ACADEMIC REGULATIONS
AND
COURSE STRUCTURE
CHOICE BASED CREDIT SYSTEM
MLR20

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Bachelor of Technology (B.Tech)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2020 - 2021)

MLR Institute of Technology

(Autonomous)

Laxman Reddy Avenue, Dundigal (V), Quthbullapur (M),

Hyderabad – 500043, Telangana State

https://www.mlrinstitutions.ac.in, Email: director@mlrinstitutions.ac.in

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

VISSION

Achieve global recognition through innovation, interdisciplinary research and excellence in Data Science. Empower students with professional competence to excel in industry, higher studies and entrepreneurship.

MISSION

M1: To foster a culture of innovation and interdisciplinary research that addresses real-world challenges through the application of advanced Data Science techniques and emerging technologies.

M2: To equip students with strong analytical, technical and professional skills, enabling them to excel in industry, pursue higher education and engage in entrepreneurial ventures.

M3: To promote collaboration with academia, industry and research organizations globally, ensuring continuous learning, ethical practice and societal impact through Data Science.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

PEO1: To enable the graduates of the program to have a globally competent professional career in Data Science domain.

PEO2:To prepare students to excel in Data Science with the technical skills and competency to carry out research and address basic needs of the society.

PEO3 : To empower the graduates of the program to have entrepreneurial skills with a lifelong learning attitude in order to support the growth of the economy of a country.

PROGRAM OUTCOMES

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

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

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

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

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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

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

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

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

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

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

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

B.Tech – CSE(DS) : PROGRAM SPECIFIC OUTCOMES

PSO 1: Analyse and visualize data in the context of real world problems, communicate findings, and interpret results using data analytics for decision making

PSO 2: Students of the Data Science will explore interdisciplinary research and applications to solve industry problems and sustainable development goals.

FOREWORD

The autonomy is conferred on MLR Institute of Technology by UGC, based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

MLR Institute of Technology is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college in order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

CONTENTS

1. Regulations..... 02
2. Course Structure..... 21
3. I B. Tech I Sem Syllabus..... 29
4. I B. Tech II Sem Syllabus..... 46
5. II B. Tech I Sem Syllabus..... 59
6. II B. Tech II Sem Syllabus..... 76
7. III B. Tech I Sem Syllabus..... 94
8. III B. Tech II Sem Syllabus..... 111
9. IV B. Tech I Sem Syllabus..... 129
10. IV B. Tech II Sem Syllabus..... 148
11. Open Electives 161

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2020-21)
&
B. Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2021-22)

For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by MLR Institute of Technology under Autonomous status is herein referred to as MLRIT (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for M L R Institute of Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, M L R Institute of Technology shall be the chairman Academic Council.

1. ADMISSION

1.1. **Admission into first year of four year B. Tech. degree programmes of study in Engineering**

1.1.1. **Eligibility:**

A candidate seeking admission into the first year of four year B. Tech. degree Programmes should have:

(i) Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii) Secured a rank in the EAMCET examination conducted by TSCHE for allotment of a seat by the Convener, EAMCET, for admission.

1.1.2. **Admission Procedure:**

Admissions are made into the first year of four year B. Tech. Degree Programmes as per the stipulations of the TSCHE.

(a) Category A seats are filled by the Convener, TSEAMCET.

(b) Category B seats are filled by the Management.

1.2. **Admission into the second year of four year B. Tech. degree Program in Engineering**

1.2.1 **Eligibility**:

A candidate seeking admission under lateral entry into the II year I Semester B. Tech. degree Programmes should have passed the qualifying exam (B.Sc. Mathematics or Diploma in concerned course) and based on the rank secured by the candidate at Engineering Common Entrance Test ECET (FDH) in accordance with the instructions received from the Convener, ECET and Government of Telangana.

1.2.2 **Admission Procedure**:

Admissions are made into the II year of four year B. Tech. degree Programmes through Convener, ECET (FDH) against the sanctioned strength in each Programmes of study as lateral entry students.

2. PROGRAMMES OFFERED

MLR Institute of Technology, an autonomous college affiliated to JNTUH, offers the following B.Tech. Programmes of study leading to the award of B. Tech. degree under the autonomous scheme.

1) B.Tech. - Aeronautical Engineering
2) B.Tech.- Artificial Intelligence & Machine Learning
3) B.Tech. - Computer Science and Engineering
4) B.Tech - CSE (Artificial Intelligence & Machine Learning)
5) B.Tech - CSE(Data Science)
6) B.Tech - CSE (Cyber Security)
7) B.Tech - Computer Science & Information Technology
8) B.Tech. - Electronics and Communication Engineering
9) B.Tech - Electrical & Electronics Engineering
10) B.Tech. - Information Technology
11) B.Tech. - Mechanical Engineering

3. DURATION OF THE PROGRAMMES

3.1 Normal Duration

3.1.1 B. Tech. degree programme extends over a period of four academic years leading to the Degree of Bachelor of Technology (B.Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.1.2 For students admitted under lateral entry scheme, B. Tech. degree programme extends over a period of three academic years leading to the Degree of Bachelor of Technology (B. Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.2 Maximum Duration

3.2.1 The maximum period within which a student must complete a full-time academic programme is 8 years for B. Tech. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.2 For students admitted under lateral entry scheme in B. Tech. degree programme, the maximum period within which a student must complete a full-time academic programme is 6 years. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.3 The period is reckoned from the academic year in which the student is admitted first time into the degree Programme.

4. AWARD OF B.Tech. DEGREE

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

4.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight years.

4.2 The candidate shall register for 160 credits and secure 160 credits.

4.3 The degree will be conferred and awarded by Jawaharlal Nehru Technological University Hyderabad on the recommendations of the Chairman, Academic Council.

5. PROGRAMME STRUCTURE

5.1 UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed below.

Semester Scheme:

Each UGP is of 4 Academic Years (8 Semesters), each year divided into two Semesters of 22 weeks (≥90 working days), each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/Course Structure as suggested by AICTE are followed.

5.1.2 The B.Tech. Programme of MLR Institute of Technology are of Semester pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 15-18 Weeks duration with a minimum of 90 Instructional Days per Semester.

5.1.3 Credit Courses:

a) All 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 (Lecture Periods: Tutorial Periods: Practical Periods : Credits) Structure, based on the following general pattern ..

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

5.1.4 **Course Classification:**

All Courses offered for the UGP are broadly classified as:

- **Basic Science Courses (BSC)** include Mathematics, Physics, Chemistry, Biology etc.

- **Engineering Science Courses (ESC)** courses include Materials, Workshop, Basics of Electrical/Electronics/ Mechanical/Computer Science & Engineering, Engineering Graphics, Instrumentation, Engineering Mechanics, Instrumentation etc.

- **Humanities and Social Science including Management Courses (HSMC)** courses include English, Communication skills, Management etc.

- **Professional Core Courses (PCC)** are core courses relevant to the chosen specialization/branch.

- **Professional Elective Courses (PEC)** are courses relevant to the chosen specialization/ branch offered as electives.

- **Open Elective Courses (OEC)** courses from other technical and/or emerging subject areas offered in the College by the Departments of Engineering, Science and Humanities.

- **Mandatory Course:** Course work on peripheral subjects in a programme, wherein familiarity considered mandatory. To be included as non-Credit, Mandatory Courses, with only a pass in each required to qualify for the award of degree from the concerned institution.

- **Project Work** and/or internship in industry or elsewhere, seminar.

- **MOOCS –** Massive Open Online Courses in a variety of disciplines available at both introductory and advanced levels, accessible from e-resources in India and abroad. .

5.1.5 **Course Nomenclature:**

The Curriculum Nomenclature or Course-Structure Grouping for the each of the UGP E&T (B.Tech. Degree Programme), is as listed below (along with AICTE specified Range of Total Credits).

S. No.	***Broad Course Classification***	***Course Group/ Category***	***Course Description***
1)	BSC,ESC & HSMC	BSC – Basic Sciences Courses	Includes - Mathematics, Physics and Chemistry Subjects
2)		ESC - Engineering Sciences Courses	Includes fundamental engineering subjects.
3)		HSMC – Humanities and Social Sciences including Management	Includes subjects related to Humanities, Social Sciences and Management.
4)	PCC	PCC – Professional Core Courses	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.
5)	PEC	PEC– Professional Elective Courses	Includes Elective subjects related to the Parent Discipline / Department / Branch of Engg.
6)	OEC	OEC – Open Elective Courses	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/ Department / Branch of Engg.
7)	PWC	Project Work	Major Project.
8)		Industrial Training/ Mini- Project	Industrial Training/ Internship/ Mini-Project.
9)		Seminar	Seminar / Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.
10)	MC	Mandatory Courses	Mandatory Courses (non-credit)
Total Credits for UGP (B. Tech.)Programme			

- Minor variations as per AICTE guidelines

6. COURSE REGISTRATION

6.1 A 'Faculty Advisor or Counsellor' shall be assigned to each student, who advises him/her about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his/her competence, progress, pre-requisites and interest.

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

6.3 A Student can apply for Registration, which includes approval from his faculty advisor, and then should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

6.4 A student may be permitted to register for his/her course of CHOICE with a Total of prescribed credits per Semester (permitted deviation being±12%), based on his PROGRESS and SGPA/CGPA, and completion of the 'PRE-REQUISITES' as indicated for various courses in the Department Course Structure and Syllabus contents.

6.5 Choice for 'additional Courses' must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Counsellor.

6.6 If the Student submits ambiguous choices or multiple options or erroneous (incorrect) entries during Registration for the Course(s) under a given/specified Course Group/ Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.

6.7 Dropping of Courses or changing of options may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor, 'within 15 Days of Time' from the commencement of that Semester. Course Options exercised through Registration are final and CAN NOT be changed, and CAN NOT be inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected 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 will be made by Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

7. COURSES TO BE OFFERED

7.1 A typical section (or class) strength for each semester shall be 60.

7.2 courses may be offered to the Students, only if minimum of 20 students (1/3rd of the section strength) opt for it.

7.2 More than ONE TEACHER may offer the SAME SUBJECT (Lab/Practical's may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - 'CGPA Basis Criterion' (i.e., the first focus shall be on early Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

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

7.4 OPEN ELECTIVES will be offered by a department to the students of other departments.

8. B.Tech. (HONOURS) DEGREE

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

8.1. B.Tech. Students in regular stream can opt for B.Tech.(Hons.), provided they have a CGPA of .0 and above up to the end of IVth semester without any history of arrears and attempting of betterment.

8.2 For B. Tech (Honors), a student needs to earn additional 20 credits (over and above the required

160 credits for B. Tech degree). Student to opt for the courses from NPTEL/ SWAYAM /

Coursera /other MOOC platform as recommended by concern BOS relevant to her/his discipline through MOOCs as recommended by the BOS.

8.3 If the credits of NPTEL/ SWAYAM/ Coursera /other MOOC platform courses do not match

with the existing subject proper scaling will be done by the college.

8.4 After registering for the B.Tech (Honours) programme, if a student fails in any course he/she

will not be eligible for B.Tech(Honours).

8.7 Students who have obtained "C grade " or "reappear" or "Repeat Course" / "Re Admitted" or

"Detained" category in any course, including the MOOCs courses, are not eligible for B.Tech(Honours)degree. Up to 8 semesters without any history of arrears and attempting of

betterment is not eligible to get B.Tech(Hons.).

8.8 Those who opted for B. Tech (Honours) but unable to earn the required additional credits in 8

semesters or whose final CGPA is less than 8 shall automatically fall back to the B.Tech.

Programme. However, additional course credits and the grades thus far earned by them will be

shown in the grade card but not included for the CGPA.

