing, Asoke K Telukder, Roopa R Yavagal, TMH
3. Wireless Communication and Networking – William Stallings, 2003, PHI

Reference Books:

1. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE
2. Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH.
3. Vijay Garg, Wireless Communications and Networking, Elsevier Publications, 2007.

Online References:

1. https://onlinecourses.nptel.ac.in/noc22_ee61/preview Communication Networks by Prof. Goutam Das, IIT Kharagpur
2. https://nptel.ac.in/courses/117102062/: Wireless Communication by Dr. Ranjan Bose

Course Outcomes:

After completion of the course the student will be able to

1. Interpret the basic concepts of Communication Technology.
2. Comprehend wireless technology systems.
3. Devise mobile computing architecture and its standards.
4. Summarise mobile computing security concerns and applications.
5. Classify wireless Local and Wide area networks and their specifications.
6. Differentiate 2G and 3G wireless standards.

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III Year B.Tech. II-Semester **L T P C**

Course Code: 126KR **3 0 0 3**

VERILOG HDL

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the need of Hardware Descriptive Languages.
2. Expose students to Language constructs and Conventions of Verilog HDL.
3. Design Digital Circuits using Verilog HDL.
4. Verify the Digital System Designs using Test benches.

UNIT 1: (~8 Lecture Hours)

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, Module, Testbench.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.

UNIT 2: (~8 Lecture Hours)

Gate Level Modelling: Introduction, AND Gate Primitive, Module Structure, Other gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delays, Strengths and Construction Resolution, Net Types, Design of Basic Circuits.

UNIT 3: (~10 Lecture Hours)

Modelling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignments to Vectors, Operators.

Switch Level Modelling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays', Strength Contention with Trireg Nets.

UNIT 4: (~10 Lecture Hours)

Behavioural Modelling : Introduction, Operations and Assignments, Functional Bifurcation, 'Initial' Construct, 'Always' construct, Assignments with delays, 'Wait' construct, Multiple Always Blocks, Designs at Behavioural Level, Blocking and Non-Blocking Assignments, The 'Case' statement, Simulation Flow, 'If' and 'If – Else' Constructs, 'Assign and De-Assign' Constructs, 'Repeat' Construct, For loop, The 'Disable' Construct, While Loop, Forever loop, Parallel Blocks, 'Force-Release' Construct, Event

UNIT 5: (~10 Lecture Hours)

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, File Based Tasks and Functions, Compiler Directives, Hierarchical Access, User Defined Primitives.

Text Books:

1. T.R. Padmanabhan, B. Bala Tripura Sundari, Design Through Verilog HDL, Wiley, 2009.
2. Verilog HDL-Samir Palnitkar, II Edition, Pearson Education, 2009.

Reference Books:

1. Michel D. Ciletti, "Advanced Digital Design with the Verilog HDL", PHI, 2009.
2. ZainalabdienNavabi, "Verilog Digital System Design", TMH, II Edition, 2006.

Online Resources:

1. Hardware Modelling using Verilog by Prof.Indranil Sengupta, IIT Kharagpur - https://nptel.ac.in/courses/106105165
2. System Design through Verilog by Prof.Shaik Rafi Ahamed, IIT Guwahati - https://archive.nptel.ac.in/courses/108/103/108103179/
3. Free online book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Amir Palnitkar, https://d1.amobbs.com/bbs_upload782111/files_33/ ourdev_585395BQ8J9A.pdf .

Course Outcomes:

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

1. Identify the need for hardware descriptive languages, various language Constructs and conventions of Verilog HDL.
2. Design basic digital systems using gate level and switch level HDL modelling.
3. Build digital systems at dataflow level using Verilog HDL.
4. Demonstrate the use of behavioural level modelling constructs to design digital systems.
5. Write test benches to analyze and verify the digital systems.
6. Implement digital circuits using advanced Verilog HDL constructs.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KM **3 0 0 3**

PRINCIPLES OF COMMUNICATIONS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Introduce the students to modulation and various analog modulation schemes.
2. Distinguish between Pulse, Analog and Digital Communication systems.
3. Analyze the concepts of satellite, optical communications.
4. Understand and compare cellular and telecommunication system concepts.

UNIT 1: (~8 Lecture Hours)

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT 2: (~10 Lecture Hours)

Modulation Techniques: Analog Modulation- Amplitude Modulation Fundamentals, Amplitude Modulator and Demodulator Circuits, Fundamentals of Frequency Modulation, PAM, PWM, PPM, Pulse Code Modulation techniques. Transmission of Binary data in communication system-Principles of Digital transmission, Transmission efficiency, modern concepts, wide band modulation.

UNIT 3: (~10 Lecture Hours)

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

UNIT 4: (~10 Lecture Hours)

Optical Communication: Optical Principles, Optical Communication Systems, Fiber-Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT 5: (~10 Lecture Hours)

Telecommunication Systems: Telephones Telephone system, Facsimile, Internet Telephony. Cellular Communications: Cell phone technologies-Cellular telephone systems, Mobile phone systems, Digital cell phone systems (2G, 2.5G, UMTS 3G, 4G).

Text Books:

1. Louis E. Frenzel -Principles of Electronic Communication Systems, 3rd Edition, McGraw Hill publications,2008.
2. K.Sam Shanmugam, Digital and Analog Communication Systems, JohnWiley and Sons, 2004.

Reference Books:

1. Theodore S. Rappaport, Wireless Communications-Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2nd Edition, Wiley Publications.

Online Resources:

1. https://nptel.ac.in/courses/108104098/

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the basic concepts of modulation and understand the different kinds of analog modulation techniques.
2. Understand and analyze the different types of pulse analog and digital modulation systems.
3. Describe the Telephone systems and network fundamentals.
4. Statetheoperativephysicalprincipleoflaunchingsatellitesandexplain the concept & operation of GPS.
5. Comprehend about the principle of optical communication system, functioning of optical cables and wave division multiplexing.
6. Describe the cellphone operational concepts.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KC **3 0 0 3**

ENGINEERING MATERIALS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. To impart knowledge on the concepts of Dielectric electric materials in comparison with magnetic materials.
2. To introduce special purpose materials.
3. To make students familiar with the concepts of different materials for electrical applications.
4. To familiarize students with the concepts of semiconductor materials.

UNIT 1: (~8 Lecture Hours)

Electrical Materials Introduction: Types of Materials, Properties

Dielectric materials: Types-Solid, Liquid and Gaseous dielectrics - Electric conductivity in Solid, Liquid and Gaseous dielectrics.

UNIT 2: (~8 Lecture Hours)

Semiconductor Materials

Types of semiconductors, properties, Doping Techniques, - Current carriers in Semiconductor- Photoconductors, Characteristics.

UNIT 3: (~8 Lecture Hours)

Magnetic Materials

Classification of Magnetic Materials, Properties, Curie point, Magnetically soft and hard Materials- Feebly Magnetic Materials, Cermet Permanent Magnets, Ageing of Magnets - Factors effecting Permeability and Hysteresis.

UNIT 4: (~8 Lecture Hours)

Special Purpose Materials

Refractory Materials, Radioactive Materials, Insulating varnishes and coolants, Properties and Applications of mineral oils, Testing of Transformer Oil as per BIS, IEC.

UNIT 5: (~8 Lecture Hours)

Materials for Specific Applications

Materials for solar cells and battery, Materials for coatings for enhanced solar thermal energy collection, Cold Mirror Coatings, Heat Mirror Coatings, Antireflection Coatings.

Text Books:

1. R K Rajput, A course in Electrical Engineering Materials, Laxmi Publications, 2009.
2. C S Indulkar and S Thiruvengadam, An introduction to Electrical Engineering Materials, Revised Edition, S. Chand & Company, 2013.
3. T K Basak, A course in Electrical Engineering Materials, New Age Science Publications, 2009.

Reference Books:

1. A.J. Dekker, Electrical Engineering Materials, PHI Publication, 2006.
2. TTTI Madras, Electrical Engineering Materials, McGraw Hill Education, 2004.

Course Outcomes:

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

1. Distinguish between different types of materials by virtue of their properties.
2. Categorize & analyze Dielectric and semiconductor materials.
3. Classify the magnetic materials using their properties.
4. Differentiate & identify special-purpose materials for electrical applications.
5. Identify special-purpose materials for non-electrical applications.
6. Analyze the working of materials from the point of view of specific applications in electrical & other fields.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KL **3 0 0 3**

OPERATIONS RESEARCH

(Open Elective – 1)

Prerequisites: -Nil-

Course objectives:

1. Define and formulate linear programming problems and appreciate their limitations.
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. Develop mathematical skills to analyze and solve dynamic programming models arising from a wide range of applications
4. Help students develop the ability to make informed decisions based on quantitative analysis.

UNIT 1: (~10 Lecture Hours)

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem-Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M methods, Special cases in LP-Degeneracy, unbounded, infeasibility & alternative optima.

UNIT 2: (~9 Lecture Hours)

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions-Northwest corner rule, least cost method and Vogel's approximation method. Optimality test by MODI method & stepping stone method.

UNIT 3: (~9 Lecture Hours)

a) Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced Assignment problem.

b) Sequencing models: Solution of sequencing Problem-Processing n jobs through 2 Machines-Processing n jobs through 3 Machines-Processing n jobs through m Machines. Processing 2 jobs through m-machines.

UNIT 4: (~10 Lecture Hours)

a) Dynamic programming: Characteristics of dynamic programming. Dynamic programming approach for Coach/Shortest Path and cargo loading problems.

b) Inventory models: Inventory costs. Models with deterministic demand-model (a) demand rate uniform and production rate infinite, model (b) demand rate uniform and production rate finite.

UNIT 5: (~10 Lecture Hours)

a) **Games Theory:** Competitive games rectangular game saddle point, minimax (maximin) method of optimal strategies, and value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point-mixed strategy for 2*2 games.

b) **Replacement Models:** Replacement of Items that deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly: individual replacement policy, group replacement policy.

Text Books

1. S.D.Sharna, operations research theory methods and applications, 2020th edition, Kedar Nath Ram Nath, 2014.
2. J K Sharma.,Operations Research, theory and applications, 6th edition, Macmillan India Ltd, 2017.

Reference Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. F.H. Hillier and G.J. Lieberman, Introduction to Operations Research, Tata-McGraw-Hill, 2010.

Online Resources:

1. Website/ Materials: IOR Tutorials (Interactive Operations Research Tutorial)
2. Onlinecourses.nptel.ac.in

Course Outcomes:

At the end of the course students are expected to

1. Apply linear programming models to several Engineering Applications.
2. To use several other techniques like Transportation, Assignment, and Sequencing Models in the real world applications.
3. In Dynamic Programming selected models were taught.
4. Apply simple mathematical models in Inventory into the real Engineering Applications.
5. Solve Game theory problems related to business applications
6. Develop optimum replacement policy.