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

Table : Assigned Credits

Online Course Duration	Assigned Credits
04 Weeks	01 Credit
08 Weeks	03 Credits
12 Weeks	04 Credits

9. B.Tech. (MINOR) DEGREE

This concept is introduced in the curriculum of all conventional B. Tech. programmes offering a major degree. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme. In order to earn a Minor in a discipline a student has to earn 20 extra credits by studying any seven theory subjects from the programme core & professional elective courses of the minor discipline or equivalent MOOC courses available under SWAYAM platform. The list of courses to be studied either in MOOCs or conventional type will be decided by the department at the time of registration for Minor degree.

a. B.Tech. students in regular stream can opt for B.Tech.(Minor.), provided they have a CGPA

of 8.0 and above up to the end of IVth semester without any history of arrears and attempting

of betterment.

b. Students aspiring for a Minor must register from **V** semester onwards and must opt for Minor in a discipline other than the discipline he/she is registered in. However, Minor discipline registrations are not allowed before V semester and after VI semester.

c. Students will not be allowed to register and pursue more than two subjects in any semester.
d. Completion of a Minor discipline programme requires no addition of time to the regular Four year Bachelors' programme. That is, Minor discipline programme should be completed by the end of final year B. Tech. program along with the major discipline.
e. A student registered for Minor in a discipline shall pass in all subjects that constitute the requirement for the Minor degree programme. No class/division (i.e., second class, fist class and distinction, etc.) shall be awarded for Minor degree programme.

10. ATTENDANCE REQUIREMENTS

a. A student will be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/Courses (excluding Mandatory or Non-Credit Courses) for that Semester.

b. 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 on genuine and valid grounds, based on the student's representation with supporting evidence by following the govt. rules in vogue.

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

d. Shortage of Attendance below 65% in aggregate shall in No case be condoned.

e. A student shall not be promoted to the next Semester unless he/she satisfies the attendance requirements of the current Semester. The student may seek readmission for the Semester when offered next. He / She shall not be allowed to register for the subjects of the Semester while he/she is in detention. A student detained due to shortage of attendance, will have to repeat that Semester when offered next. The academic regulations under which the student has been readmitted shall be applicable.

f. A student detained lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits. The academic regulations under which the student has been readmitted shall be applicable.

g. Students whose attendance is less than 75% are not entitled to get the scholarship / fee reimbursement in any case as per the TS Govt. Rules in force.

11. ACADEMIC REQUIREMENTS FOR PROMOTION/COMPLETION OF REGULAR B.TECH PROGRAMME COURSE STUDY.

11.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Course, if he secures not less than 35% marks in the End Semester Examination, and a minimum of 40% of 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 P Grade or above in that Course.

11.2 A Student will not be promoted from I Year to II Year, unless he/she fulfils the Attendance requirements.

11.3 A Student will not be promoted from II Year to III Year, unless he/she fulfils the Attendance and Academic Requirements and (i) secures a Total 50% of Credits up to II Year II Semester from all the relevant regular and supplementary examinations.

11.4 A Student will not be promoted from III Year to IV Year, unless he/she fulfils the attendance and Academic Requirements and (i) secures a Total 50% of Credits up to III Year II Semester, from all the regular and supplementary examinations.

11.5 After securing the necessary 160 Credits as specified for the successful completion of the entire UGP, resulting in 160 Credits for UGP performance evaluation, i.e., the performance of the Student in these 160 Credits shall alone be taken into account for the calculation of the final CGPA.

If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses Totalling to 160 Credits as specified in the Course Structure of his/her Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 160 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in items 8 and 9.1-9.5.

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

When a Student is detained due to shortage of attendance/lack of credits in any Semester, he may be re-admitted into that Semester, as and when offered. However the regulations at the time of admissions hold good.

12. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

12.1 The performance of a student in each Semester shall be evaluated Course-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory. The B.Tech Project Work (Major Project) will be evaluated for 100 marks in Phase-I and 200 Marks in Phase-II.

12.2 For all Theory Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

12.3 a) For Theory Subjects (inclusive of Minor Courses), during the semester, there shall be two Continues Internal Evaluations (CIE) examinations for 30 marks each. Each CIE examination consists of one subjective paper for 25 marks, and assignment for 5 marks for each subject. Question paper contains two Parts (Part-A and Part-B.) The distribution of marks for PART-A and PART-B will be 10 marks & 15 marks respectively for UG programme.

Pattern of the question paper is as follows:

PART–A

Consists of ***one compulsory question*** with five sub questions each carrying two mark. For the I-Mid examinations the sub question would be from first 2 ½ units and for the II-Mid examination the sub question would be from the remaining 2 ½ units.

PART-B

Consists of five questions (out of which students have to answer three questions) carrying five marks each. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question). The questions can consist of sub questions also.

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

c) First Assignment should be submitted before the commencement of the first mid-term examinations, and the Second Assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified/given by the concerned subject teacher.

d) If any candidate is absent for the CIE examinations or those who want to improve their internal marks in any subject can opt for improvement exam as and when offered. The improvement exam is a 45 minutes duration and consisting of 30 objective questions from the entire syllabus of the subject. Best marks is consider as a final marks from the average of two mid examinations or improvement examination marks. The improvement can be taken after the payment of prescribed fee. There is no Internal Improvement for the courses Machine Drawing, Production Drawing, Engineering Drawing, Engineering Graphics and practical, mandatory courses.

12.4 For Practical Courses, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks, and 70 marks are assigned for Lab/Practical End Semester Examination (SEE). Out of the 30 marks for internals, day-to-day work in the laboratory shall be evaluated for 15 marks; and for the remaining 15 marks - two internal practical tests (each of 15 marks) shall be conducted by the concerned laboratory teacher and the average of the two tests is taken into account. The SEE for Practical's shall be conducted at the end of the Semester by Two Examiners appointed by the Chief Controller of Examinations in consultation with the Head of the Department.

12.5 For the Subjects having Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (10 marks for day-to-day work and 20 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

12.6 Open Elective Course**:** Students can choose one open elective course (OE-I) during III-B.Tech I-semester, one (OE-II) during III-B.Tech II-semesterr, one (OE-III) in IV-B.Tech I-semester, and one (OE-IV) in IV-B.Tech II-semester from the list of open elective courses given. However, students cannot opt for an open elective courses offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any Semester.

12.7 There shall be an mini project to be taken up during the vacation after II-B.Tech. II-Semester examination. However, the mini project and its report shall be evaluated in III-B.Tech I- Semester SEE & CIE. The mini project shall be submitted in a report form and presented before the committee. There is an internal marks of 30, the evaluation should be done by the supervisor. The There is an external marks of 70 and the same evaluated by the external examiner appointed by the Chief Controller of Examinations and he secures a minimum of 35% of marks in the Semester End Examination and a minimum aggregate of 40% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

12.8 There shall be a independent study in III-B.Tech II-Semester and will be conducted SEE by through a test or a committee consisting of One External Examiner, Head of the Department and two Senior faculty members of the Department. The independent study is intended to assess the student's understanding of the subjects he/she studied during the B.Tech course of study and evaluated for 100 marks. There shall be no CIE for independent study.

12.9 Each Student shall start the Project Work Phase-I during the IV B.Tech I Semester(VII Semester), as per the instructions of the Project Guide/Project Supervisor assigned by the Head of Department. Total 100 marks allotted for the Project Work Stage-I. 40% of marks shall be evaluated Project Guide/Project supervisor CIE (Continuous Internal Evaluation) based on the reports submitted and conduct presentations. Remaining 60% of marks shall be evaluated by committee comprising of the Head of the Department, project supervisor and senior faculty member from concerned department based on Viva/Seminar Presentation. He/She must secure the 40% of the marks from CIE. For Project work Phase-II in IV Year II Sem. There is an internal marks of 50, the evaluation should be done by the

supervisor. The There is an external marks of 150 and the same evaluated by the external examiner appointed by the Chief Controller of Examinations and he secures a minimum of 35% of marks in the Semester End Examination and a minimum aggregate of 40% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

12.10. **Semester End Examination:**

a) Question paper contains 2 Parts (Part-A and Part-B) having the questions distributed equally among all units.

b) The distribution of marks for i) PART-A for 20 marks ii) PART-B for 50 marks. Pattern of the question paper is as follows:

PART–A

Consists of one question which are compulsory. The question consists of ten sub-questions one from each unit and carry 2 marks each.

PART-B

Consists of 5 questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question).

12.11 For Mandatory Non-Credit Courses offered in a Semester, after securing ≥ 65% attendance and has secured not less than 35% marks in the SEE, and a minimum of 40% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for these courses/activities.However, for non credit courses '**Satisfactory'** or "**Unsatisfactory'** shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.12 SWAYAM: College intends to encourage the students to do a minimum of one MOOC in discipline and open elective during third year. The respective departments shall give a list of **s**tandard MOOCs providers including SWAYAM whose credentials are endorsed by the BoS chairperson. In general, MOOCs providers provide the result in percentage. In such case, the college shall follow the grade table mentioned in 14.2. The Credits for MOOC(s) shall be transferred same as given for the respective discipline or open electives. In case a student fails to complete the MOOCs he/she shall re-register for the same with any of the providers from the list provided by the department. Still if a student fails to clear the course/s, or in case a provider fails to offer a MOOC in any semester, then in all such cases the college shall conduct the end semester examinations for the same as per the college end semester examination pattern. The syllabi for the supplementary examinations shall be same as that of MOOCs. There shall be no internal assessment however the marks obtained out of 70 shall be scaled up to 100 marks and the respective letter grade shall be allotted. The details of MOOC(s) shall be displayed in Memorandum of Grades of a student, provided he/she submits the proof of completion of it or them to the examination branch through the Coordinator/Mentor, before the end semester examination of the particular semester.

13. AWARD OF DEGREE

After a student has satisfied the requirement prescribed for the completion of the Programme and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes Shown in Table.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 6.50 to < 8.00 CGPA
Second Class	≥ 5.50 to < 6.50 CGPA
Pass Class	≥ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

a) **Improvement of Grades and Completion of the Course**

i) Candidates who have passed in a theory course in a Semester are allowed to appear for improvement of Grade in the next immediate supplementary examination for a maximum of three subjects only. Candidates will not be allowed to improve grade in the Laboratory, Seminars, Internships and Project Work.

ii) Improved grade will not be counted for the award of prizes/medals and Rank. However the previous grade will be considered for the award of prizes/medals and rank in case of toppers.

iii) If the candidate does not show improvement in the grade, his/her previous grade will be taken into consideration.

14. LETTER GRADE AND GRADE POINT

14.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practical's, or Seminar, or Project, or Internship*/Mini-Project, Minor Course etc., based on the %marks obtained in CIE+SEE (Continuous Internal Evaluation + Semester End Examination, both taken together), and a corresponding Letter Grade shall be given.

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

% of Marks Secured (Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points*
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 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 (Average)	5
Below 40% (< 40%)	F (FAIL)	0
Absent	AB	0

14.3 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

offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

14.4 A Letter Grade does not imply any specific % of Marks.

14.5 In general, a student shall not be permitted to repeat any Subject/Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Subjects/Courses pertaining to that Semester, when he is detained.

14.6 A student earns Grade Point (GP) in each Subject/Course, on the basis of the Letter Grade obtained by him 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 Point (GP) x Credits …. For a Course

14.7 The Student passes the Subject/Course only when he gets GP ≥ 4 (P Grade or above).

14.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) 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 that ix Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i Subject.

Illustration of Computation of SGPA Computation

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	4	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x10= 30
Course5	3	C	5	3 x 5 = 15
Course6	4	B	6	4 x 6 = 24

Thus, **SGPA =139/20 =6.95**

14.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL 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

(i.e., up to and inclusive of S Semesters, S ≥ 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 up to 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 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.