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III Year B.Tech. II-Semester **L T P C**

Course Code: 126KJ **3 0 0 3**

INTRODUCTION TO DATA ANALYTICS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. To learn the importance of data and its types.
2. To understand Regression Analysis and Multi Variate Data.
3. To gain a basic knowledge on Machine learning.
4. To study Non-Linear Optimization Techniques.

UNIT 1: (~9 Lecture Hours)

Fundamentals of Data Analytics: Role of data analytics in science and engineering, types of data and data summarization methods, levels of measurement, data storytelling, data journalism, data warehousing.

UNIT 2: (~6 Lecture Hours)

Simple-Linear Regression: Simple Linear regression model, estimate regression coefficients, properties of least square estimators, estimation of σ^2, confidence intervals and test for β_0 & β_1, ANOVA, Coefficient of determination.

UNIT 3: (~9 Lecture Hours)

Multiple Linear Regression: Multiple Linear Regression using Matrix Method-Test for significance for Regression coefficients-ANOVA, Regularization methods- LASSO, RIDGE, and Elastic nets.

UNIT 4: (~12 Lecture Hours)

Foundation for Machine learning:

Machine learning Techniques- Overview, Introduction to Multivariate data, Principal Component Analysis, Dimensionality reduction -Linear Discriminant Analysis -Naive -Baye's classification, Hierarchical (Agglomerative) clustering, Non-Hierarchical clustering (K-means algorithm).

UNIT 5: (~9 Lecture Hours)

Non-Linear Optimization Techniques:

Problem Formulation for Nonlinear Programming, Unconstrained optimization (Hessian Matrix Method), Constrained multivariate optimization with equality constraints (Lagrangian Multipliers Technique), Constrained Multivariate optimization with inequality constraints (Kuhn Tucker conditions).

Text Books:

1. S.P.Gupta, Statistical Methods , Sultan Chand & Sons, 46th Edition
2. Galit Shmueli Peter C. Bruce Inbal Yahav Nitin R. Patel Kenneth C. Lichtendahl Jr. Data Mining for Business Analytics Concepts, Techniques, and Applications in R, Wiley Publications
3. Operations Research by Er. Prem Kumar Gupta, Dr. D. S. Hira, S. Chand Publications.

Reference Books:

1. Montgomery, Douglus C., and George C.Runger. Applied Statistics and Probability for Engineers John Wiley & Sons 2010.
2. Tang-Ning-Tan, Micheal-Steinbach, Vipin Kumar, Anuj Karpatne, Introduction to Data Mining, Pearson India Education Services Ltd. (2016)
3. Roxy Peck,San Luis Obispo, Iowa Jay L. Devore ,Introduction to Statistics and Data Analysis, Cengage Learning, 5th Edition.
4. Cole Nussbaumer Knaflic, Story Telling with Data, wiley Publications.
5. Hiller and Lieberman, Introduction to Operation Research, McGraw Hill Higher Education, 7th edition.

Online Resources:

1. E-book on Multivariate Data Analysis. https://www.drnishikantjha.com/papersCollection/Multivariate%20Data%20Analysis.pdf
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119296294
3. nptel.ac.in/courses/ Introduction to Data Analytics

Course outcomes:

After completing the course, the student will be able to

1. Understand the definitions and concepts associated with Data Analysis.
2. Determine the Simple Linear regression coefficient and test the significance.
3. Estimate the Multiple Linear regression coefficient and test the significance.
4. Implement the knowledge of Multivariate data and regularization methods.
5. Acquire basic concepts in Machine learning.
6. Learn about Optimization techniques.

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III Year B.Tech. II-Semester **L T P C**

Course Code: 126KH **3 0 0 3**

INTELLECTUAL PROPERTY RIGHTS

(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:

1. Educate the importance of IPR in Engineering
2. Enlighten the various types of IP's and their protection.
3. Maintain IPR's for Business sustainability.

UNIT 1: (~09 Lecture Hours)

Introduction to Intellectual property

Intellectual property: Introduction – Features - Types of Intellectual property - Importance of Intellectual property rights - International organizations - Agencies and treaties, Conventions.

UNIT 2: (~08 Lecture Hours)

Patents

Patents: Concept of Patent – Duration – Patent Process – Patent searching – Procedure for filing of Patents - Ownership, Transfer, Assignment and Licensing of Patent – Remedies for Infringement of Patents.

UNIT 3: (~10 Lecture Hours)

Copyrights and Trademarks

Copyrights – Fundamental of Copyright law - Originality of material- Rights of Reproduction - Rights to perform the work publicly - Copyright Ownership issues - Copyright registration - Notice of Copyright - Remedies for infringement in Copyrights.

Trademarks – Purpose and functions of Trademarks - Acquisition of Trademark rights - Protectable matter - Selecting and evaluating Trademark - Trademarks registration process – Remedies for infringement in Trade marks.

UNIT 4: (~08 Lecture Hours)

Industrial Designs

Industrial Designs – Importance of Industrial Design – Essential requirement of Registration – Registration Process of Industrial Designs – Benefits of registration – Assignment, Transmission and Licensing of Industrial Designs - Remedies for infringement of Designs.

UNIT 5: (~10 Lecture Hours)

Trade Secrets

Trade Secrets – Trade secret law – Determinants of Trade secret status - Liability for misappropriation of Trade Secrets – Protection for submission -

Trade secret litigation – Unfair competition – Interface between Intellectual Property Rights and Competition – Safeguards against Unfair competition. **Intellectual property audits –** Types of IP Audit – Procedure of Preparing Audit – Auditing IP Assets.

Text Books:

1. Deborah. E. Bouchoux (2015) Intellectual property right, 4th Edition, Cengage learning.
2. Prabuddha Ganguli (2017) Intellectual property right – Unleashing the knowledge economy, 4th Edition,Tata McGraw Hill Publishing company ltd.

Reference Books:

1. S.P Satarkar (2003) Intellectual Property Rights and Copyrights, Ess Ess Publications.
2. Kompal Bansal, Parikshit Bansal (2020) Fundamentals of Intellectual property for Engineers, BS Publications.

Online Resources:

1. Introduction on Intellectual Property to Engineers and Technologists https://nptel.ac.in/courses/109105112/

Course Outcomes :

After learning the contents of this course, the student must be able to

1. Understand the dynamics and legalistic framework of IPR
2. Acquaint the procedure of securing patents and its procedure.
3. Acquire information and make use of Copy right protection.
4. Examine the eminence of trade marks in growth of Business.
5. Identify the importance of safeguarding Industrial designs.
6. Sustain Trade Secrets and aspects of IP audit.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KB **3 0 0 3**

DISASTER MANAGEMENT
(Open Elective – 1)

Prerequisites: -Nil-

Course Objectives:
1. To introduce the basic concepts in Disaster Management.
2. To explain the different types of natural and manmade disasters.
3. To provide the information on Disaster Management Mechanism.
4. To introduce the concept of capacity building, safety in industries.
5. To provide an overview on the roles of national and international cooperation in disaster management.
6. To explain the application of spatial technologies in disaster management.

UNIT 1: (~9 Lecture Hours)

Introduction to Disaster Management: Introduction – Hazard, Disaster, Vulnerability, Risk, Capacity Building, Environmental Hazard, Disaster and Stress, Disaster Phenomena and Events (Global, National and Regional).

Classification - Natural and Man-made Hazards (Planetary, Extra Planetary, Endogenous and Exogenous Hazards). Climate Change Impact – (Global Warming, Ozone Layer Depletion, Deforestation, Forest Fires).

UNIT 2: (~9 Lecture Hours)

Planetary and Extra Planetary Hazards: Endogenous Hazards and Exogenous Hazards. **Earthquakes, Landslides, Volcanic Eruptions –** Causes, Effects, distribution, human adjustment, perception and mitigation measures

Cyclones, Floods, Droughts, Cold Waves and Heat Waves - Causes, Effects, distribution, human adjustment, perception and mitigation measures.

Extra Planetary Hazards and Disasters – Asteroids, Meteoroids, Meteors, Meteorites.

Man Induced Hazards and Disasters – Nuclear Hazards (Chernobyl), Industrial/ Chemical – (Bhopal Gas Tragedy), Biological – (Covid-19), Road and Rail Accidents, Plane Crash.

UNIT 3: (~8 Lecture Hours)

Disaster Management Mechanism: Disaster Management Cycle – Prevention, Mitigation, Preparedness, Response, Recovery and Rehabilitation. Planning for Relief. Concepts of Risk Management and Crisis Management – (Risk Reduction and Survival Strategies).

UNIT 4: (~9 Lecture Hours)

Disaster Risk Reduction (DRR) - Structural and Non-Structural Measures; Risk Analysis, Vulnerability and Capacity Assessment; Early Warning Systems, Post Disaster Environmental Response (Water, Sanitation, Food Safety, Waste Management, Disease Control, Security, Communications); Roles and Responsibilities of Government, Community, Local Institutions, NGOs and other Stakeholders; Policies and Legislation for Disaster Risk Reduction, Industrial Safety Plan.

UNIT 5: (~9 Lecture Hours)

National & International Co-Operation in Disaster Management: DRR Programmes in India and the activities of National Disaster Management Authority, Role of NDMA, NDRF, NIDM in Disaster Management, NDMA Guidelines, Disaster Management Act, 2005 and National Policy on Disaster Management, 2009, The National Disaster Management Plan, 2016, Organizational Structure for Disaster Management. Global Framework for Disaster Risk Reduction (Sendai Framework, Paris Agreement, Sustainable Development Goals, Hyogo Framework, Yokohoma Strategy on Disaster Risk Reduction). Bilateral Agreements, Use of latest technologies – Remote Sensing (RS) and Geological Information System (GIS).

Text Books:

1. Manual on Disaster Management, National Disaster Management Agency, Govt of India.
2. Disaster Management by Mrinalini Pandey, Wiley, 1st Edition, 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Private Limited, 2015.
4. Disaster Mitigation: Experiences and Reflections by Pradeep Sahni, PHI Learning Private Limited, 2010.
5. Natural Hazards and Disasters by Donald Hyndman and David Hyndman - Cengage Learning, 2006.
6. UNEP – Disaster Risk Reduction - https://www.unep.org/explore-topics/disasters-conflicts/what- we-do/risk-reduction

Reference Books:

1. Earth and Atmospheric Disasters Management by N. Pandharinath, CK Rajan, BS Publications, 2009.
2. Environmental Geography by R. B. Singh, Heritage Publishers, New Delhi, 1990.
3. Environmental Geography by Savinder Singh, Prayag Pustak Bhawann, 1997.
4. The Environment as Hazards by B. I. Kates and G. F. White. Oxford Press, New York, 1978.

5. Disaster Management by R. B. Singh, Rawat Publication, New Delhi, 2000.
6. Disaster Management by H. K. Gupta, Universities Press, India, 2003.
7. Space Technology for Disaster Mitigation in India (INCED) by R. B. Singh, University of Tokyo, 1994.
8. Disaster Management in Hills by Satender, Concept Publishing Co., New Delhi, 2003.
9. An Overview on Natural and Manmade Disaster and their Reduction by R. K. Bhandani, CSIR, New Delhi.
10. Manuals on Natural Disaster Management in India by M. C. Gupta, National Centre for Disaster Management, IIPA, New Delhi, 2001.

Web Resources:

- National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf).
- National Institute of Disaster Management (NIDM) (https://nidm.gov.in)
- WHO–Disaster Management Resources- https://www.who.int/surgery/publications/immesc_disaster_management/en/

Online Courses:

- https://swayam.gov.in/courses/4983-disaster-management
- https://reliefweb.int/training/2455444/free-online-course-disaster-risk-reduction-and-management
- https://www.unisdr.org/we/inform/events/47107
- https://www.futurelearn.com/courses/disaster-management/2
- https://www.ifrc.org/en/get-involved/learning-education-training/certified-professional- development-courses/online-certificate-programme-in-disaster-management/

Course Outcomes:

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

1. Explain and differentiate disasters and their vulnerabilities - causes, impacts and mitigation measures.
2. Articulate the disaster management mechanism in natural and man induced disasters.
3. Design Industrial Safety Plan for Industrial Hazards.
4. Plan and implement for the Disaster Risk Reduction.
5. Prepare disaster management plan for specific disasters with the help of national and international agencies.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KY **3 0 0 3**

INTERNET OF THINGS
(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:
1. To introduce the terminology, technology and its applications.
2. To introduce the concept of M2M (machine to machine) with necessary protocols.
3. To introduce the Python Scripting Language which is used in many IoT devices.
4. To introduce the Raspberry Pi platform, that is widely used in IoT applications.
5. To introduce the implementation of web based services on IoT devices.

UNIT 1: (~9 Lecture Hours)
Introduction to Internet of Things-Definition and Characteristics of IoT, Physical Design of IoT-IoT Protocols, IoT Communication Models, IoT Communication APIs. IoT enabled Technologies- Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs-Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT 2: (~9 Lecture Hours)
IoT and M2M-Software Defined Networks, Network Function Virtualization, Difference between SDN and NFV for IoT Basics of IoT System Management with NETCONF, YANG-NETCONF, YANG, and SNMP NETOPEER.

UNIT 3: (~9 Lecture Hours)
Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, Modules, packaging, File Handling, Date/Time Operations, Classes, Exception handling Python packages -JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT 4: (~9 Lecture Hours)
IoT Physical Devices and Endpoints-Introduction to Raspberry Pi-Interfaces (serial, SPI, I2C) Programming-Python program with Raspberry Pi with focus of interfacing external gadgets, Controlling Output and Reading input from pins.

UNIT 5: (~9 Lecture Hours)

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Web server – Web server for IoT, Cloud for IoT, Python web application framework, Designing a REST ful web API.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson and Shawn Wallace, Getting Started with RaspberryPi, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Reference Books:

1. David, Hanes and Salgueiro Gonzalo, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Pearson 2017.
2. Dirk Slama and Frank Puhlmann, Enterprise IoT: Strategies and Best Practices for Connected Products and Servicesby 2015.

Online Resources:

1. https://www.tutorialspoint.com
2. https://www.edureka.co
3. https://www.onlinecourses.nptel.ac.in

Course Outcomes:

After completion of the course, students will be able to

1. Understand the IoT Systems.
2. Apply the concept of M2M (machine to machine) with necessary protocols.
3. Create programs using python scripting language in IoT devices.
4. Build programs for Raspberry Pi interfaces.
5. Choose to communicate with IoT Systems through web-interface.
6. Apply IoT principles for domain specific applications.

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IV Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: 127KT	**3**	**0**	**0**	**3**

CYBER SECURITY

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To familiarize various types of cyber-attacks and cyber-crimes, Laws and IT Acts.
2. To study the defensive techniques against Cyber attacks.
3. To explore various security challenges faced by mobile workforce and their implications under Cybercrime.
4. To determine various web threats faced by organizations and understand about Social Media Networking.
5. To understand various data privacy issues and role of Cyber Forensics.

UNIT 1: (~9 Lecture Hours)

Introduction to Cybercrime: Introduction, Cybercrime – Definitions and origins of the word, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000 - Hacking and the Indian Law(s), A Global Perspective on Cybercrimes – Cybercrime and the Extended Enterprise.

UNIT 2: (~9 Lecture Hours)

Cyber Offenses: How Criminals Plan Them: Introduction – Categories of Cybercrime, How Criminals plan the Attacks – Reconnaissance, Passive Attacks, Active Attacks, Scanning and Scrutinizing Gathered Information, Attack, Social Engineering, Cyber stalking – Types, Cases reported on Cyberstalking, Working of Stalking, Real-Life incident of Cyberstalking, Cybercafé and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT 3: (~9 Lecture Hours)

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones.

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT 4: (~9 Lecture Hours)

Privacy Issues

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

UNIT 5: (~9 Lecture Hours)

Cyber Security: Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications. **Social Media marketing:** Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Cyber Forensics:

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Text Books:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B.B.Gupta,D.P.Agrawal,HaoxiangWang,ComputerandCyberSecurity: Principle s, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

Reference Books:

1. James Graham, Richard Howard and Ryan Otson, Cyber Security Essentials, CRC Press.
2. Chwan-Hwa (john) Wu and J.David Irwin, Introduction to Cyber Security, CRC Press T&F Group.

Online Resources:

1. https://www.open.edu/openlearn/futurelearn/cyber-security
2. https://cloudian.com/guides/data-protection/data-protection-and-privacy-7-ways-to-protect- user-data/
3. https://www.cybersecurityeducation.org/resources/
4. https://onlinecourses-swayam2-ac- in.translate.goog/nou19_cs08/preview?_x_tr_sl=en&_x_tr_tl=ta&_x_tr_hl=ta&_x_tr_pto=sc
5. https://www.mygreatlearning.com/academy/learn-for-free/courses/cyber-forensics

Course Outcomes:

After completion of the course, students will be able to

1. Understand the evolution of Internet in the context of emerging Cyber threats and their laws.
2. Distinguish the forms of Cybercriminal activities and Social Engineering methods used to undertake crimes.
3. Understand the Security challenges posed by mobile and wireless devices.
4. Define privacy policies and their specifications.
5. Apply risk management policies to protect organization's critical information and forensically investigate security incidents.
6. Understand real time cybercrimes to assess the scenarios in India, Global and Legal Perspectives.

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IV Year B.Tech. I-Semester **L T P C**

Course Code: 127KZ **3 0 0 3**

MACHINE LEARNING BASICS

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To be able to identify machine learning problems corresponding to different applications.
2. To understand a various machine learning algorithms along with their strengths and weaknesses.
3. To understand the basic theory underlying machine learning.
4. To Introduce Decision Tree learning, Instance Based Learning techniques.

UNIT 1: (~10 Lecture Hours)

Introduction: Well posed learning problems, designing a learning system Perspectives and issues in machine learning.

Concept Learning: Concept learning task, Concept Learning as search through a hypothesis space, Finding maximally specific hypothesis, Version spaces and the Candidate-Elimination algorithm, Inductive Bias.

UNIT 2: (~10 Lecture Hours)

Decision Tree Learning: Decision Tree representation, appropriate problems for Decision Tree Learning, Hypothesis space search in Decision Tree Learning,Issues in Decision Tree Learning.

Neural Network Learning: Introduction, The Neuron Model, Activation Functions, Neural Network Architecture: Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks.

UNIT 3: (~9 Lecture Hours)

Support Vector Machines: Introduction, Linear Classifier, Non-linear Classifier, Training SVM, Support Vector Regression.

Bayesian Learning: Bayes theorem and concept learning, Minimum Description Length Principle, Bayes optimal classifier, Gibbs Algorithm, Naïve Bayes Classifier, The EM algorithm.

UNIT 4: (~ 8 Lecture Hours)

Computational Learning Theory: Sample complexity for finite and infinite hypothesis spaces, Mistake bound model.

Instance – Based Techniques: K-nearest neighbor Learning, Locally Weighted Regression, Radial Basis Function, Case Based reasoning, Remarks on Lazy vs Eager learning.

UNIT 5: (~ 8 Lecture Hours)

Genetic Algorithm: Biological motivation, Representing Hypothesis, Genetic Operators, Fitness function and selection, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, Edition 2013

Reference Books:

1. Saroj Kaushik, Artificial Intelligence, CENGAGE Learning, 2011.
2. Trevor Hasti, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, 2nd Edition, Springer Series in Statistics, 2001.
3. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Online Resources:

1. http://www.cs.cmu.edu/~tom/
2. http://www.holehouse.org/mlclass/

Course Outcomes:

After completion of the course, students will be able to

1. Gain Knowledge on the basic theory in machine learning
2. Understand machine learning problems corresponding to different applications.
3. Identify machine learning techniques appropriate to respective problems.
4. Compare various machine learning algorithms along with their strengths and weaknesses.
5. Analyze the machine learning algorithms under supervised and unsupervised paradigms.
6. Apply different learning algorithms to solve problems of moderate complexity.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KU **3 0 0 3**

DATA VISUALIZATION USING PYTHON

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To understand the basics and data pre-processing techniques of data visualization.
2. Learn various techniques for visualization of data.
3. To draw the plots and learn how to customize them.
4. To Plot charts with images and maps.
5. To design the right plot to understand the data.

UNIT 1: (~ 8 Lecture Hours)

Introduction to Data & Visualization: Data foundations – Types of Data – Nominal, Ordinal, Interval, Ratio Scaled.

Data Pre-processing: Why Pre-process the data? Descriptive Data Summarization – Measuring the Central Tendency, Measuring the Dispersion of Data – Ratio scaled.

UNIT 2: (~ 8 Lecture Hours)

Visualizing Data: Mapping Data on to Aesthetics and Types of Data, Scales Map Data values on to Aesthetics,

Drawing your first plot and customizing them: Defining plot types – Bar, Line, and stacked charts. Defining plot line styles, properties, and format strings. Adding a legend and annotations. Making histograms, making pie charts count, Plotting with filled areas.

UNIT 3: (~10 Lecture Hours)

More plots and Customization: Adding a data table to the figure, using subplots, filling an under-plot area.

Plotting charts with images: Processing images with PIL, plotting with images, displaying an image with other plots in the figure.

UNIT 4: (~ 9 Lecture Hours)

Plotting charts with Maps: Plotting data on a map using base map, plotting data on a map using google API, Generating CAPTCHA images.

Using Right plots to understand the Data: Using scatter plots and histograms, plotting the cross correlations between two variables, importance of auto correlation.