For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Credits : 20 SGPA : 6.9	Credits : 22 SGPA : 7.8	Credits : 25 SGPA : 5.6	Credits : 26 SGPA : 6.0	Credits : 26 SGPA : 6.3	Credits : 25 SGPA : 8.0

Thus, **CGPA =** $\frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144} = 6.73$

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

14.11 For Calculations listed in Item 12.6–12.10, performance in failed Subjects/Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

14.12 Conversion formula for the conversion of GPA into indicative percentage is

% of marks scored = (final CGPA -0.50) x 10

15. DECLARATION OF RESULTS

Computation of SGPA and CGPA are done using the procedure listed in 12.6– 2.10.

No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given Semester.

16. WITH HOLDING OF RESULTS

If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason what so ever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

17. REVALUATION

Students shall be permitted for revaluation after the declaration of end Semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

18. SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even Semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write more than one examination per day.

ADVANCED SUPPLEMENTARY EXAMINATION

Advanced supplementary examinations will be conducted for IV year II Semester after announcement of regular results.

19. TRANSCRIPTS

After successful completion of prerequisite credits for the award of degree a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

20. RULES OF DISCIPLINE

20.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of controller of Examination for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

20.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that course(s) and grading is done accordingly.

20.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

20.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Examiner is final.

21. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

a) Controller of examinations - Chairman
b) Addl. Controller of examinations.- Member Convenor
c) Subject expert - member
d) Head of the department of which the student belongs to. - Member
e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

22. TRANSITORY REGULATIONS

Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be), and same Professional Electives/Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his I Year I Semester).

23. AMENDMENTS TO REGULATIONS

The Academic Council of MLR Institute of Technology reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

24. STUDENT TRANSFERS

There shall be no Branch transfers after the completion of Admission Process. Transfer of students from other colleges or universities are permitted subjected to the rules and regulations of TSCHE (TE Department) and JNTUH in vogue.

25. GRADUATION DAY

The College shall have its own Annual Graduation Day for the award of Degrees issued by the College/University.

26. AWARD OF MEDALS

Institute will award Medals to the outstanding students who complete the entire course in the first attempt within the stipulated time.

27. SCOPE

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her".

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

iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

Academic Regulations for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2020-2021 on wards)

1. The Students have to acquire 124 credits from II to IV year of B.Tech Programme (Regular) for the award of the degree.

2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3. The same attendance regulations are to be adopted as that of B. Tech. (Regular)

Promotion Rule:

A Student will not be promoted from III Year to IV Year, unless he/she fulfils the Attendance and Academic Requirements and (i) secures a Total of 50% Credits up to III Year II Semester, from all the regular and supplementary examinations.

Award of Class:

After the student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes: The marks obtained for 124 credits will be considered for the calculation of CGPA and award of class shall be shown separately.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA $\geq$ 8.00
First Class	$\geq$ 6.50 to < 8.00 CGPA
Second Class	$\geq$ 5.50 to < 6.50 CGPA
Pass Class	$\geq$ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

All other regulations as applicable for B. Tech. Four-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme).

MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices / Improper Conduct	Punishment
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the 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 candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	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 candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	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 Addl. Controller of examinations / 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 addl. Controller of examinations 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 addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his 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 candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive Semesters

		from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	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 candidate 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 candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	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 candidate 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 candidate has appeared including practical examinations and project work of that Semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

COURSE STRUCTURE

Course Structure

Computer Science and Engineering - Data Science - MLR 20

I B.Tech.- I-Semester

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5BS02	Linear Algebra and Calculus	BSC	3	1	-	4	30	70	100
A5BS11	Applied Chemistry	BSC	4	-	-	4	30	70	100
A5CS01	Programming for Problem Solving	ESC	3	-	-	3	30	70	100
A5HS01	English	HSMC	2	-	-	2	30	70	100
A5CS02	Programming for Problem Solving Lab	ESC	-	-	3	1.5	30	70	100
A5BS12	Applied Chemistry Lab	BSC	-	-	3	1.5	30	70	100
A5HS02	English Language and Communication Skills Lab	HSMC	-	-	2	1	30	70	100
TOTAL			12	01	08	17	210	490	700
Mandatory Course (Non-Credit)									
A5MC01	Seminar-I	MC	-	-	02	-	30	70	100

I B.Tech.- II-Semester

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5BS04	Advanced Calculus	BSC	3	1	-	4	30	70	100
A5BS08	Applied Physics	BSC	3	1	-	4	30	70	100
A5EE70	Basic Electrical and Electronics Engineering	ESC	3	1	-	4	30	70	100
A5ME02	Engineering Graphics	ESC	1	-	4	3	30	70	100
A5BS15	Applied Physics Lab	BSC	-	-	3	1.5	30	70	100
A5EC01	Introduction to Internet of Things	ESC	-	-	3	1.5	30	70	100
A5ME04	Engineering Workshop	ESC	-	-	2	1	30	70	100
TOTAL			10	03	12	19	210	490	700
Mandatory Course (Non-Credit)									
A5MC02	Seminar-II	MC	-	-	02	-	30	70	100

II B.TECH.- I SEMESTER									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5BS05	Probability and Statistics	BSC	3	1	-	4	30	70	100
A5BS16	Discrete Mathematics	BSC	3	1	-	4	30	70	100
A5EC72	Digital Electronics and Computer Organization	ESC	3	1	-	4	30	70	100
A5IT01	Object Oriented Programming	PCC	3	1	-	4	30	70	100
A5IT03	Python Programming	PCC	3	1	-	4	30	70	100
A5IT05	Python Programming Lab	PCC	-	-	3	1.5	30	70	100
A5IT02	Object Oriented Programming Lab	PCC	-	-	3	1.5	30	70	100
Total			15	05	06	23	210	490	700
Mandatory Course (Non-Credit)									
A5MC03	Environmental Studies	MC	2	-	-	-	30	70	100

II B.Tech.- II SEMESTER									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5HS06	Business Economics and Financial Analysis	HSMC	3	-	-	3	30	70	100
A5AI01	Data structures using Python	ESC	3	1	-	4	30	70	100
A5CS05	Database Management Systems	PCC	3	-	-	3	30	70	100
A5CS08	Design and Analysis of Algorithms	PCC	3	1	-	4	30	70	100
A5CS13	Operating Systems	PCC	3	1	-	4	30	70	100
A5AI02	Data structures using Python Lab	ESC	-	-	3	1.5	30	70	100
A5CS06	Database Management Systems Lab	PCC	-	-	3	1.5	30	70	100
Total			15	03	06	21	210	490	700
Mandatory Course (Non-Credit)									
A5MC04	Gender Sensitization	MC	-	-	2	-	30	70	100

III B.Tech.- I SEMESTER

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5DS01	Data Analytics	PCC	3	1	-	4	30	70	100
A5IT04	Automata and Compiler Design	PCC	3	-	-	3	30	70	100
A5DS03	Web Programming	PCC	3	1	-	4	30	70	100
PEC	Professional Elective-I	PEC	3	-	-	3	30	70	100
OEC	Open Elective-I	OEC	3	-	-	3	30	70	100
A5DS04	Web Programming Lab	PCC	-	-	3	1.5	30	70	100
A5DS02	Data Analytics Lab	PCC	-	-	2	1	30	70	100
A5DS14	Mini Project	PWC	-	-	-	2	30	70	100
Total			15	02	05	21.5	240	560	800
Mandatory Course (Non-Credit)									
A5MC05	Human Values and Professional Ethics	MC	-	-	2	-	30	70	100

III B.Tech.- II SEMESTER

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5AI19	Machine Learning	PCC	3	-	-	3	30	70	100
A5CS15	Computer Networks	PCC	3	1	-	4	30	70	100
A5CS17	Big Data Analytics	PCC	3	1	-	4	30	70	100
PEC	Professional Elective-II	PEC	3	-	-	3	30	70	100
OEC	Open Elective-II	OEC	3	-	-	3	30	70	100
A5AI20	Machine Learning Lab	PCC	-	-	3	1.5	30	70	100
A5CS18	Big Data Analytics Lab	PCC	-	-	2	1	30	70	100
A5DS15	Independent Study/MOOCs	PWC	-	-	-	1	-	100	100
Total			15	02	05	20.5	210	590	800

IV B.Tech.- I SEMESTER									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A5DS05	Deep Learning	PCC	3	1	-	4	30	70	100
A5IT11	Human Computer Interaction	PCC	3	-	-	3	30	70	100
PEC	Professional Elective-III	PEC	3	-	-	3	30	70	100
PEC	Professional Elective-IV	PEC	3	-	-	3	30	70	100
OEC	Open Elective-III	OEC	3	-	-	3	30	70	100
A5DS06	Deep Learning Lab	PCC	-	-	2	1	30	70	100
A5DS16	Major Project Phase - 1	PWC	-	-	8	4	100	-	100
Total			15	01	10	21	280	420	700

IV B.Tech. - II SEMESTER									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
PEC	Professional Elective-V	PEC	3	-	-	3	30	70	100
PEC	Professional Elective-VI	PEC	3	-	-	3	30	70	100
OEC	Open Elective-IV	OEC	3	-	-	3	30	70	100
A5DS17	Major Project Phase - 2	PWC	-	-	16	8	50	150	200
Total			09	-	16	17	140	360	500

PROFESSIONAL ELECTIVES			
PE - I		**PE - II**	
A5DS07	Exploratory Data Analytics	A5DS08	Python for Data Science
A5DS09	NoSQL Databases	A5DS18	Data Wrangling
A5AI07	Data Mining Techniques	A5AI03	Artificial Intelligence
PE - III		**PE - IV**	
A5DS22	Social Network Analytics	A5DS10	Big Data Management
A5DS20	Time Series Analysis and Forecasting	A5DS21	Text Analytics and Natural Language Processing
A5CS23	Cloud Computing	A5AI12	Computer Vision
PE - V		**PE - VI**	
A5DS11	Data Collection and Analysis with IOT.	A5DS12	Data Visualization
A5DS19	Predictive Modeling and Analytics	A5DS13	Business Intelligence and Analytics
A5CY23	Bit Coins	A5IT20	Information Retrieval Systems

OPEN ELECTIVE COURSES

OPEN ELECTIVE COURSE - I			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE62	Fundamentals of Avionics	Aeronautical Engineering
2.	A5AE63	Introduction to Aerospace Technology	
3.	A5CS30	Core Java Programming	Computer Science and Engineering
4.	A5CS22	Introduction to Data Analytics	
5.	A5EC54	Microprocessors and Interfacing	Electronics & Communication Engineering
6.	A5EC55	Principles of Communications	
7.	A5EE52	Electrical Wiring and Safety Measures	Electrical &Electronics Engineering
8.	A5EE53	Electrical Materials	
9.	A5IT21	Fundamentals of Data Structures	Information Technology
10.	A5IT22	Introduction to Machine Learning	
11.	A5ME71	Elements Of Mechanical Engineering	Mechanical Engineering
12.	A5ME72	Fundamentals of Engineering Materials	
13.	A5HS06	Business Economics and Financial Analysis	HSM
14.	A5HS07	Basics of Entrepreneurship	
OPEN ELECTIVE COURSE - II			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE64	Introduction to Jets and Rockets	Aeronautical Engineering
2.	A5AE65	Non-Destructive Testing Methods	
3.	A5CS31	Fundamentals of DBMS	Computer Science and Engineering
4.	A5CS07	Introduction to Design and Analysis of Algorithms	
5.	A5EC58	Microcontrollers and Applications	Electronics & Communication Engineering
6.	A5EC61	Fundamentals of Image processing	
7.	A5EE56	Analysis of Linear Systems	Electrical &Electronics Engineering
8.	A5EE57	Neural Networks and Fuzzy Logic	
9.	A5IT23	Basics of Python Programming	Information Technology
10.	A5IT11	Human Computer Interaction	
11.	A5ME73	Fundamentals of Mechatronics	Mechanical Engineering
12.	A5ME74	Basics Of Thermodynamics	
13.	A5HS09	Advanced Entrepreneurship	HSM