UNIT 5: (~ 9 Lecture Hours)

Making 3D visualizations: Creating 3D bars and Creating 3D Histograms. **Case Studies on Data Visualization using Python:** Visualizations in python on sales data, any other case study on real time dataset.

Text Books:

1. Igor Milovanovic, Python Data Visualization Cookbook, PACKT publishing, 2013.
2. Claus O. Wilke, Fundamentals of Data Visualization, First Release Edition, O'Reilly Publication.

Reference Books:

1. Daniel Keim, Georges Grinstein and Matthew O. Ward, Interactive Data Visualization Foundations, Techniques, and Applications, Natick, Massachusetts: A K Peters, Ltd.
2. Kieran Healy, Data Visualization: A Practical Introduction, 1st Edition, Princeton University Press.
3. Edward R. Tufte, The Visual Display of Quantitative Information, 2nd Edition, Graphics Press.

Online Resources:

1. https://clauswilke.com/dataviz/
2. https://www.coursera.org/learn/python-for-data-visualization

Course Outcomes:

After completion of the course, students will be able to

1. Understand fundamental computer knowledge in the visualization process and pre-processing of the data.
2. Analyze the tools for creating, importing & exporting data, and generate reports using different chart types.
3. Able to design plots and how customize them.
4. Knowledge on visualizing images, maps and generating CAPTCHAs.
5. Understand the data and choose correct visualization to that.
6. Able to apply data visualization techniques on real-time datasets.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KV **3 0 0 3**

SENSORS AND ACTUATORS

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To create a conceptual understanding of the basic principles of sensors, actuators, and their operations.
2. To promote awareness regarding recent developments in the fields of sensors and actuators
3. To provide an idea of strengths and weaknesses of the various types of sensors and actuators.
4. To analyze different types of Sensors, Pneumatic, Hydraulic, and Micro actuators.

UNIT 1: (~ 10 Lecture Hours)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor.

Types: Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors.

UNIT 2: (~ 9 Lecture Hours)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Resistance Change Type Thermometric Sensors.

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto-resistive Sensing, Semiconductor Magneto-resistors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers.

UNIT 3: (~ 9 Lecture Hours)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, Automation.

UNIT 4: (~ 9 Lecture Hours)

Actuators: Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator;

cylinder, rotary actuators. Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.

UNIT 5: (~ 9 Lecture Hours)

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic-Linear, Rotary, Resonant, Electro Hydrodynamic Magnetic- Thermo magnetic, Magnetostatic micro actuators.

Text Books:

1. D. Patranabis, Sensors and Transducers, Prentice Hall India Pvt., 2nd Ed, 2021.
2. Massood Tabib and Azar, Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures, First edition, Kluwer academic publishers, Springer, 1997.
3. Manfred Kohl, Shape Memory Actuators, first edition, Springer.

Reference Books:

1. Robert H Bishop, The Mechatronics Hand Book, CRC Press, 2002.
2. Clarence W. De Silva, "Sensors and Actuators Engineering System Instrumentation", Taylor & Francis Ltd, 2nd Ed,2015.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview
2. https://nptel.ac.in/courses/108108147

Course Outcomes:

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

1. List the different types of sensors and actuators based on their working principle.
2. Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics
3. Interpret the functional principles of sensors and actuators.
4. Demonstrate the working operations, strengths, and weaknesses of the various types of sensors and actuators.
5. Distinguish different types of sensors and actuators based on their mathematical model.
6. Select the relevant Sensors, Pneumatic, Hydraulic and Micro actuators for real-time advanced applications.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KW **3 0 0 3**

ELEMENTS OF SATELLITE COMMUNICATIONS

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. Acquire foundation in orbital mechanics for the satellites with Applications of satellite Communication.
2. Provide basic knowledge of Satellite Sub Systems.
3. Familiarize basic knowledge of Link Design of Satellite.
4. Understand Earth Station Technology.
5. Understand the concepts of LEO , GEO stationary Satellite systems.

UNIT 1: (~ 10 Lecture Hours)

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.
Orbital Mechanics: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Orbital Effects in Communication Systems Performance.

UNIT 2: (~ 10 Lecture Hours)

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

UNIT 3: (~ 8 Lecture Hours)

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

UNIT 4: (~ 8 Lecture Hours)

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

UNIT 5: (~ 12 Lecture Hours)

Low Earth Orbit and Non Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

Text Books:

1 Satellite Communications – Timothy Pratt, Jeremy Allnutt, WSE, Wiley Publications, 3rd Edition, 2019.

2 Satellite Communication by Robert M. Gagliardi, CBS Publisher, 1st Edition 2019.

3. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Reference Books:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication – D.C Agarwal, Khanna Publications, 5th Edition 2008.
3. Satellite Communications: Concepts and Applications – K.N. Raja Rao, PHI, 2nd Edition 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 4th Edition, 2009.

Online Resources:

1. UCLA University EC ENGR X 422.19 https://www.uclaextension.edu/engineering/electrical- computer-engineering/course/satellite-communication-system-design-ec-engr-x
2. MIT Open courseware https://ocw.mit.edu/courses/16-851-satellite-engineering-fall- 2003/resources/l2_orbital_mech/

Course Outcomes:

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

1. Understand basic concepts and frequency allocations for satellite communication, orbital mechanics.
2. Envision the satellite sub systems with the Knowledge of Multiple beam focusing.
3. Familiarize the concept of G/T ratio
4. Analyze in design of satellite links for specified C/N.
5. Understand Earth station technologies.
6. Know the concepts of LEO, NGSO Satellite Systems with High Throughput.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127LC **3 0 0 3**

TELECOMMUNICATION SWITCHING SYSTEMS

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To expose through the evolution of switching systems from electromechanical systems to stored program controlled digital systems.
2. To provide knowledge to the students regarding design and analysis of electronic space division switching systems.
3. To provide knowledge to the students regarding design and analysis of time division switching systems.
4. To inculcate students on various traffic engineering concepts.
5. To inculcate students on various switching techniques used in Telecommunications.

UNIT 1: (~10 Lecture Hours)

Telecommunication Switching Systems: Introduction, Evolution of Telecommunications, Basics of a switching system, Crossbar Switching, Principles of Crossbar Switching, Crossbar Switch Configuration, Crosspoint Technology, Crossbar Exchange Organization.

UNIT 2: (~8 Lecture Hours)

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced services, Two-Stage Networks, Three-Stage Networks.

UNIT 3: (~8 Lecture Hours)

Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching, n - Stage Combinational Switching.

UNIT 4: (~10 Lecture Hours)

Telecommunications Traffic : Introduction, The Unit of Traffic, Congestion, Traffic Measurement, A Mathematical Model, Lost-Call Systems, Theory, Traffic Performance, Loss Systems in Tandem, Use of Traffic Tables, Queuing Systems, The Second Erlang Distribution, Probability of Delay.

UNIT 5: (~10 Lecture Hours)

Circuit Switching and Packet Switching: Switching Networks, Circuit Switching Networks, Circuit Switching Concepts, Packet Switching Principles.

Virtual Circuit Switching: Global Addressing, Virtual Circuit Identifier, Three Phases, Data Transfer Phase, Setup Phase, Teardown Phase.

Text Books:

1. Thyagarajan Viswanathan, Tele Communication Switching System and Networks, PHI, 2000.
2. J. E Flood, Telecommunications Switching and Traffic Networks, Pearson Education, 2006.
3. William Stallings, Data and Computer Communications, Seventh Edition, TMH, 2003.

Reference Books:

1. Behrouz A.Forouzan, Data Communications and Networking, Third Edition, TMH.
2. Achyut. S.Godbole, Data Communications & Networks, TMH, 2004.
3. H. Taub & D. Schilling, Principles of Communication Systems, 2nd Edition, TMH, 2003.
4. S.Keshav, An Engineering approach to computer networking, Addison Wesely.

Online References:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/0471208051
2. https://en.wikipedia.org/wiki/Telecommunication

Course Outcomes:

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

1. Understand the evolution of telecommunication systems, advancements in telecommunications, classification of switching systems as well as the basics of switching systems.
2. Analyse the principles and various configurations of Crossbar Switching considering factors like switching capacity and switching elements.
3. Analyze electronic space division switching, Two-Stage Networks, and Three-Stage Networks, considering factors like switching capacity, switching elements and blocking probability.
4. Understand various configurations of time division switching and combination of both Space Switching and Time Switching to achieve improved efficiency and flexibility.
5. Apply mathematical models to measure telecommunication traffic, predict congestion, and assess network performance, considering factors like call loss and queuing systems.
6. Develop an understanding of various switching techniques like Circuit switching, Packet switching and Virtual Circuit Switching.

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IV Year B.Tech. I-Semester **L T P C**

Course Code: 127LA **3 0 0 3**

RENEWABLE ENERGY SOURCES

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To understand various renewable energy resources available at a location and assessments of its potential, using tools and techniques.
2. To create awareness on Solar energy radiation, its interactions, measurement and estimation.
3. To study site selection for wind turbines, wind systems, measurements and instrument.
4. To acquire knowledge on Geothermal, wave, tidal and OTEC resources, site selection.

UNIT 1: (~7 Lecture Hours)

Introduction: Definitions, Concepts and limitations of RES Criteria for assessing the potential of NCES, Classification of RES- Solar-Wind-Geothermal- Biomass- Ocean energy sources, Comparison. **Solar energy**: Solar radiation spectrum - Extra-terrestrial and terrestrial solar radiation, solar constant, Measurement of solar Radiation -Pyranometer, Pyrheliometer, sunshine recorder.

UNIT 2:(~9 Lecture Hours)

Solar Energy Collection, **Storage and Applications**: Energy Collection: Flat plate and Concentrating collectors, Classification of Concentrating collectors.

Energy Storage: Definition of Sensible heat, Latent heat, Stratified storage - Solar ponds - Applications.

Solar Photovoltaic Generation (elementary treatment only): PV Generation, Photovoltaic energy conversion – Operating principle, Photovoltaic cell concepts, Cell, module, array, Series and parallel combinations, Potential in India.

UNIT 3: (~9 Lecture Hours)

Wind energy (elementary treatment only): Power in Wind, Betz criteria, Types of wind mills, Aerodynamics of wind energy -basic components of wind energy systems, Potential in India.

Bio-energy: Biomass resources ,Bio-Conversion Technologies -Densification-Combustion and Incineration -thermo-chemical -Bio chemical – Aerobic &Anaerobic digestion -ethanol fermentation Types of Bio-gas plants-floating drum and fixed dome type.

UNIT 4: (~9 Lecture Hours)

Geothermal energy: Structure of Earth's Interior-Geothermal Resources - Hydro thermal resources - Geopressured -Hot dry rocks- magma resources. Geothermal Power generation from various geothermal resources.