OPEN ELECTIVE COURSE-III			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE66	Introduction to Aircraft Industry	Aeronautical Engineering
2.	A5AE67	Unmanned Aerial Vehicles	
3.	A5CS33	Introduction to Cloud Computing	Computer Science and Engineering
4.	A5CS34	Computer Organization and Operating Systems	
5.	A5EC62	Introduction to Sensors and Actuators	Electronics & Communication Engineering
6.	A5EC63	Introduction to Computer Vision	
7.	A5EE60	Solar Energy and Applications	Electrical &Electronics Engineering
8.	A5IT24	Introduction to AI	Information Technology

9.	A5IT25	Software Testing Fundamentals	
10.	A5ME75	Basics of Robotics	Mechanical Engineering
11.	A5ME76	Fundamentals of Operations Research	
12.	A5HS10	Indian Ethos and Business Ethics	HSM
OPEN ELECTIVE-IV			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE68	Fundamentals of Wind Power Technology	Aeronautical Engineering
2.	A5AE69	Guidance and Control of Aerospace Vehicles	
3.	A5CS20	Distributed Databases	Computer Science and Engineering
4.	A5CS29	Software Project Management	
5.	A5EC64	Introduction to Mobile Communications	Electronics & Communication Engineering
6.	A5EC65	Basics of Embedded System Design	
7.	A5EE61	Instrumentation and Control	Electrical &Electronics Engineering
8.	A5EE63	Energy Storage Systems	
9.	A5IT26	Introduction to Mobile Application Development	Information Technology
10.	A5IT27	Big Data	
11.	A5ME77	Introduction to Material Handling	Mechanical Engineering
12.	A5ME78	Renewable Energy Sources	
13.	A5HS11	Management Science	HSM
14.	A5HS12	Intellectual Property Rights	

I B.TECH I SEMESTER SYLLABUS

LINEAR ALGEBRA AND CALCULUS

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5BS02	BSC	3	1	-	4	30	70	100
Contact Classes: 44	Tutorial Classes: 8	Practical Classes: Nil				Total Classes: 52		

COURSE OBJECTIVES

The course should enable the students to:

1. The concept of differential equations and solve them using appropriate methods.
2. Usage of the appropriate test to find the convergence and divergence of the given series.
3. Concept of Rank of a matrix, Consistency and solving system of linear equations.
4. The Rank and Nullity of vectors.
5. Concept of eigen values, eigen vectors and diagonalization of the matrix.

COURSE OUTCOMES

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

1. Identify the different types of differential equations and solve them using appropriate methods
2. Apply the appropriate test to find the convergence and divergence of the given series
3. Solve the system of linear equations using rank of a matrix.
4. Find Rank and Nullity of given vectors.
5. Diagonalize the matrix using eigen values and eigen vectors.

UNIT - I	ORDINARY DIFFERENTIAL EQUATIONS	CLASSES: 12

Introduction- Exact and reducible to Exact differential equations-Newton's Law of cooling-Law of Growth and Decay. Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous term of the type Q(x) = e^{ax}, Sin ax, Cosax, $e^{ax}v(x)$, $x^n v(x)$ - Method of variation of parameters.

UNIT - II	SEQUENCES AND SERIES	CLASSES: 08

Basic definitions of Sequences and series – Convergence and divergence –Comparison Test- Ratio Test –Raabe's Test - Cauchy's n^{th} root Test –Integral Test – Absolute and Conditional convergence – Power Series.

UNIT - III	THEORY OF MATRICES	CLASSES:12

Real matrices: Symmetric-skew-symmetric and orthogonal matrices –Complex matrices: Hermitian, Skew –Hermitian and Unitary matrices –Elementary row and column transformations –Elementary matrix-Finding rank of a matrix by reducing to Echelon form and Normal form-Finding the inverse of a matrix using elementary row/column transformations (Gauss-Jordan method)-Consistency of system of linear equations (homogeneous and non-homogeneous) using the rank of a matrix –Solving m n and n n linear system of equations by Gauss Elimination

UNIT - IV	VECTOR SPACES	CLASSES: 10

The n-dimensional Vectors –Vector space – linear dependence of vectors –Basis and dimensions –linear transformations-range and kernel of a linear map – rank and nullity - rank and nullity theorem – inverse of a linear transformation-composition of linear map- Matrix associated with a linear map.

UNIT - V	EIGEN VALUES, EIGEN VECTORS AND INNER PRODUCT SPACES	CLASSES: 10

Eigen values and Eigen vectors of a matrix- Eigenbases - Diagonalization- Inner product space – Norm of a vector – Schwarz's Inequality – Normed vector space – Orthogonal and orthonormal sets – Gram Schmidt orthogonalization process.

TEXT BOOKS:

1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East – West press, Reprint 2005.

REFERENCE BOOKS:

1. G.B.Thomas, calculus and analytical geometry,9th Edition, Pearson Reprint 2006.
2. N.P Bali and Manish Goyal ,A Text of Engineering Mathematics,Laxmi publications,2008.
3. E.L.Ince, Ordinary differential Equations,Dover publications,1958.

WEB REFERENCES:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#Mathematics
3. https://www.sosmath.com/
4. https://www.mathworld.wolfram.com/

E -TEXT BOOKS:

1. https://www.e-booksdirectory.com/details.php?ebook=10166

MOOCS COURSE:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

APPLIED CHEMISTRY

I B. TECH- I SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5BS11	BSC	4	-	-	4	30	70	100
Contact Classes:50	Tutorial Classes: 0	Practical Classes: 0				Total Classes: 50		

COURSE OBJECTIVES:

The course should enable the students to:

1. Impart knowledge on soft and hard water types and softening methods.
2. Introduce the basic concepts to develop electrochemical cells.
3. Familiarize the redox principle in batteries and fuel cells.
4. Enhance knowledge on corrosion and its significance.
5. Expose on polymer, nano and smart materials.

COURSE OUTCOMES:

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

1. **Illustrate** the types of hard and soft water, treatment of drinking and industrial water.
2. **Demonstrate** the basic principles of Electrochemistry in electrochemical cells.
3. **Impart** knowledge on the basic concepts of battery, biosensors and sources of renewable energy.
4. **Apply** the methods of metal finishing in solving corrosion related problems.
5. **Identify** the significance of polymers, nano and smart materials.

UNIT - I	WATER AND ITS TREATMENT	CLASSES: 10

Introduction - Hardness of water- Causes and effects of hardness - Expression and Units of Hardness - Determination of hardness by complex metric method- Numerical problems – Treatment of water by Ion exchange process - Potable water and its specifications – steps involved in treatment of potable water: screening, aeration, sedimentation, coagulation, filtration and sterilisation of water by Chlorination. Desalination of water by Reverse Osmosis.

UNIT - II	ELECTROCHEMISTRY AND ITS APPLICATIONS	CLASSES:10

Electro chemical cells – electrode potential - standard electrode potential - Nernst Equation -Types of electrodes - SHE, Calomel, Quinhydrone and Glass electrode -Electrochemical series, and its application- Numerical Problems. Potentiometric: acid- base and redox titration.

UNIT - III	BATTERIES AND SENSORS	CLASSES: 10

Batteries - battery characteristics- classification of batteries: primary, secondary, solar batteries- Applications – Construction and Functioning of Primary batteries - Li/MnO_2 cell, lithium cells, Secondary batteries- Lead acid storage battery and Lithium ion battery- Advantages of battery. Solar cells – advantages of solar cells. Sensors - Biosensors their application and advantages.

UNIT - IV	CORROSION AND ITS CONTROL	CLASSES: 10

Introduction-causes and effects-Chemical and Electrochemical corrosion – Mechanism of electrochemical corrosion- factors affecting rate of corrosion- corrosion control methods - cathodic protection and Protective coatings – Metallic coatings- Methods of metallic coatings – Hot dipping methods: Galvanizing, Tinning, cementation (sherardizing) - electroplating (Copper), electroless plating (nickel). Organic coating - Paints (constituents and functions).

UNIT - V	ENGINEERING MATERIALS	CLASSES: 10

Polymers -Polymeric materials – characteristics of Plastics, fibres and elastomers - thermoplastic and thermosetting resins - Conducting polymers – Preparation, properties and application of Polyacetylene and polyaniline (Polyaniline) - Biodegradable polymers – Advantages- Applications of Polylactic acid and poly glycolic acid.

Nanomaterials - characteristics - synthesis (Sol- gel method) – application and Advantages of Nano materials.

Smart materials - Introduction - Types of smart materials and applications.

TEXT BOOKS:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi, 2014.
2. O G Palanna, Engineering Chemistry, Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, 2003.
2. Engineering Chemistry (NPTEL Web-book), 11th edition by B.L. Tembe, Kamaluddin and M.S. Krishnan.
3. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press, 2013

WEB REFERENCES:

1. https://www.scribd.com/document/23180395/Engineering-Chemistry-Unit-I-Water-Treatment
2. https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry-supplement%20text.pdf
3. https://www.nano.gov/you/nanotechnology-benefits

E-TEXT BOOKS:

1. http://www.freebookcentre.net/Chemistry/Chemistry-Books-Online.html
2. http://www.freebookcentre.net/Chemistry/ElectroChemistry-Books-Download.html
3. http://www.freebookcentre.net/Chemistry/Materials-Chemistry-Books.html
4. http://www.freebookcentre.net/Chemistry/Polymer-Chemistry-Books.html
5. http://www.freebookcentre.net/chemistry-books-download/Engineering-Chemistry-by-Bharath-Institute-of-Science-and-Technology.html

MOOCS COURSE

1. http://nptel.ac.in/courses/122101001/34
2. https://ocw.mit.edu/courses/chemistry/

PROGRAMMING FOR PROBLEM SOLVING

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS01	ESC	3	-	-	3	30	70	100
Contact Classes: 64	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 64		

COURSE OBJECTIVES

The course should enable the students to:

1. Impart knowledge about problem solving and algorithmic thinking.
2. Familiarize with the syntax and semantics of C programming language.
3. Learn the usage of structured programming approach in solving problems.
4. Use arrays, pointers, strings and structures in solving problems.
5. Understand how to solve problems related to matrices, Searching and sorting.

COURSE OUTCOMES

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

1. Apply algorithmic thinking to understand, define and solve problems
2. Develop computer programs using programing constructs and control structures
3. Decompose a problem into functions to develop modular reusable code.
4. Use arrays, pointers, strings and structures to formulate algorithms and programs.
5. Use files to perform read and write operations.

UNIT - I	INTRODUCTION - PROBLEM SOLVING AND ALGORITHMIC THINKING	CLASSES: 12

Problem Solving and Algorithmic Thinking Overview – Problem Definition, logical reasoning, Algorithm definition, practical examples, properties, representation, flowchart, algorithms vs programs.
Algorithmic Thinking – Constituents of algorithms - Sequence, Selection and Repetition, input-output; Computation – expressions, logic; Problem Understanding and Analysis – problem definition, variables, name binding, data organization: lists, arrays etc. algorithms to programs.

UNIT - II	OPERATORS, EXPRESSIONS AND CONTROL STRUCTURES	CLASSES: 15

Introduction to C language: Structure of C programs, data types, data inputs, output statements, Operators, precedence and associativity, evaluation of expressions, type conversions in expressions.
Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.

UNIT - III	ARRAYS AND FUNCTIONS	CLASSES: 17

Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi dimensional arrays, Basic Searching Algorithms: Linear and Binary search
Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, call by reference, Passing arrays to functions, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Towers of Hanoi etc.

UNIT - IV	STRINGS AND POINTERS	CLASSES: 10

Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.
Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers,

functions returning pointers, Dynamic memory allocation.

UNIT - V	STRUCTURES AND FILE HANDLING	CLASSES: 10

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self-referential structures, unions, typedef , enumerations.
File handling: command line arguments, File modes, basic file operations read, write and append, example programs

TEXT BOOKS:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Byron Gottfried, “Programming with C”, Schaum's Outlines Series, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS:

1. W. Kernighan Brian, Dennis M. Ritchie, “The C Programming Language”, PHI Learning, 2nd Edition, 1988.
2. Yashavant Kanetkar, “Exploring C”, BPB Publishers, 2nd Edition, 2003.
3. Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014.
4. R. S. Bichkar, “Programming with C”, Universities Press, 2nd Edition, 2012.
5. Dey Pradeep, Manas Ghosh, “Computer Fundamentals and Programming in C”, Oxford University Press, 2nd Edition, 2006.
6. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Computational_thinking
2. https://nptel.ac.in/courses/106/104/106104128/
3. https://en.cppreference.com/w/c/language
4. https://www.learn-c.org/

E-TEXT BOOKS:

1. https://slidelegend.com/queue/computational-thinking-for-the-modern-problem-solver_59d6f01e1723ddb0c7a0df47.html
2. http://flowgorithm.altervista.org/#elf_l1_Lw
3. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm

MOOC COURSE

1. https://www.coursera.org/learn/computational-thinking-problem-solving
2. https://onlinecourses.nptel.ac.in/noc18_cs33/preview
3. https://www.alison.com/courses/Introduction-to-Programming-in-c
4. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

ENGLISH

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS01	HSMC	2	-	-	2	30	70	100
Contact Classes: 32	Tutorial Classes: 0	Practical Classes: 00				Total Classes: 32		

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop language proficiency with emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Apply the theoretical and practical components of English syllabus to study academic subjects more effectively and critically.
3. Analyze a variety of texts and interpret them to demonstrate in writing or speech.
4. Write/ compose clearly and creatively, and adjust writing style appropriately to the content, the context, and nature of the subject.
5. Develop language components to communicate effectively in formal and informal situations.

COURSE OUTCOMES:

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

1. Construct sentences by using appropriate parts of speech.
2. Write letters/paragraphs/reports etc for meaningful professional communication.
3. Make use of appropriate vocabulary in both written and spoken contexts.
4. Comprehend and analyze different levels of written documents.
5. Analyze and correct common errors in spoken and written forms.

UNIT - I	**Of Studies by Francis Bacon**	**CLASSES: 06**

Vocabulary: The concept of Word Formation, Prefixes and Suffixes
Grammar: Word Families- Nouns, Pronouns, Verbs, Adjectives, Adverbs
Reading Skills: Reading for General Details
Writing Skills: Punctuation, Writing Paragraphs

UNIT - II	**Scientist in Training: The Oxford Years Stephen Hawking's Biography by Kristine Larsen**	**CLASSES: 06**

Vocabulary: Synonyms and Antonyms, Standard Abbreviations
Grammar: Preposition, Conjunctions, Articles
Reading Skills: Reading for Specific Details, Making Inferences
Writing Skills: Letter Writing- Letters of Request, Apology and Complaint- Letter of Application with Resume

UNIT - III	**The Teenage Years by Sarah Gray**	**CLASSES: 07**

Vocabulary: Idioms and Phrasal verbs, Technical Vocabulary
Grammar: Sentence Structures, Tenses
Reading Skills: Reading between the Lines
Writing Skills: Essay writing and Describing Objects, Places and Events

UNIT - IV	**Unlock Your Own Creativity by Robert Von Oech**	**CLASSES: 07**

Vocabulary: One word Substitutes, Words often confused
Grammar: Direct and Indirect Speech, Active and Passive Voice

Reading Skills: Reading Techniques- Skimming and Scanning of the Text Writing Skills: Technical Report Writing, E-mail writing, Picture Essay		
UNIT - V	**A Talk on Advertising by Herman Wouk**	**CLASSES: 06**
Vocabulary: Misplaced Modifiers, Redundancies Grammar: Subject Verb Agreement (Concord), Common Errors in English Reading Skills:Reading Techniques- Intensive and Extensive Reading Writing Skills: Memo, Précis and Resume Writing		

TEXT BOOKS:

1. Green, David. Contemporary English Grammar Structures and Composition. Second Edition. Trinity Press. 2016.
2. Michael Swan. Practical English Usage. Oxford University Press. 2017.

REFERENCE BOOKS:

1. Murphy, R. Essential Grammar in Use. Cambridge University Press. 2015.
2. Wood, F.T. Remedial English Grammar. Macmillan. 2007.
3. Krishnamurthy. N, Modern English: A Book of Grammar Usage and Composition. Third Edition. Trinity Press. 2016.
4. Zinsser, William. On Writing Well. Harper Resource Book. 2001.
5. Hamp-Lyons, L. Study Writing. Cambridge University Press.2006.

WEB REFERENCES:

1. http//www.bbc.co.uk/learningenglish
2. http//learnenglish.britishcouncil.org
3. https//www.cambridgeenglish.org/learning-english/
4. https//study.com/academy/subj/english.html

E-TEXT BOOKS:

1. https//www.pdfdrive.com/advanced-english-books.html

MOOC COURSE

1. http//nptel.ac.in/courses/109/106/109106067
2. https//www.britishcouncil.org.tr/en/english/mooc

PROGRAMMING FOR PROBLEM SOLVING LAB

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS02	ESC	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes:48		

COURSE OBJECTIVES:

The course should enable the students to:

1. Familiarize with flowgorithm to solve simple problems
2. Develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
3. Develop modular, reusable and readable C Programs using the concepts like functions, arrays, strings, pointers and structures.

COURSE OUTCOMES

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

1. Solve simple mathematical problems using Flowgorithm.
2. Correct syntax errors as reported by the compilers and logical errors encountered at run time
3. Develop programs by using decision making and looping constructs.
4. Implement real time applications using the concept of array, pointers, functions and structures.
5. Solve real world problems using matrices, searching and sorting

LIST OF EXPERIMENTS

Week - 1 INTRODUCTION TO FLOGORITHM

a. Installation and working of Flowgorithm Software.
b. Write and implement basic arithmetic operations using Flowgorithm – sum, average, product, difference, quotient and remainder of given numbers etc.

Week - 2 FLOWGORITHM - OPERATORS AND EVALUATION OF EXPRESSIONS

a. Draw a flowchart to calculate area of Shapes (Square, Rectangle, Circle and Triangle).
b. Draw a flowchart to find the sum of individual digits of a 3 digit number.
c. Draw a flowchart to convert days into years, weeks and days.
d. Draw a flowchart to read input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored.

Week - 3 FLOWGORITHM –CONDITIONAL STATEMENTS

a. Draw a flowchart to find roots of a quadratic equation.
b. Draw a flowchart to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd
c. Draw a flowchart to check whether the triangle is equilateral, isosceles or scalene triangle

Week - 4 OPERATORS

a. Write a C program to swap values of two variables with and without using third variable.
b. Write a C program to enter temperature in Celsius and convert it into Fahrenheit.
c. Write a C program to calculate Simple and Compound Interest.
d. Write a C program to calculate s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

Week - 5	CONDITIONAL STATEMENTS

a. Write a C program to find largest and smallest of given numbers.
b. Write a C program which takes two integer operands and one operator form the user(+,-,*,/,% use switch)
c. Write a program to compute grade of students using if else adder. The grades are assigned as followed:

marks<50	F
50≤marks< 60	C
60≤marks<70	B
70≤marks	B+
80≤marks<90	A
90≤mars≤ 100	A+

Week - 6	LOOPING STATEMENTS

a. Write a C program to find Sum of individual digits of given integer
b. Write a C program to generate first n terms of Fibonacci series
c. Write a C program to generate prime numbers between 1 and n
d. Write a C Program to find the Sum of Series SUM=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!
e. Write a C program to generate Pascal's triangle.
f. Write a C program to generate pyramid of numbers.

```
        1
    1   3   1
1   3   5   3   1
```

Week - 7	ARRAYS

a. Write a C Program to implement following searching methods
   i. Binary Search
   ii. Linear Search
b. Write a C program to find largest and smallest number in a list of integers
c. Write a C program
   i. To add two matrices
   ii. To multiply two matrices
d. Write a C program to find Transpose of a given matrix

Week - 8	FUNCTIONS

a. Write a C program to find the factorial of a given integer using functions
b. Write a C program to find GCD of given integers using functions
c. Write a C Program to find the power of a given number using functions

Week - 9	RECURSION

a. Write a C Program to find binary equivalent of a given decimal number using recursive functions.
b. Write a C Program to print Fibonacci sequence using recursive functions.
c. Write a C Program to find LCM of 3 given numbers using recursive functions

Week - 10	STRINGS

a. Write a C program using functions to
   a. Insert a sub string into a given main string from a given position
   b. Delete n characters from a given position in a string
b. Write a C program to determine if given string is palindrome or not

Week - 11	POINTERS

a. Write a C program to print 2-D array using pointers
b. Write a C program to allocate memory dynamically using memory allocation functions (malloc, calloc, realloc, free)

Week - 12	STRUCTURES

a. Write a C Program using functions to
   i. Reading a complex number
   ii. Writing a complex number
   iii. Add two complex numbers
   iv. Multiply two complex numbers

   Note: represent complex number using structure

b. Write a C program to read employee details employee number, employee name, basic salary, hra and da of n employees using structures and print employee number, employee name and gross salary of n employees.

TEXT BOOKS:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Yashavant Kanetkar, “Let Us C”, BPB Publications, New Delhi, 13th Edition, 2012.

REFERENCE BOOKS:

1. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018
2. King KN, “C Programming: A Modern Approach”, Atlantic Publishers, 2nd Edition, 2015.
3. Kochan Stephen G, “Programming in C: A Complete Introduction to the C Programming Language”, Sam‘s Publishers, 3rd Edition, 2004.
4. Linden Peter V, “Expert C Programming: Deep C Secrets”, Pearson India, 1st Edition, 1994.

WEB REFERENCES:

1. http://www.flowgorithm.org/documentation/
2. http://www.sanfoundry.com/c-programming-examples
3. http://www.geeksforgeeks.org/c
4. http://www.cprogramming.com/tutorial/c

APPLIED CHEMISTRY LAB

I B. TECH- I SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5BS12	BSC	-	-	3	1.5	30	70	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 39				Total Classes: 39		

COURSE OBJECTIVES:

The course should enable the students to:

1. To provide an experimental foundation for the theoretical concepts introduced in the lectures
2. To teach how to make careful experimental observations and how to think about and draw conclusions from such data
3. Students can identify and analyze different parameters of water and its treatment methods.
4. Students can select tools and techniques in chemical analysis.

COURSE OUTCOMES:

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

1. Estimate hardness, alkalinity and chloride content in water to check its suitability for drinking.
2. Estimate the percentage content of metal oxide in construction material.
3. The measurement of physical properties like adsorption and viscosity.
4. Demonstrate the digital and instrumental methods of analysis
5. Synthesize various organic compounds.