Ocean energy: OTEC - Principle of utilization, types up of OTEC plants-open loop and closed loop OTEC systems **Tidal and wave energy**: potential and conversion Techniques.

UNIT 5: (~6 Lecture Hours)

Direct Energy Conversion: Need for DEC, types of DEC-fuel cell, Magento hydro dynamic energy conversion (MHD) Thermoelectric conversion working principle (elementary treatment only) Combined cycle and Co-generation.

Text Books:

1. D.P.Kothari, K.C.Singhal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 2nd Edition, P.H.I., 2014.
2. B.H.Khan, Non-Conventional Energy Resources, 3rd Edition, McGraw Hill Education, 2017
3. Twidell&Wier, Renewable Energy Resources, 3rd Edition, CRC Press (Taylor & Francis), 2006.

Reference Books:

1. G.D. Rai, Non-Conventional Energy Sources, 5th Edition, Khanna Publishers, 2009
2. Sukhatme.S.P, Solar Energy: Principles of Thermal Collection and Storage, 3rd Edition, Tata McGraw Hill, 2008.

Online Resources:

1. https://nptel.ac.in/courses/103103206

Course Outcomes:

After completion of this course, the students should able to

1. Define and comprehend the relevance of RES.
2. Identify different forms of Wind and Solar energy systems.
3. Assess working of OTEC, Ocean energy, Biomass energy and Geothermal energy systems.
4. Explain the need for usage of renewable energy resources and energy conservation.
5. Differentiate between power generation concepts of Renewable & Non-Renewable sources.
6. Describe the conversion technologies using biomass, Tidal, Wave and Geothermal energy resources.

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IV Year B.Tech. I-Semester **L T P C**

Course Code: 127LB **3 0 0 3**

RESEARCH METHODOLOGY

(Open Elective – 2)

Prerequisites: -Nil-

Course objectives: This course will enable the students:

1. To develop an understanding towards basic concepts of the research methodology.
2. To familiarize primary disparity between quantitative research and qualitative research.
3. To provide knowledge to define appropriate research problem and its parameters.
4. To familiarize tools and techniques used for preparation of report writing.

UNIT 1: (~ 10 Lecture Hours)

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Importance of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

UNIT 2: (~ 9 Lecture Hours)

Defining the Research Problem: Definition of Research Problem, selecting the Problem, Necessity of Defining the Problem, Technique involved in Defining a Problem.

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Literature Review: Need of Review, Guidelines for Review, Record of Research Review.

UNIT 3: (~ 9 Lecture Hours)

Research Design: Meaning of Research Design, Need for Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design.

Design of Sample Surveys: Sample Design, Sampling and Non Sampling Errors, Sample Survey Versus Census Survey. Types of Sampling Designs: Non Probability Sampling, Probability Sampling.

UNIT 4: (~ 10 Lecture Hours)

Data Collection and Preparation: Collection of Primary data: Observation method, Interview method, Questionnaires, Schedules. Collection of Secondary data, Case study method.

Data Preparation: Questionnaire checking, Editing, Coding, Classification, Tabulation. Graphical Representation: Pie chart, Bar chart, Histogram, Frequency Polygon.

UNIT 5: (~ 10 Lecture Hours)

Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions of interpretation. Significance of Report Writing, Steps in Writing the Report, Format of the Research Report. Technical paper writing/Journal paper writing, Making Presentation, Use of Visual Aids, Elementary Treatment of Plagiarism Tools.

Text Books:

1. C.R Kothari & Gaurav Garg, Research Methodology, Methods & Technique, New Age International Publishers, 2019.
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2016.

Reference Books:

1. R.Pannerselvam, Research Methodology, Prentice hall of India, 2014.
2. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.
3. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.

Online Resources:

1. Onlinecourses.nptel.ac.in

Course Outcomes:

At the end of the course students are expected to

1. Develop an understanding on various kinds of research and objectives of doing research.
2. Perform literature reviews using print and online databases.
3. Design good research.
4. Collect required data for Research and to adopt methods for data collection.
5. Interpret the data from research perception.
6. Write and present a substantial technical report and document.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KX **3 0 0 3**

INDUSTRIAL MANAGEMENT
(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:
1. Educate the importance of productivity in production process.
2. Managing various production activities and quality aspects
3. Inculcate the importance of industrial safety & legislation.

UNIT 1: (~ 10 Lecture Hours) **Introduction to Industrial Management**
Industrial Management – Introduction – Need and Scope of Industrial Management.

Production Management – Plant location – Factors affecting Plant location - Plant Layout – Types of Plant Layout – Product, Process, Fixed Position and Combination Layout - Production **–** Introduction – Types of Production.
Productivity – Production vs Productivity – Objectives – Factors affecting Productivity – (Theory only) – Measures to improve Productivity and its benefits.

UNIT 2: (~ 09 Lecture Hours) **Operations and Materials Management**
Operations Management – Work study – Definition – Objectives – Principles of Work study – Method study - Definition - Objectives – Steps of Method study. Work measurement – Definition - objectives – Time study – Steps in Time study – Uses of Time study.

Materials Management – Definition – Objectives – Functions – Purchase procedure – ABC analysis – VED Analysis.

UNIT 3: (~ 09 Lecture Hours) **Inventory and Stores Management**
Inventory Management – Introduction - Functions of Inventory Control – Advantages of Inventory Control – Economic Order Quantity - Methods of Inventory issues – FIFO, LIFO, Simple average and Weighted Average methods (simple problems).

Stores Management – Stores Keeping – Classification of Stores – Stores Records.

Modern techniques in Inventory and Stores Management – Introduction to Material Resource Planning (MRP) - Enterprise Resource Planning (ERP) – Just in Time (JIT) - Supply Chain Management (SCM).

UNIT 4: (~ 10 Lecture Hours) **Quality Management and Control**
Quality Management – Introduction, Contributions of Juran, Deming, Crosby, Total Quality Management - Quality Policy.

Statistical Quality Control – Need for Quality control- Sampling techniques - Advantages of Quality control – Shewart Control Charts - Test of variables - Mean chart and Range chart – Test of Attributes
– c Chart and p Chart (simple problems) - Six Sigma.

UNIT 5: (~ 10 Lecture Hours) **Industrial Safety and Security**

Industrial Safety– Objectives of Industrial safety – Planning of Industrial safety – Industrial accidents and their types – Causes of Accidents – Risk Management in Industrial safety.

Industrial Security- Introduction- Need - Principles of security – Essential ingredients of security.

Text Books:

1. O.P. Khanna (2018) Industrial Engineering and Management, Dhanpat Rai Publications Pvt. Ltd.
2. T.R. Banga, N K Agarwal, S.C. Sharma (2008) Industrial Engineering and Management Science, 12th Edition, Khanna Publishers.

Reference Books:

1. Joseph, G. Monks (2012) Operations Management -Theory and Problems, 3rd Edition, McGraw- Hill Series.
2. NVS Raju (2013) Industrial Engineering & Management, Cengage Learning.
3. Besterfield (2013) Total Quality Management, 3rd Edition, Pearson.
4. S.Subramanian (2006) Industrial Security Management, Gyan Publishing House.

Online Resources:

1. Operations Management : https://onlinecourses.nptel.ac.in/noc18_me26/preview

Course Outcomes:

After learning the contents of this course, the student must be able to

1. Organize the activities of Business efficiently.
2. Adapt to appropriate methods of production yielding productivity.
3. Identify efficient methods of production.
4. Handle inventory efficiently for improving Productivity.
5. Implement and maintain Quality standards in Production.
6. Understand industrial safety and security.

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IV Year B.Tech. I-Semester	**L T P C**
Course Code: 127KS	**3 0 0 3**

BEHAVIOURAL SKILLS AND PROFESSIONAL COMMUNICATION

(Open Elective – 2)

Prerequisites: -Nil-

Course Objectives:

1. To achieve the desired life skills and social skills in their workplace.
2. To enable students to handle and overcome the professional challenges and conflicts in a working environment.
3. To facilitate the students to understand and develop their managerial skills in a professional environment.
4. To help the students understand professional and cross cultural communication through digital technologies.
5. To develop critical thinking skills for speech and writing.

UNIT 1: (~09 lecture hours)

Life Skills

Essential Social Skills and Presentation Skills– Confidence Building – Self-esteem– Positive Attitude – Assertiveness – Johari Window.

UNIT 2: (~10 lecture hours)

Critical Thinking Skills

Decision Making - Problem Solving – Negotiation - Conflict Resolution and Creative Thinking – Blooms Taxonomy.

UNIT 3: (~10 lecture hours)

Managerial Skills

Time Management – Stress Management – Crisis Management – Conflict Management – Relationship Management.

UNIT 4: (~10 lecture hours)

Professional Skills

Digital Communication – Social Networking – Cross Cultural and Cross Functional Communication – Professional Etiquettes and Netiquettes.

UNIT 5: (~09 lecture hours)

Fundamental Values Through Diversity And Inclusivity:

Meaning and concept of diversity and inclusivity – learner diversity— Diversity for sustainability— strength of diversity for inclusivity –Inclusivity in workplace— strategies for inclusivity Importance of Resilience – Concepts of resilience – qualities of a resilient person – strategies for building resilience.

Reference Books:

1. Meenakshi Raman and Shalini, Softskills: Key to success in workplace and life, Cengage Publications (2018).
2. Barun, K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2nd Edition (2016).
3. Sailesh Sen Gupta, Business and Managerial Communication, PH1 Learning Pvt. Ltd., (2011).

Online Courses:

1. Softskills : https://onlinecourses.nptel.ac.in/noc21_hs76/preview
2. Emotional Intelligence: https://onlinecourses.nptel.ac.in/noc20_hs13/preview

Course Outcomes:

After completion of the course, the students will be able to

1. Communicate with more confidence and self-esteem.
2. Give better presentation and explanation using digital aids and tools.
3. Perform effectively and efficiently in the work place environment.
4. Exhibit better tolerance and receptiveness in understanding and accepting diversity.
5. Apply higher thinking order in the self-development process.
6. Equip oneself to handle the work related challenges and conflicts professionally.

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IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LE **3 0 0 3**

CLOUD COMPUTING

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. To explain evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects of cloud.

UNIT 1: (~9 Lecture Hours)

Introduction- Cloud computing at a glance, Historical developments, Building cloud computing environments.

Cloud Computing Architecture - The cloud reference model, Types of clouds, Economics of the cloud, Open challenges.

UNIT 2: (~8 Lecture Hours)

Virtualization - Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples- Xen, VMware, Microsoft Hyper-V. Migrating into a Cloud, Virtual Machines Provisioning and Migration Services.

UNIT 3: (~10 Lecture Hours)

Cloud Platforms in Industry: Amazon web services, Google App Engine, Microsoft Azure, Aneka- Integration of private and public cloud.