LIST OF EXPERIMENTS

Experiment - 1	Determination of total hardness of water by complexometric method using EDT
Experiment - 2	Determination of Alkalinity of given water sample
Experiment - 3	Estimation of Chloride content of water by Argentometry.
Experiment - 4	Estimation of amount of HCl by Conductometry.
Experiment - 5	Estimation of amount of Acetic acid by Conductometry..
Experiment - 6	Estimation of amount of ferrous ion by potentiometry using potassium dichromat
Experiment - 7	Estimation of HCl by potentiometry
Experiment - 8	Determination of Viscosity of a given liquid using Ostwald's Viscometer
Experiment - 9	Determination of surface tension of a given liquid using Stalagmometer
Experiment - 10	Synthesis of Aspirin
Experiment - 11	Synthesis of Thiokol Rubber
Experiment - 12	Separation of organic mixture by Thin layer Chromatography and calculation of RF values.
Experiment - 13	Determination of percentage of Calcium Oxide in Cement
Experiment - 14	Estimation of Manganese Dioxide in Pyrolusite

REFERENCE BOOKS:

1. Senior practical physical chemistry, B. D. Khosla, A. Gulati and V. Garg (R. Chand and amp; Co., Delhi)
2. An introduction to practical chemistry, K. K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi)
3. Vogel's textbook of practical organic chemistry 5th edition.
4. Text book on Experiments and calculations in Engineering chemistry- S. S. Dara.

WEB REFERENCES:

1. http://www.arxiv.org/pdf/1510.00032
2. http://www nptel.ac.in/courses/122103010/
3. http://www. researchgate.net/.../276417736_Video_Presentations_in_Engineering-Ph...
4. http://www. wileyindia.com/engineering-physics-theory-and-practical.html

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS02	HSMC	-	-	2	1	30	70	100
Contact Classes: 00	Tutorial Classes: 00	Practical Classes: 32				Total Classes: 32		

COURSE OBJECTIVES:

The course should enable the students to:

1. Facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
2. Enhance English language skills, communication skills and to practice soft skills.
3. Improve fluency and pronunciation intelligibility by providing an opportunity for practice in speaking.
4. Get trained in different interview and public speaking skills such as JAM, debate, role play, group discussion etc.
5. Instill confidence and make them competent enough to express fluently and neutralize their mother tongue influence.

COURSE OUTCOMES

AT the end of the course students will be able to

1. Develop better perception of nuances of English language through audio- visual experience.
2. Acquire Neutralization of accent for intelligibility.
3. Participate in group activities.
4. Employ speaking skills with clarity and confidence which in turn enhances their employability.

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 to appreciate its 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: Just A Minute (JAM) Sessions
- Describing objects/situations/people
- Role play – Individual/Group activities
- Group Discussions
- Debate

EXERCISE-I	

CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Word Stress and Rhythm
ICS Lab:
Understand: Communication at Work Place- Spoken vs. Written language.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Introductions- Greetings – Taking Leave.

EXERCISE-II	

CALL Lab:
Understand: Structure of Syllables — Weak Forms and Strong Forms in Context.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.
ICS Lab:
Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette.

EXERCISE-III	

CALL Lab:
Understand: Intonation-Errors in Pronunciation-the Interference of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.
ICS Lab:
Understand: How to make Formal Presentations.
Practice: Formal Presentations- Extempore

EXERCISE-IV	

CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks.
Practice: Group Discussions, Debate

EXERCISE-V	

CALL Lab:
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Introduction to Interview Skills.
Practice: Mock Interviews.

REFERENCE BOOKS:

1. Whitby, N. Business Benchmark. Cambridge University Press (with CD) 2nd Edition.
2. Kumar, S. & Lata, P. (2011). Communication Skills. Oxford University Press.
3. Balasubramanian, T. (2008). A Text book of English Phonetics for Indian Students, Macmillan.
4. Thorpe, E. (2006). Winning at Interviews, Pearson Education.
5. Sethi, J. et al. (2005). A Practical Course in English Pronunciation (with CD), Prentice Hall of India.

WEBSITES:

1. https://www. britishcouncil.org
2. https://www. bbc.co.uk
3. https://www. grammarly.com
4. https://www. fluentu.com
5. https://www.cambridgeenglish.org/exams-and-tests/business-preliminary
6. https://www.cambridgeenglish.org/exams-and-tests/business-vantage

I B.TECH II SEMESTER

SYLLABUS

ADVANCED CALCULUS

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5BS04	BSC	3	1	-	4	30	70	100
Contact Classes: 44	Tutorial Classes: 08	Practical Classes: Nil				Total Classes: 52		

COURSE OBJECTIVES

The course should enable the students to:

1. Evaluation of improper integrals using Beta and Gamma functions.
2. The partial derivatives of several variable functions.
3. Concept and application of Laplace transforms.
4. Fourier series for periodic functions.
5. Numerical techniques.

COURSE OUTCOMES

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

1. Evaluate the improper integrals using beta and gamma functions.
2. Find the Maxima and Minima of several variable functions.
3. Solve the differential equations using Laplace transform techniques.
4. Find the Fourier series of the periodic functions.
5. Apply various numerical techniques to solve differential equations.

UNIT - I	BETA GAMMA FUNCTIONS AND MULTIPLE INTEGRALS	CLASSES: 11

Beta- Gamma Functions and their Properties-Relation between them- Evaluation of improper integrals using Gamma and Beta functions.
Double and triple integrals (Cartesian and polar), Change of order of integration in double integrals.

UNIT - II	CALCULUS OF SEVERAL VARIABLES	CLASSES: 11

Limit, Continuity - Partial derivative- Partial derivatives of higher order -Total derivative - Chain rule,Jacobians-functional dependence & independence. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints)

UNIT - III	LAPLACE TRANSFORMS	CLASSES: 12

Laplace transforms of elementary functions- First shifting theorem - Change of scale property – Multiplication by t^n- Division by t – Laplace transforms of derivatives and integrals – Unit step function – Second shifting theorem – Periodic function – Evaluation of integrals by Laplace transforms – Inverse Laplace transforms- Method of partial fractions – Other methods of finding inverse transforms – Convolution theorem – Applications of Laplace transforms to ordinary differential equations.

UNIT - IV	FOURIER SERIES	CLASSES:10

Periodic function-Determination of Fourier Coefficients-Fourier Series-Even and Odd functions-Fourier series in arbitrary interval-Even Odd periodic continuation-Half range Fourier sine and cosine expansions.

UNIT - V	NUMERICAL TECHNIQUES	CLASSES: 08

ROOT FINDING TECHNIQUES :
Bisection method-Regulafalsimethod,Iteration method and Newton Raphson method.
NUMERICAL INTEGRATION :
Trapezoidal rule - Simpson's one-third rule - Simpson's three-eighth rule.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:Taylor's series method – Euler's - modified Euler's Method – Runge-Kutta method.

TEXT BOOKS:

1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.

REFERENCE BOOKS:

1. G.B.Thomas, calculus and analytical geometry,9th Edition, Pearson Reprint 2006.
2. N.P Bali and Manish Goyal ,A Text of Engineering Mathematics,Laxmi publications,2008.
3. E.L.Ince, Ordinary differential Equations,Dover publications,1958.

WEB REFERENCES:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#Mathematics
3. https://www.sosmath.com/
4. https://www.mathworld.wolfram.com/

E -TEXT BOOKS:

1. https://www.e-booksdirectory.com/details.php?ebook=10166

MOOCS COURSE:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

APPLIED PHYSICS

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5BS08	BSC	3	1	-	4	30	70	100
Contact Classes:44	Tutorial Classes:8	Practical Classes: 0				Total Classes: 52		

COURSE OBJECTIVES

The course should enable the students to:

1. Learn the behavior of matter waves and applications of Schrödinger wave equations
2. Understand the formation of energy bands in solids
3. Acquire the fundamental knowledge of semiconductor devices and their applications
4. Learn the basic principles of laser and optical fiber
5. Describe the fundamentals in quantum computations and explain how it can be used in cryptography

COURSE OUTCOMES:

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

1. Apply principles of quantum mechanics to calculate observables on known wave functions.
2. Apply the concept of band theory to explain the behavior of different electronic materials.
3. Analyze the inner working of semiconductor p-n diodes, LED and new semiconductor devices.
4. Explain the basic principles of laser physics, working of lasers, principle of propagation of light in Optical fibers and Solve the numerical problems associated
5. Apply the basic tools and techniques of quantum computation and quantum information in a problem solving scenario

UNIT - I	INTRODUCTION TO QUANTUM PHYSICS	CLASSES: 10

Black body radiation, Planck's law, photoelectric effect, Compton effect, Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's experiment, Heisenberg's Uncertainty Principle, Schrodinger's Time Independent Wave Equation-Physical Significance of the wave Function, Particle in One Dimensional Potential Box.

UNIT - II	BAND THEORY OF SOLIDS	CLASSES: 10

Band theory - Quantum theory of free electron, Bloch theorem, Kronig-Penny model,E-k diagram, effective mass of electron.

Energy bands in Solids: Origin of energy band formation in solids, Fermi energy level, Fermi-Dirac Statistics (Qualitative treatment), classification of materials as conductors, insulators and semiconductors.

UNIT - III	SEMI-CONDUCTORS	CLASSES:12

Semiconductor Physics: Intrinsic and Extrinsic Semiconductors – formation of p-type and n-type, Fermi Level. Direct and Indirect Band gap semiconductors, Hall Effect and applications.

Physics of Semiconductor Devices: PN Junction Diode, V-I characteristics and applications. LED - Construction, working and applications. Solar cells- working and its applications. Efficiency issues of Solar cell.

UNIT - IV	LASER & FIBER OPTICS	CLASSES: 10

Lasers: Characteristics of Laser, Basic processes between two energy levels. Pumping mechanism, Meta stable state and Population inversion. Working of Nd-YAG laser, applications of lasers in different fields.

Fiber Optics: Structure of fibers, Principle of fiber (TIR), Acceptance angle and NA. Types of fibers- SI and GI fibers- R.I profiles. Single and Multimode fibers-SMSI, MMSI, MMGI. OFC System with block diagram. Fiber optic sensors – Basic principle, working of Pressure and Temperature Sensors. Applications of fibers in different fields.

UNIT - V	QUANTUM COMPUTATION AND CRYPTOGRAPHY	CLASSES: 10

Quantum computation: Idea of classical bits and qubits, Bloch vector representation of state of qubit. Single qubit logic gates- Pauli X, Y, Z and Hadmard gate in matrix form. Two level gates: CNOT and SWAP gates. Comments on No cloning theorem. Quantum Teleportation – Basic Idea.

Cryptography Methods: Introduction to cryptography, Classical and Public key cryptosystems, Verman cipher, The RSA protocol; Quantum Key distribution protocol - BB84 protocol.

TEXT BOOKS:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing
2. R. Robinett, “Quantum Mechanics”, OUP Oxford, 2006.IIndEdn.
3. P.K Palanisamy, Engineering Physics, Sitech Publications, 2013, IVthEd
4. Nielsen M. A., I. L Chung, Quantum Computation & Quantum Information, Cambridge Univ. Press

REFERENCE BOOKS:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Grew-Hill inc.(1995)
2. O. 1Svelto, “Principles of Lasers”, Springer Science & Business Media, 2010
3. D. A. Neamen, “Semiconductor Physics and Devices”, Times Mirror High Education Group, Chicago, 1997
4. Principles of Quantum computation and Information – By G. Benenti, G. Casati, G. Strini, World Scientific

WEB REFERENCES:

1. https://www.edx.org/course?search_query=semiconductor+physics
2. https://www.edx.org/course/nanotechnology-fundamentals-purduex-nano530x

E-TEXT BOOKS:

1. http://www.phys.sinica.edu.tw/TIGP-ANO/Course/2010_Fall/classnotes/NanoB_week14.pdf
2. https://www.scribd.com/document/70908178/Semiconductor-Devices-Basic-Principles-Jasprit-Singh
3. https://www.scribd.com/doc/105174065/Fundamentals-of-Photonics
4. ftp://nozdr.ru/biblio/kolxo3/P/PE/PEo/Thyagarajan%20K.,%20Ghatak%20A.%20Lasers..%20Fundamentals%20and%20Applications%20(2ed.,%20GTP,%20Springer,%202010)(ISBN%20144196441X)(O)(674s)_PEo_.pdf
5. https://subodhtripathi.files.wordpress.com/2012/01/optical-fiber-communications-by-gerd-keiser_2.pdf

MOOCS COURSE

1. http://nptel.ac.in/courses/115102025/ (Fundamental concepts of semiconductors)
2. http://nptel.ac.in/courses/104104085/2(Lasers and its applications)
3. https://nptel.ac.in/courses/115/101/115101092/(Quantum computing)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE70	ESC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Develop fundamentals, including Ohm's law, Kirchhoff's laws and be able to solve for currents, voltages and power in electrical circuits.
2. Develop EMF equation and analyze the operation of DC Machines.
3. Analyze the working principle of Transformer.
4. Discuss the operation of AC Machines.
5. Analyze the operation of PN junction diode and rectifiers.
6. Discuss the operation and characteristics of Transistors.

COURSE OUTCOMES:

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

1. Analyze and solve for current values in resistive circuits with independent sources.
2. Analyze the working of DC machines and solve the numerical problems..
3. Analyze the working of AC electrical machines and solve the numerical problems.
4. Analyze the V-I characteristics of PN – junction diode and describe the operation of rectifiers.
5. Analyze the different configurations of Transistors and obtain its characteristics.

UNIT - I	ELECTRICAL CIRCUITS	CLASSES: 12

Basic definitions-Ohm's Law, types of elements, types of sources , Kirchhoff's Laws – simple problems., series & parallel resistive networks with DC excitation, star to delta and delta to star transformations.

UNIT - II	DC MACHINES	CLASSES: 12

Principle of Operation of DC Motor, types of DC motor, Torque equation & Losses and problems. DC Generator construction and working Principle, EMF Equation types of generators and problems.

UNIT - III	AC MACHINES	CLASSES:12

Working principle and Construction of transformer, Emf Equation & problems, Principle operation of 3-phase induction motor, slip and torque Equation, Torque –slip characteristics & problems, principle operation of 3-phase Alternator, Emf Equation of Alternator & problems.

UNIT - IV	DIODE AND ITS CHARACTERISTICS	CLASSES: 12

PN JUNCTION DIODE: Operation of PN junction Diode: forward bias and reverse bias, Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics. Rectifiers, Half wave, Full wave and bridge Rectifiers –capacitor filters, inductor filters

UNIT - V	TRANSISTORS	CLASSES: 10

Bipolar Junction Transistor - NPN & PNP Transistor, CB, CE, CC Configurations and Characteristics – Transistor Amplifier.

TEXT BOOKS:

1. Basic Electrical Engineering by *M.S.Naidu and S.Kamakshaiah* TMH
2. Electronic Devices and circuits by *J.Millman, C.C.Halkias and Satyabrata Jit* 2ed.,

REFERENCE BOOKS:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”,Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).

ENGINEERING GRAPHICS

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5ME02	ESC	1	-	4	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Create awareness and emphasize the need for Engineering Drawing in various branches of engineering.
2. Enable the student with various concepts of dimensioning, conventions and standards related to engineering drawings.
3. Follow the basic drawing standards and conventions.
4. Develop skills in three-dimensional visualization of engineering component.

COURSE OUTCOMES

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

1. Sketch the various curves used in engineering and their applications
2. Apply the knowledge of quadrant system and say to which quadrant and angle of project the object belongs.
3. Evaluate the given object position and draw the projections of objects
4. Analyze the given sectioned objects like in sheet metal applications.
5. Develop the new drawings for the industry requirements

UNIT - I	INTRODUCTION TO ENGINEERING DRAWING	CLASSES: 07

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute.

UNIT - II	DRAWING OF PROJECTIONS OR VIEWS: ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY	CLASSES: 10

Principles of orthographic projections – conventions – first and third angle projections. Projections of points-Projection of lines inclined to both the planes.
PROJECTIONS OF PLANES: Projections of regular planes, inclined to both planes.

UNIT - III	PROJECTION OF REGULAR SOLIDS	CLASSES: 08

PROJECTION OF SOLIDS-Solids inclined to one plane and both planes (Auxiliary plane method)
Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone

UNIT - IV	DEVELOPMENT OF SURFACES/SOLIDS	CLASSES: 04

DEVELOPMENT OF SURFACE/SOLIDS: Theory of development, development of lateral surface along with base

UNIT - V	ISOMETRIC DRAWINGS	CLASSES: 05

Divisions of pictorial projection, theory of Isometric Drawing- Isometric view and Isometric projections; Drawing Isometric circles, Dimensioning, Isometric Objects; Conversion of Isometric view to Orthographic views and Orthographic to isometric views, Missing views.

TEXT BOOKS:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers .

REFERENCE BOOKS:

1. Johle (2009), Engineering Drawing, Tata Mc Graw Hill, New Delhi, India.

WEB REFERENCES:

1. nptel.ac.in/courses/112103019/
2. web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf

E-TEXT BOOKS:

1. https://www.researchgate.net/publication/305754529_A_Textbook_of_Engineering_Drawing_A_Textbook
2. https://www.researchgate.net/publication/305754529_A_Textbook_of_Engineering_Drawing

MOOC COURSE

1. https://onlinecourses.nptel.ac.in/noc20_me79/preview

APPLIED PHYSICS LAB

I B. TECH- II SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5BS15	BSC	-	-	3	1.5	30	70	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 39				Total Classes: 39		

COURSE OBJECTIVES:

The course should enable the students to:

1. Provide an experimental foundation for the theoretical concepts introduced in the lectures
2. Teach how to make careful experimental observations and how to think about and draw conclusions from such data
3. Help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments
4. Introduce the concepts and techniques which have a wide application in experimental science but have not been introduced in the standard courses
5. Teach how to write a technical report this communicates scientific information in a clear and concise manner

COURSE OUTCOMES:

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

1. Analyze the electric properties of semiconductor materials by determining energy gap of semiconductors, threshold voltage of LEDs and efficiency issues of solar cell with careful experimental and draw conclusions from such data
2. Evaluate the mechanical properties of a given material using dynamic method in torsional pendulum
3. Estimate the optical properties of light such as diffraction by using grating material for calculation of the wavelength of Laser, and to determine acceptance angle, NA of optical fiber using OFC and determine the value off plank's constant
4. Analyze the electromagnetic properties by using Stewart Gee's experiment and determining the Quality factor, resonance frequency of a given LCR circuit

LIST OF EXPERIMENTS

Experiment - 1	**Energy gap of P-N junction diode:** To determine the energy gap of a semiconductor diode
Experiment - 2	**Solar Cell:** To study the V-I and P-I characteristics of solar cell
Experiment - 3	**Light Emitting Diode:** Plot V-I characteristics of light emitting diode Plot V-I characteristics of light emitting diode
Experiment - 4	**Hall effect:**To determine Hall co-efficient of a given semiconductor
Experiment - 5	**PIN Photo Diode** To study the V-I Characteristics of Photo Diode by calculating the photo current.
Experiment - 6	**Optical fiber:** To determine the numerical aperture and acceptance angle of an optical fiber
Experiment - 7	**LASER:** To determine the wavelength of a given laser source by using diffraction grating method

Experiment - 8	**LCR Circuit:** To determine the Resonance frequency and Quality factor of a LCR Circuit
Experiment - 9	**Thermistor:** To study the variation of resistance with respect to temperature using thermistor.
Experiment - 10	**Torsional Pendulum:** To determine the rigidity modulus of a given metal wire by using Torsional pendulum
Experiment - 11	**Plank's Constant:** To determine value of plank's constant using by measuring radiation in fixed spectral range
Experiment - 12	**Stewart Gee's experiment:** To study the variation of magnetic field along the axis of a circular coil

REFERENCE BOOKS:

1. "Semiconductor Physics and Devices: Basic Principles" by Donald A Neamen
2. "Optics, Principles and Applications" by K K Sharma.
3. "Principles of Optics" by M Born and E Wolf.
4. "Oscillations and Waves" by Satya Prakash and Vinay Dua
5. "Waves and Oscillations" by N Subrahmanyam and Brij Lal

WEB REFERENCES:

1. **http://www.arxiv.org/pdf/1510.00032**
2. http://www nptel.ac.in/courses/122103010/
3. **http://www.** researchgate.net/.../276417736_Video_Presentations_in_Engineering-Ph...
4. **http://www.** wileyindia.com/engineering-physics-theory-and-practical.html

INTRODUCTION TO INTERNET OF THINGS

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC01	ESC	-	-	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes:36		

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop basic programming skills through graphical programming
2. Learn hardware interfacing and debugging techniques
3. Design and develop android apps

COURSE OUTCOMES:

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

1. Able to demonstrate various sensor interfacing using Visual Programming Language.
2. Able to analyze various Physical Components.
3. Able to demonstrate Wireless Control of Remote Devices.
4. Able to design and develop Mobile Application which can interact with Sensors

INTRODUCTION TO IOT

1. Introduction to basic electronic components and digital electronic
2. Introduction to sensors and Actuators
3. Introduction to microcontroller
4. Introduction to Arduino IDE

LIST OF EXPERIMENTS

WEEK - 1	Blinking of LED with different delays
WEEK - 2	Digital I/O Interface [IR Sensor, PIR Sensor]
WEEK - 3	Analog Interface [ADC, Temperature Sensor]
WEEK - 4	Motor speed And Direction control
WEEK - 5	Serial Communication
WEEK - 6	Wireless Interface –Bluetooth & Wi-Fi Technologies
WEEK - 7	Wireless Control of wheeled robot
WEEK - 8	Smart Home Android App Development

REFERENCES

1. Sylvia Libow Martinez, Gary S Stager, Invent To Learn: Making, Tinkering, and Engineering in the Classroom, Constructing Modern Knowledge Press, 2016
2. Michael Margolis, Arduino Cookbook, Oreilly, 2011

ENGINEERING WORKSHOP

I B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5ME04	ESC	-	-	2	1	30	70	100
Contact Classes: 42	Tutorial Classes: Nil	Practical Classes: 28				Total Classes:70		

COURSE OBJECTIVES:

The course should enable the students to:

1. Get the hands on experience on various trades.
2. Capable to make useful products using one or more operations.

COURSE OUTCOMES:

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

1. Fabricate components with their own hands
2. Get practical knowledge of the dimensional accuracies and tolerances.
3. Produce small devices of their interest

WEEKS	BASIC TRADES
	Fitting
Week 1	Filing Four Sides of Work piece
Week 2	L- Fit
	Carpentry
Week 3	Half Lap Joint
Week 4	Dove Tail Joint
	Tin Smithy
Week 5	Tin Smithy- Prepare a Rectangular Tray
Week 6	Prepare A Square Tin
	Electrical
Week 7	House Wiring Parallel and Series Connection
Week 8	House Wiring Two Way Switch
	Electronics
Week 9	Soldering Parallel Connection
Week 10	Soldering Series Connection
Week 11	Useful product using 3 or more operations

II B.TECH I SEMESTER SYLLABUS

PROBABILITY AND STATISTICS

II B. TECH- I SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5BS05	BSC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. The concepts of discrete and continuous random variables, the probability distribution and density Function.
2. Evaluation of marginal and conditional distribution of multiple random variables.
3. The concept of correlation and regression to find covariance.
4. Evaluation of the given data for appropriate test of hypothesis.
5. Analyzing the data for variance.