Cloud Programming and Software Environments: Programming Support for Google App Engine: Programming the Google App Engine, Google File System(GFS), BigTable, Google's NOSQL System, Chubby, Google's Distributed Lock Service, Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service(S3), Amazon Elastic Block Store(EBS) and SimpleDB, Microsoft Azure Programming Support.

UNIT 4: (~9 Lecture Hours)

Security in the Cloud- Cloud Security Challenges, Software-as-a-Service Security.

Secure Distributed Data Storage in Cloud Computing - Cloud Storage: from LANs to WANs, Technologies for Data Security in Cloud Computing.

Data Security in the Cloud- The Current State of Data Security in the Cloud, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security-Pros and Cons.

UNIT 5: (~9 Lecture Hours)

SLA Management - Traditional Approaches to SLO Management, Types of

SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.

Advanced Topics in Cloud Computing – Energy Efficiency in Clouds: Energy-Efficient and Green Cloud Computing Architecture, Market Based Management of Clouds: Market-Oriented Cloud Computing, A Reference Model for MOCC, Technologies and initiatives Supporting MOCC, Federated Clouds/Inter Cloud: Characteristics and Definition, Cloud Federation Stack.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S.Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill Education, 2013.
2. Rajkumar Buyya, James Broberg and Andrzej, Cloud Computing: Principles and paradigms Wiley, 2011.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security by CRC, 2010.

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, Jack J Dongarra and Elsevier, Distributed and cloud computing, 2012.
2. A. Kannammal, Fundamentals of Cloud Computing, CL India, 2015.
3. Tim Mather, Subra Kumaraswamy and Shahed Latif, Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance. By Publisher: O'Reilly Media 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs42
2. https://aws.amazon.com/
3. https://azure.microsoft.com/en-in
4. https://cloud.google.com/

Course Outcomes:

After completion of the course, students will be able to

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and Illustrate the broad perceptive of cloud architecture and model.
2. Apply and design suitable Virtualization concept.
3. Explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and design other web cloud applications.
4. Assess Cloud storage systems and Cloud security, the risks involved, its impact and develop cloud application.
5. Devise performance negotiations between cloud service providers and consumers through SLAs.
6. Interpret enterprise level requirements by learning Energy efficient, Market ready, Federated cloud systems.

IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LD **3 0 0 3**

BLOCKCHAIN TECHNOLOGIES

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. To enable students develop understanding on Blockchain Technology
2. To equip students with knowledge on cryptocurrencies working.
3. To empower students, gain knowledge on Blockchain implementation technologies.

UNIT 1: (~ 6 Lecture Hours)

Blockchain 101: The History of Blockchain and Bitcoin, Types of Blockchain, Consensus, CAP theorem and blockchain. Decentralization: - Decentralization using Blockchain, Methods of decentralization, Routes to decentralization Blockchain and Full Ecosystem, Smart contracts, Decentralized Organizations, Platforms for Decentralization.

UNIT 2: (~ 8 Lecture Hours)

Introducing Bitcoin: Bitcoin, Digital Keys and Addresses, Transactions, Mining. Bitcoin Network and Payments: – Wallets, Bitcoin payments, Innovation in Bitcoin Alternative Coins: – Theoretical Foundations, Bitcoin limitations, Namecoin, Primecoin, Zcash Smart Contracts: – Ricardian Contracts.

UNIT 3: (~ 10 Lecture Hours)

Ethereum 101: The Ethereum network, Components of the Ethereum ecosystem. Further Ethereum: - Programming Languages-Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols. Development Tools and Frameworks: - Solidity Language.

UNIT 4: (~ 10 Lecture Hours)

Introducing Web3: Web3 – Contract Deployment, POST Requests, Development frameworks. Hyperledger: - Hyperledger as a protocol, The reference architecture, Fabric-Hyperledger Fabric– Distributed Ledger, Sawtooth Lake, Corda.

UNIT 5: (~ 10 Lecture Hours)

Alternative Blockchains: Blockchains**-** Kadena, Ripple, Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigchainDB, Multichain, Tendermint, Platforms and Frameworks-Eris. Scalability and Other Challenges: - Scalability, Privacy. Current Landscape and What's Next: – Emerging trends, Other Challenges, Blockchain Research, Notable Projects, Miscellaneous Tools.

Text Book:

1. Imran Bashir, Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, 2nd Edition, Packt Publishing, 2018.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands On Approach, VPT, 2017.
2. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abilash KA and MeenaKarthikeyan, Universities Press, 2020.
3. The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing and Securing Distributed Blockchain-based projects, Elad Elrom, Springer Nature B.V, 2019.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105184/
2. https://github.com/rddill-IBM/ZeroToBlockchain
3. tech.seas.harvard.edu/free-blockchain
4. https://www.codecademy.com/learn/introduction-toblockchain/modules/fundamental-blockchain- concepts
5. The Basics of Blockchain & Bitcoin Fundamentals Course | Udemy

Course Outcomes:

After completion of this course, students will be able to

1. Acquire understanding on Blockchain Technology built-in way.
2. Interpret how various cryptocurrencies work.
3. Articulate Ethereum Blockchain for developing smart contracts.
4. Apprehend knowledge on Web3 and Hyperledger Fabric for decentralized apps.
5. Exemplifying different alternative and emerging Blockchains.
6. Discover real-time usage of Blockchain.

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IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LL **3 0 0 3**

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. To introduce the fundamental concepts and techniques of natural language processing.
2. To understand the role of syntax and semantics of the text processing.
3. To gain an in-depth understanding of the computational properties and commonly used algorithms for processing linguistic information.
4. To explore different ways of building an NLP system through a case study on Question Answering system.

UNIT 1: (~10 Lecture Hours)

Introduction: What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications.

Finding the Structure of Words: Words and their Components, Issues and Challenges, Morphological Models.

Finding the Structure of Documents: Introduction, Methods, Complexity of Approaches, Performances of the Approaches.

UNIT 2: (~9 Lecture Hours)

Syntax: Parsing Natural Language,

Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues: Tokenization, Case and Encoding, Word Segmentation, Morphology.

UNIT 3: (9 Lecture Hours)

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Wordsense, Predicate- Argument Structure, Meaning Representation.

UNIT 4: (~ 9 Lecture Hours)

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models- Class-Based Language Models, Syntax-Based Language Models, Neural Network language Models, Language-Specific Modeling Problems.

UNIT5: (~ 8 Lecture Hours)

Question Answering: Introduction and History, Architectures, Source Acquisition and Preprocessing, Question Analysis, Search and Candidate Extraction, Answer Scoring, Cross Lingual Question Answering, A Case Study.

Text Book:

1. Daniel M. Bikel and ImedZitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, Pearson Publication, 2013.

Reference Books:

1. Tanvier Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford Higher Education, 2008.
2. Daniel Jurafsky and James H. Martin, Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2011.
3. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O Reilly, 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. Natural Language Processing Specialization (DeepLearning.AI) | Coursera
3. https://www.udemy.com/topic/natural-language-processing/
4. Stanford CS 224N | Natural Language Proce‘ssing with Deep Learning
5. CS 626-460: Natural Language Processing (iitb.ac.in)

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate knowledge on the fundamental principles of natural language processing and document structure.
2. Understand the syntax processing and multilingual issues of language processing.
3. Analyze semantic interpretation and system paradigms for semantic parsing.
4. Understand various parameters to evaluate language models.
5. Identify suitable modeling techniques for solving real time problems.
6. Explore different ways to model the system similar to question answering system.

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IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LF **3 0 0 3**

DATA MINING

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. Learn data mining concepts understand association rules mining.
2. Discuss classification algorithms learn how data is grouped using clustering techniques.
3. To develop the abilities of critical analysis to data mining systems and applications.
4. To implement practical and theoretical understanding of the technologies for data mining.
5. To understand the strengths and limitations of various data mining models.

UNIT 1: (~9 Lecture Hours)

Introduction to Data Mining: What is Data Mining, Definition, KDD, Data Mining Architecture, Challenges, Data Mining Functionalities, Data Mining Task Primitives, and Major Issues in Data Mining?

Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction: Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Measures of Similarity and Dissimilarity Basics, Similarities and dissimilarities between Simple Attributes and Data Objects.

UNIT 2: (~9 Lecture Hours)

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Algorithm, Support and Confidence Measures, Association Rule Generation, FP- Growth Algorithm, Mining various kinds of Association rules, Compact Representation of Frequent Item sets: Maximal Frequent Item Sets, Closed Frequent Item Sets.

UNIT 3: (~9 Lecture Hours)

Classification and Prediction: Problem Definition, General Approaches to solving a classification problem, Evaluation of classifiers, Classification Techniques, Decision Tree Induction, Naive Bayes Classifier, Bayesian Belief Networks, K–Nearest neighbor classification Algorithm and Characteristics, Prediction: Linear, Logistic Regressions.

UNIT 4: (~9 Lecture Hours)

Clustering: Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Clustering - K-Means Algorithm, K- Means Additional issues, PAM Algorithm, Hierarchical Clustering: Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Specific techniques: MIN, MAX, Group Average, Ward's method and Centroid methods Key Issues in Hierarchical clustering, Strengths and Weakness, Outlier Detection.

UNIT 5: (~9 Lecture Hours)

Mining Time Series and Sequence Data: Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases.

Mining Multimedia, Text and Web Data: Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Text Books:

1. Jiawei Han and Michelinen Kamber, Data Mining-Concepts and Techniques, 2012, 3rd Edition, Morgan Kaufmann Publishers, Elsevier.
2. Pang-Ning Tan, Vipin Kumar and Michael Steinbanch, Introduction to Data Mining, Pearson Education.

Reference Books:

1. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press.
2. Pualraj Ponnaiah, Data Warehouse Fundamentals by Wiley- Interscience Publication.
3. VikaramPudi and P Radha Krishna, Data Mining by Oxford University Press.

Online Resources:

1. https://www.kdnuggets.com/websites/index.html
2. https://www.ngdata.com/data-mining-resources.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts and tasks of data mining.
2. Perform the pre-processing of data.
3. Formulate the association rules using different Algorithms.
4. Evaluate various classifiers.
5. Analyze different clustering techniques.
6. Understand the mining of temporal and multimedia data.

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IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LP **3 0 0 3**

WEARABLE DEVICES AND ITS APPLICATIONS

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. Identify the need for development of wearable devices and its implications on various sectors.
2. Comprehend the design and development of various wearable inertial sensors and wearable and physiological activity monitoring devices for use in healthcare applications.
3. Discuss the usage of various biochemical and gas sensors as wearable devices.
4. Acquaint various wearable locomotive sensors as assistive devices for tracking and navigation.

UNIT 1: (~ 08 Lecture Hours)

Introduction to Wearable Devices

Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Types of wearable Sensors: Invasive & Non-invasive; Intelligent clothing, Industry sectors' overview – sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.

UNIT 2: (~ 10 Lecture Hours)

Wearable Inertial Sensors

Wearable Inertial Sensors - Accelerometers, Gyroscopic sensors and Magnetic sensors; Modality of Measurement- Wearable Sensors, Invisible Sensors, In-Shoe Force and Pressure Measurement; Applications: Fall Risk Assessment, Fall Detection, Gait Analysis, Quantitative Evaluation of Hemiplegic and Parkinson's Disease patients. Physical Activity monitoring: Human Kinetics, Cardiac Activity, Energy Expenditure measurement: Pedometers, Actigraphs.

UNIT 3: (~ 10 Lecture Hours)

Wearable Devices for Healthcare

Wearable Blood Pressure (BP) Measurement: Cuff-Based Sphygmomano meter, Cuffless Blood Pressure Monitor. Study of flexible and wearable Piezoresistive sensors for cuffless blood pressure measurement.

Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile, Modality of measurement wearable, adhesive/tattoo type. Conductive textile electrodes, Knitted Piezoresistive Fabric (KPF) sensors.

UNIT 4: (~ 8 Lecture Hours)

Wearable Biochemical and Gas Sensors

Wearable Biochemical Sensors: Parameters of interest, System Design – Textile based, Microneedle based; Types: Non-invasive Glucose Monitoring Devices, GlucoWatch® G2 Biographer, GlucoTrackTM; Pulse oximeter, Portable Pulse Oximeters, wearable pulse oximeter; Wearable capnometer for monitoring of expired carbon dioxide. Wearable gas sensors: Metal Oxide (MOS) type, electrochemical type, new materials-CNTs, graphene, Zeolites; Detection of atmospheric pollutants.

UNIT 5: (~ 12 Lecture Hours)

Wearable Cameras and Microphones for Navigation

Cameras in wearable devices, Applications in safety and security, navigation, Enhancing sports media, Automatic digital diary. Cameras in smart-watches; Use of Wearable Microphones: MEMS microphones, Bioacoustics, Microphones and AI for respiratory diagnostics and clinical trials. Wearable Assistive Devices for the Blind - Hearing and Touch sensation, Assistive Devices for Fingers and Hands, Assistive Devices for wrist, forearm and feet, vests and belts, head-mounted devices.

Text Books:

1. Toshiyo Tamura and Wenxi Chen, "Seamless Healthcare Monitoring", Springer 2018.
2. Edward Sazonov and Michael R. Neuman, "Wearable Sensors - Fundamentals, Implementation and Applications", Elsevier Inc., 2014.
3. Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, "Wearable and Autonomous Biomedical Devices and Systems for Smart Environment", Springer 2010.

Reference Books:

1. Subhas Chandra "Wearable Electronics Sensors - For Safe and Healthy Living", Springer (June 8, 2015).
2. Shantanu Bhattacharya, A K Agarwal, NripenChanda, Ashok Pandey and Ashis Kumar Sen, "Environmental, Chemical and Medical Sensors", Springer Nature Singapore Pte Ltd. 2018
3. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.
4. N. Luo, W. Dai, C. Li, Z. Zhou, L. Lu, C. C. Y. Poon, et al., "Flexible Piezoresistive Sensor Patch Enabling Ultralow Power Cuffless Blood Pressure Measurement," Advanced Functional Materials, vol. 26, pp. 1178-1187, 2016.

Online Resources:

1. https://www.udemy.com/course/wearable-technology-a-complete-primer-on-wearables
2. https://www.coursera.org/learn/wearable-technologies

Course Outcomes:

After completion of the course, students will be able to

1. Identify and understand the need for development of wearable devices and its influence on various sectors.
2. Discuss the applications of various wearable inertial sensors for biomedical applications.
3. Design and development of various Wearable monitoring devices for detection of biochemical and physiological body signals activity for use in healthcare applications.
4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices.
5. Identify the use of various wearable locomotive tools for safety and security, navigation.
6. Acquaint the usage of wearable devices as environmental monitoring, safety and navigational assistive devices and other modern applications.

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IV Year B.Tech. II-Semester **L T P C**
Course Code: 128LG **3 0 0 3**

SYSTEMS ENGINEERING
(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:
This can be termed an advance level course in the electronic communication engineering domain. The course has the following main objectives:

1. To demonstrate an understanding of systems terminology, definitions, the design process, maintenance, and support of modern technological systems.
2. To applying tools, methodologies, and procedures to manage systems engineering problems and model systems.
3. To analyze the functions of a system and validate them
4. To understand the risks involved in systems engineering and developing effective systems solutions to mitigate or reduce the risks.
5. To employ systems engineering analytical tools, techniques, methodologies, and processes to assist in designing efficient and cost-effective design solutions.
6. To evaluate a system and subsequently test it.

UNIT 1: (~ 10 Lecture Hours)

Introduction to Systems engineering: Need for systems engineering, Systems engg viewpoint, perspectives, domains, Systems engineering fields, approaches, activities, and products, Systems engineering as a profession.

Complex system structure-building blocks, hierarchy, interfaces, environment, interactions, complexity, System development process – life cycle, evolutionary characteristics, Systems engineering method, Systems testing throughout development.

UNIT 2: (~ 10 Lecture Hours)

Managing systems: Development, risks, work breakdown structure (WBS), systems engineering management plan (SEMP), Systems risk management, organizing for systems engineering, Need analysis – originating, operations, functional, and feasibility, Need validation, systems ops requirement, System requirements development, performance requirements.

Implementing concept : exploration, validating requirements, Concept definition – selection and validation, functional analysis and allocation, Systems architecture, system modeling languages, Model-Based Systems Engineering (MBSE), Decision making, modeling for decisions, Simulation, Trade-off analysis.

UNIT 3: (~ 8 Lecture Hours)

Risk Management: Program risk reduction, prototype development for risk mitigation, Development testing, risk reduction, Revision of functional analysis and design, Overview of probability data analysis, Hypothesis testing.

UNIT 4: (~ 10 Lecture Hours)

Engineering design : Implementing system building blocks, component design, Design validation, change management, Concepts of reliability, redundancy, Concepts of maintainability, availability, producibility, User interface design and GUI, Case Studies and Case Study Presentation.

UNIT 5: (~ 12 Lecture Hours)

Testing and Evaluation and Installation: Integration, testing and evaluating total system, Test planning and preparation, system integration, Developmental and operational test and evaluation, Engineering for production, transition from development to production, Installation, Installation testing, In-service support, Upgrades and modernization.

Text Books:

1. Kossiakoff, A., Sweet, W.N., Seymour, S.J., and Biemer S.M., Systems Engineering Second ed. John Wiley Sons Inc., New Jersey, 2011
2. International Council of Systems Engineering, Systems Engineering Handbook, A guide for System Life Cycle Processes and Activities, version 3.2.1, January 2011.
3. Systems Engineering Fundamentals, Department of Defense, Defense Acquisition University, Systems Engineering Fundamentals, 2001.

Reference Book:

1. B. S., and Fabrycky, Systems Engineering and Analysis (5th Ed), Blanchard, W. J. (2006).
2. Pearson Prentice Hall: Upper Saddle River, NJ. [ISBN 978-0-13-221735-4]

Online Resources:

1. Systems Engineering: Theory and Practice by Prof. Deepu Philip (IIT Kanpur) https://onlinecourses.nptel.ac.in/noc21_mg39/preview

Course Outcomes:

Having gone through this course on Systems Engineering, the students would be able to

1. Explain the significance of Systems Engineering and the System development process.
2. Carry out the Systems engineering Management Plan and risk management.
3. Model a system and implement decision making functions.
4. Develop prototype for risk mitigation and test it.
5. Implement, validate, maintain and design the user interface of the system.
6. Install, Test and evaluate the entire system.

IV Year B.Tech. II-Semester **L T P C**
Course Code: 128LN **3 0 0 3**

WASTE MANAGEMENT TECHNIQUES AND POWER GENERATION

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. To classify the sources of solid waste& e-waste.
2. To identify methods of solid waste disposal.
3. To understand various waste management techniques.
4. To study various energy generation methods as per type of waste available locally.
5. To analyze energy generation methods and recycling of waste.

UNIT 1: (~ 8 Lecture Hours)

Waste Management Sources & types of wastes (Industrial, Municipal, agro, domestic). Generation of wastes, Pollution standards, Waste characterization. Functional elements of waste management, technological aspects related to waste, on site handling, storage, collection, transfer and transport.

UNIT 2: (~8 Lecture Hours**) Waste Management Issues**

Planning, organization & control Hazardous & toxic wastes, hazard & its management, classification, generation, handling, processing and disposal. Industrial safety, Waste disposal, Environmental impact (toxic & non-toxic).

UNIT 3: (~10 Lecture Hours)

Conversion Techniques & Methods Recovery of value added components: Recycling, conversion products and energy Conversion technologies: Incineration, – principal features of an incinerator – site selection and plant layout of an incinerator - Thermo-chemical conversions. Biochemical conversion: Biogas & ethanol Conventional Chemical & biological treatment. Power generation & its utilization.

UNIT 4: (~8 Lecture Hours)

Processing Techniques and Recovery of Energy Processing techniques – purposes mechanical volume reduction – necessary equipment – chemical volume reduction –mechanical size reduction selection of equipment – components separation – methods – drying and dewatering. Refusal disposal – various methods.

UNIT5: (~10 Lecture Hours)

Concepts of Land Fill & e-Waste

Concepts of Land Fill: Land Fill method of solid waste disposal, Landfill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, Movement and control of landfill leachate and gases, Environmental monitoring for land fill gases.

E-Waste: E-waste in global context, Environmental concerns, Global trading in hazardous waste, Management of e-waste, e-waste legislation, Government regulations on e-waste management & Recycling.

Text Books:

1. Nicholas P. Cheremisinoff. Handbook of Solid Waste Management and Waste Minimization Technologies. An Imprint of Elsevier, New Delhi (2003)
2. P.AarneVesilind, William A. Worrell and Debra R. Reinhart. Solid Waste Engineering. Thomson Asia Pte Ltd. Singapore (2002)
3. M.Dutta, B .P .Parida, B. K. Guha and T. R. Surkrishnan. Industrial Solid WasteManagement and Landfilling practice. Narosa Publishing House, New Delhi (1999).

Reference Books:

1. C.S.Rao. Environmental pollution Control Engineering. Wiley Eastern Ltd.New Delhi (1995)
2. "E- waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011"
2. M.L. Davis and D.A. Cornwell. Introduction to environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
3. S.K.Agarwal. Introduction to Environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
4. Hagerty, D.Joseph; Pavoni . Joseph L; Heer , John E., " Solid Waste Management", New York, Van Nostrand , 1973

Online Resource:

1. https://nptel.ac.in/courses/103107125

Course Outcomes:

After completion of the course, students will be able to

1. Understand technologies for generation of energy from solid waste.
2. Compare methods of solid waste disposal.
3. Identify sources of energy from waste using various conversion techniques.
4. Analyze methods for waste management.
5. Assess the harmful effects of e-waste.
6. Differentiate between the normal waste and e-waste.

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IV Year B.Tech II-Semester	**L T P C**
Course Code: 128LM	**3 0 0 3**

MARKETING MANAGEMENT

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. Outline the importance and key concepts of Marketing.
2. Understand and appreciate the emerging marketing trends
3. Highlight the foundation of Marketing mix and evolution of marketing mix in modern era.

UNIT 1: (~**08** Lecture Hours)

Introduction to Marketing Management

Marketing Management - Meaning and importance – Nature, Scope and Functions - Evolution of Marketing concepts from Production Concept to Holistic Marketing concept –Marketing Environment- Micro and Macro Environment.

UNIT 2: (~**10** Lecture Hours)

Market Segmentation

Market Segmentation: -STP Process- Levels & Patterns of Market Segmentation – Segmentation of Consumer & Business Markets –Target Marketing – Developing and Communicating a positioning strategy – Differential Tools - New Product Development and its process.

UNIT 3: (~**10** Lecture Hours)

Marketing Mix

Product Offering: Product and Product Mix – Product Line decisions – Brand Decisions – Packaging and Labelling.

Pricing Strategies: - Meaning and objectives -factors influencing Pricing-Pricing Methods and Strategies.

UNIT 4: (~**09** Lecture Hours)

Distribution: - Concept and Importance- Different types of distribution channels - Channel Intermediaries.

Promotion: -Nature and Importance of Promotions – Designing and Managing Promotion Mix – Managing Advertising – Sales Promotion - Personal Selling – Public Relation – Direct Marketing – Publicity and Social Media. Brief overview of People, Process and Physical evidence.

UNIT 5: (~**09** Lecture Hours)

Recent Trends in Marketing

Digital Marketing –Meaning and Importance - Green Marketing -– Managing Digital Communication – E-Marketing -M-Marketing and Services Marketing.

Case study/Marketing Plan for a Product or Service.

Text Books:-

1. Philip Kotler (2017). Marketing Management (15th ed.). Prentice – Hall of India Pvt. Ltd.
2. Philip Kotler, Kevin Lane Keller (2017). Marketing Management (15th ed.). Pearson.

Reference Books:

1. Rajagopal (2008). Marketing – Concept and Cases. New Age International (P) Ltd.
2. Tapan Panda (2009). Marketing Management(5th ed.). Excel Publication.
3. Ramaswamy, V.S. & Namakumari S. (2013). Marketing Management India (5th ed.). Macmillan Publication.
4. Saxena, R. (2019). Marketing Management (6th ed.). Tata McGraw Hill, New Delhi.
5. Richard, J. Semenik(2006). Promotion & Integrated Marketing Communication (1st ed.) Thomson South-Western.

Online Resources:

1. Marketing Management-I: https://nptel.ac.in/courses/110104068/
2. Marketing Management-II: https://nptel.ac.in/courses/110104070/

Course Outcomes:

After learning the contents of this course, the student must be able to

1. Remember and Comprehend the importance of the Marketing Management Process
2. Analyze the need and importance of Market segmentation, Targeting and Positioning.
3. Interpret the elements of Product mix.
4. Enumerate strategies of Pricing in fixation.
5. Comprehend the dynamics of distribution and Promotion mix elements to leverage marketing concepts for effective decision making.
6. Know the recent trends in marketing and understand the steps involved in developing a Marketing plan.

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IV Year B.Tech. II-Semester **L T P C**

Course Code: 128LH **3 0 0 3**

ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective – 3)

Prerequisites: -Nil-

Course Objectives:

1. To explain various stages of EIA process in India.
2. To provide knowledge on various aspects of Environment Impact Assessment Methodologies and apply them on developmental activities.
3. To explain the outlines of EMP.
4. To explain the procedure on environmental audit.
5. To provide an overview of environmental legislation.
6. To review a few EIA reports.

UNIT 1: (~9 Lecture Hours)

Basic Concepts of EIA: Introduction **-**Definition of Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS)**,** EIA Process Flow Chart- Initial Environmental Examination (IEE), (Screening, Scoping, Baseline Data Acquisition, Impact Identification, Prediction, Analysis, Public Hearing, Draft EIS, Final EIS), Classification of Impacts, Elements of EIA, Benefits of EIA, Preparation of Environmental Base map.

UNIT 2: (~9 Lecture Hours)

EIA Methodologies: Introduction, Criteria for the Selection of EIA Methodology, Methods of Impact Analysis – Impact Identification, Impact prediction, Impact Evaluation

Different EIA Methods- (Rapid, Comprehensive, Adhoc, Checklist, Matrix, Network, Environmental Media Quality Index and Overlay Methods). Cost Benefit Analysis.

Impacts of Development Activities on Environmental Components: Deforestation – Causes, Effects and Control Measures, Guidelines for Preparation of Environmental Impact Statement.

UNIT 3: (~8 Lecture Hours)

Environmental Management Plan: Introduction, Objectives, Goals, Purpose, Importance, Elements, EMP Preparation, Monitoring of EMP.

UNIT 4: (~9 Lecture Hours)

Environmental Audit: Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol. Stages of Environmental Audit - Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report, Post Audit Activities. Case Studies and Preparation of Environmental Impact Statement Report for various Industries.

UNIT 5: (~9 Lecture Hours)

Environmental Legislations: The Environmental (Protection) Act 1986, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981, The Motor Act 1988, The Wild life (Protection) Act 1972, National Bio-Diversity Act, 2002, Concept of ISO 9001 and ISO 14000 Standards.

Text Books:

1. Environmental Impact Assessment by Larry Canter, Mc Graw-Hill Publications, 1996.
2. Environmental Impact Assessment by R. R Barthwal, New Age International Publications, 2010.
3. Environmental Impact Assessment: Theory & Practice by P. Wathern Publishers Rutledge, London, 1992.

Reference Books:

1. Environmental Pollution by R.K. Khitoliya, S. Chand Publishing, 2014.
2. Environmental Science and Engineering by J. Glynn and W. H. Gary, Prentice Hall Publishers, 1996.
3. Environmental Science and Engineering by Suresh K. Dhameja, S.K. Kataria and Sons Publication, New Delhi.2006.
4. Environmental Pollution and Control by, H. S. Bhatia, Galgotia Publication Private Limited, Delhi. 2003.
5. Environmental Impact Assessment by M.Anji Reddy, BSP Books Private Limited, 2017.

Web Resources:

1. Environmental Impact Assessment – Open Educational Resource http://www.raymondsumouniversity.com/eia-local/about.html
2. Environmental Impact Assessment - https://unep.ch/etb/publications/enviImpAsse.php
3. Urban Environmental Management - http://www.gdrc.org/uem/eia/impactassess.html
4. Environmental Impact Assessment Report https://www.miga.org/sites/default/files/archive/Documents/EIA_Rwanda_Stones.pdf

Online Courses:

1. https://cept.ac.in/cce/admin/images/files/1347949702_po7tf.pdf
2. https://www.iisd.org/learning/eia/
3. https://www.iaia.org/iaia-training-courses.php
4. https://www.eiatraining.com/index.html.

Course Outcomes:

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

1. Identify the environmental attributes to be considered for EIA study.
2. Apply different methodologies in impact identification, prediction and analysis.
3. Prepare EMP based on environmental legislation.
4. Carry out environmental audit.
5. Prepare EIA reports.
6. Prepare EIS for various industries.

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PROGRAM EDUCATIONALOBJECTIVES:

PEO-1	Providing students with a compelling foundation in Engineering and Basic Sciences that willfurther help them conduct investigations of complex problems.
PEO-2	Applying Scientific and Engineering methodologies using modern tools and techniques in the analysis, design, and development of novel systems in the field of Computer science and Technology.
PEO-3	Promoting lifelong learning in students and help them evolve as self-motivated and responsible professionals with progressive thinking to serve the industry and society in a better way.
PEO-4	Inculcating strong communication skills to interact individually and in multidisciplinary teams and collaborate to excel in various environments with professional ethics, social awareness and environmental concern.

PROGRAM OUTCOMES (POs) – B.TECH. (CST)

PO1	**Engineering Knowledge:** To acquire firm knowledge of Mathematics, Science, Engineering & Computer Science.
PO2	**Problem Analysis:** To identify, formulate & analyze requirements of IT Applications.
PO3	**Design & Development Solutions:** To effectively apply engineering principles to the design of computer & IT based Systems.
PO4	**Investigation of complex problems:** To synthesize research based knowledge in the design of programming and analysis of data for providing valid conclusions to complex problems.
PO5	**Modern Tool Usage:** To possess skills for creating and selecting modern software development tools.
PO6	**Engineering & Society:** To apply conceptual knowledge relevant to professional engineering practices in societal, health, safety, legal and cultural issues and their consequences.
PO7	**Environment & Sustainability:** To understand the impact of engineering solutions in social and economic environments and work towards sustainable development.
PO8	**Ethics:** To understand contemporary legal, social & ethical issues in computing.
PO9	**Individual & Teamwork: T**o effectivelywork as an individual and adapt to a team environment.
PO10	**Communication:** To communicate precisely and effectively both in oral and written in all engineering activities.
PO11	**Project management & finance:** To apply engineering and management principles for managing and leading economically feasible projects in multi-disciplinary environments as an individual and team member.
PO12	**Life Long Learning:** To develop confidence to engage in independent & life long learning in the context of Technological changes.

PROGRAM SPECIFIC OUTCOMES (PSOs) – B.TECH. (CST)

PSO1	Understand, analyze and develop efficient software solutions related to algorithms, system software, web applications, data processing and networking by applying fundamental concepts of computer science and Technology.
PSO2	Adapt the emerging technologies in computing and embrace the best practices of software and hardware development to get expertise in modern software and hardware tools and cater to the real time requirements of the industry and society.

G.NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE (For Women)

AUTONOMOUS)

INSTITUTE VISION

To become a center of quality education in Engineering and Technology for women empowerment.

INSTITUTE MISSION

- To fulfill the academic aspirations of women engineers for enhancing their intellectual capabilities and technical competency.
- To Leverage Leading – Edge Technologies and cultivate exemplary work culture.
- To facilitate success in their desired career in the field of engineering to build a progressive nation.

INSTITUTE QUALITY POLICY

G. Narayanamma Institute of Technology and Science (For Women), Hyderabad is committed in imparting Quality Education and Training for women empowerment in the field of "Engineering and Technology" and to satisfy applicable requirements through continual improvement of the Quality Management System by facilitating and supporting the staff and students to work as a team in upgrading their knowledge and skill in tune with the industrial and technological developments through a set of Quality objectives.