COURSE OUTCOMES

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

1. Describe the continuous random variables and moments of Discrete and continuous random variables.
2. Calculate probabilities and derive the marginal and conditional distribution of bivariate random variables.
3. Apply the concept of correlation and regression to find covariance.
4. Evaluate the given data for appropriate test of hypothesis.
5. Test the data for analysis of variance.

UNIT-I	SINGLE RANDOM VARIABLES	CLASSES: 08

Basic definitions of probability- Random Variables – Discrete and Continuous. Probability distributions, mass function/ density function of a probability distribution, mathematical expectation, moments about origin, central moments, skewness, Kurtosis. Moment generating function of probability distribution.

UNIT-II	PROBABILITY DISTRIBUTIONS	CLASSES: 08

Binomial, Poisson, Normal, exponential and Gamma distributions -their Properties.
Moment generating functions of the above distributions and hence find the mean and variance.
Joint probability distributions- Joint probability mass /density function, Marginal probability, mass / density functions.

UNIT-III	CORRELATION & REGRESSIONSAMPLING DISTRIBUTIONS	CLASSES: 10

Coefficient of correlation, the rank correlation, Covariance of two random variables. Regression- Regression Coefficient, The lines of regression and multiple correlation & regression

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance.

Parameter estimation- Point estimation and interval estimation

UNIT-IV	TESTING OF HYPOTHESIS - I	CLASSES: 10

Testing of hypothesis: Null hypothesis, Alternate hypothesis, Type I& Type II errors – critical region, confidence interval, Level of significance. One sided test, Two sided test.

Large sample tests:

(i) Test of Equality of means of two samples, equality of sample mean and population mean (cases of known variance & unknown variance, equal and unequal variances)

(ii) Tests of significance of difference between sample S.D and population S.D.

(iii) Tests of significance difference between sample proportion and population proportion, difference between two sample proportions.

UNIT- V	TESTING OF HYPOTHESIS-II	CLASSES: 06

Student t-distribution, its properties; Test of significance sample mean and population mean, difference between means of two small samples. Snedecor's F- distribution and its properties. Test of equality of two population variances. Chi-square distribution, its properties, Chi-square test of goodness of fit.

TEXT BOOKS:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.
2. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E. Freund, New Delhi, Prentice Hall.
3. Probability and Statistics for Engineers and Sciences by Jay L. Devore, Cengage Learning

REFERENCE BOOKS:

1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Fundamentals of Mathematical Statistics by S.C. Guptha &V.K. Kapoor, S. Chand
3. Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Academic Press

WEB REFERENCES:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#Mathematics
3. https://www.sosmath.com/
4. https://www.mathworld.wolfram.com/

E -TEXT BOOKS:

1. https://www.e-booksdirectory.com/details.php?ebook=10166
2. https://www.e-booksdirectory.com/details.php?ebook=10166

MOOCS COURSE:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

.

DISCRETE MATHEMATICS

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5BS16	BSC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Help students understand discrete and continuous mathematical structures
2. Impart basics of relations and functions
3. Facilitate students in applying principles of Recurrence Relations to calculate generating
4. Functions and solve the Recurrence relations
5. Acquire knowledge in graph theory

COURSE OUTCOMES:

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

1. Analyze and examine the validity of argument by using propositional and predicate calculus
2. Apply basic counting techniques to solve the combinatorial problems
3. Apply sets relations and digraphs to solve applied problems
4. Solve the given recurrence relation using different methods such as substitution, Generating function and characteristics roots equation.
5. Use the basic concepts of graph theory and some related theoretical problems

UNIT-I	MATHEMATICAL LOGIC	CLASSES: 11

Statements and notations, Connectives, Well formed formulas, Truth Tables, Tautology, Equivalence implication, Normal forms, Logical Inference, Rules of inference, Direct Method, Direct Method using CP(Conditional Proof), Consistency, Proof of contradiction, Automatic Theorem Proving.

UNIT-II	RELATIONS	CLASSES: 16

Introduction to set theory**,** Relations, Properties of Binary Relations, Equivalence Relation, Transitive closure, Compatibility and Partial ordering relations, Lattices, Hasse diagram. Functions: inverse Function Composition of functions.

UNIT-III	ELEMENTARY COMBINATORICS	CLASSES: 12

Basis of counting, Combinations & Permutations, Enumeration of Combinations and Permutations, Enumeration of Combinations and Permutations With repetitions, Enumerating Permutations with Constrained repetitions, Binomial Coefficients, Binomial and Multinomial theorems, The principles of Inclusion – Exclusion, Pigeon- hole principles and its applications.

UNIT-IV	RECURRENCE RELATION	CLASSES: 11

Generating Functions, Function of Sequences, Calculating Coefficient of generating function, Recurrence relations, Solving recurrence relation by substitution and Generating functions , The method of Characteristics roots, Solution of Inhomogeneous Recurrence Relation.

UNIT- V	GRAPHS	CLASSES: 10

Basic Concepts, Isomorphism and Subgraphs, Trees and their properties, Spanning Trees- DFS,BFS, Minimal Spanning Trees- Prims, Kruskal's Algorithm, Planar Graphs, Euler's Formula, Multi graph and Euler circuits, Hamiltonian Graphs, Chromatic number.

TEXT BOOKS:

1. Discrete Mathematics for computer scientists & Mathematicians, *J.L. Mott, A. Kandel, T.P.* Baker PHI
2. Discrete Mathematical Structures With Applications to Computer Science, JP Tremblay, R Manohar

REFERENCE BOOKS:

1. Logic and Discrete Mathematics, *Grass Man & Trembley*, Pearson Education.

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5EC72	ESC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand different number systems.
2. Design combinational and sequential logic circuits
3. Understand concepts of register transfer logic and arithmetic operations.
4. Learn different types of addressing modes and memory organization

COURSE OUTCOMES:

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

1. Able to solve from one number to another number.
2. Able to combinational and sequential logic circuits
3. Identify basic components and design of the CPU: the ALU and control unit.
4. Compare various types of IO mapping techniques
5. Critique the performance issues of cache memory and virtual memory

UNIT - I	NUMBER THEORY and BOOLEAN ALGEBRA	CLASSES: 12

Representation of numbers of different radix, conversion of numbers from one radix to another radix, r-1‘s complement and r‘s complement. 4-bit codes. Basic Theorems and Properties of Boolean algebra, Canonical and Standard Forms, Digital Logic Gates, Universal Logic Gates. K- Map Method.

UNIT - II	COMBINATIONAL and SEQUENTIAL LOGIC CIRCUITS	CLASSES: 14

Design of Half adder, full adder, half subtractor, full subtractor. Decoder, Encoder, Multiplexer, De-multiplexer and comparator. basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with preset and clear terminals). Classification of sequential circuits (synchronous and asynchronous);

UNIT - III	DESIGN	CLASSES: 16

Conversion of flip-flops to other flip-flops. Design of Ripple counters, design of synchronous counters, Johnson counter, ring counter, shift register, bi-directional shift register, universal shift register.
Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control Memory-Reference Instructions, Input-Output and interrupt.

UNIT - IV	REGISTER TRANSFER AND MICRO-OPERATIONS:	CLASSES: 16

Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC),.Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit

UNIT - V	MEMORY SYSTEM	CLASSES: 16

INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA.
MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence

TEXT BOOKS

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Digital Design- Morris Mano, PHI, 3rd Edition.
3. M. Morris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

REFERENCE BOOKS:

1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed,John Wiley & SonsInc.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,

OBJECT ORIENTED PROGRAMMING

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT01	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basic object oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance and polymorphism concepts for reusing the program.
3. Demonstrate on the exception handling mechanism
4. Demonstrate on the multi-tasking by using multiple threads.
5. Develop data-centric applications using JDBC.
6. Understand the basics of java collection framework.

COURSE OUTCOMES:

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

1. Use object oriented programming concepts to solve real worldproblems.
2. Demonstrate the user defined exceptions by exception handling keywords (try, catch, throw, throws andfinally).
3. Use multithreading concepts to develop inter processcommunication.
4. Develop java application to interact with database by using relevant software component(JDBC Driver).
5. Solve real world problems using Collections.

UNIT-I	JAVA BASICS	CLASSES: 15

JAVA BASICS: Review of Object oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document

UNIT-II	INHERITANCE , POLYMORPHISM, PACKAGES AND INTERFACES	CLASSES: 15

INHERITANCE AND POLYMORPHISM: Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.

PACKAGES AND INTERFACES: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.

UNIT-III	EXCEPTION HANDLING AND FILES	CLASSES: 12

EXCEPTION HANDLING: Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes.

I / O STREAMS AND FILES: Concepts of streams, Stream classes- Byte and Character stream, Reading console Input and Writing Console output, File Handling.

UNIT-IV	MULTITHREADING AND JDBC	CLASSES: 12

MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.

JDBC-Connecting to Database - JDBC Type 1 to 4 drives, connecting to a database, querying a database and processing the results, updating data with JDBC.

UNIT- V	COLLECTION FRAMEWORK	CLASSES: 10

COLLECTION FRAMEWORK: Introduction to Java Collections, Overview of Java Collection frame work, Generics, Commonly used Collection classes- Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calender and Properties

TEXT BOOKS:

1. Herbert Schildt and Dale Skrien, "Java Fundamentals – A comprehensive Introduction", McGraw Hill, 1st Edition,2013.
2. Herbert Schildt, "Java the complete reference", McGraw Hill, Osborne, 7th Edition,2011.
3. T.Budd, "Understanding Object- Oriented Programming with Java", Pearson Education, Updated Edition (New Java 2 Coverage),1999.

REFERENCE BOOKS:

1. P.J.Dietel and H.M.Dietel , "Java How to program", Prentice Hall, 6th Edition,2005.
2. P.Radha Krishna , "Object Oriented programming through Java", CRC Press, 1st Edition,2007.
3. S.Malhotra and S. Choudhary, "Programming in Java", Oxford University Press, 2nd Edition, 2014.

PYTHON PROGRAMMING

II B. TECH- I SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT03	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

COURSE OUTCOMES:

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

1. Apply control structures and functions in Program
2. Analyze various String handling functions and data structures
3. Apply the files and object orientation concepts
4. Solve the problems by using Inheritance and polymorphism
5. Illustrate programs on various python libraries such asnumpy, pandas and matplotlib

SYLLABUS

UNIT - I — **CLASSES: 12**

Introduction to Python Programming: Features of Python Language, Data Types, Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Shift Operators, Ternary operator, Membership Operators, Identity Operators, Expressions and order of evaluations. Illustrative examples on all the above operators, Expressions, Control Statements, and Standard I/O Operations: input, print, 'sep','end'.

Functions and Modules:
Declaration and Definition Function Calling, Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings, Built-in Functions.

UNIT – II — **CLASSES: 13**

Strings and Regular Expressions:
String Operations, Built-in String Methods and Functions, Comparing Strings, functions in Regular Expression.
Sequence: List, Tuples, Dictionaries.

UNIT -III — **CLASSES: 12**

File Handling: Introduction, File Path, Types of Files, Opening and Closing Files, Reading and Writing Files, File Positions, Renaming and Deleting Files, Directory Methods.
Implementation of classes and objects in Python:
Classes and Objects, Methods and Self Argument, The __init__Method, Class Variables and Object Variables, The __del__Method, Public and Private Data Members, Private Methods,Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

UNIT – IV		CLASSES: 11

Implementation of Inheritance in Python:
Inheriting Classes in Python, Types of Inheritance, Composition/Containership, Abstract Classes and Interfaces, Meta class,Implementing Operator Overloading, Overriding Methods

Exception Handling in Python:
Introduction, Exception hierarchy, Handling Exception, Multiple except Blocks and Multiple Exceptions, Finally Block.

UNIT - V		CLASSES: 10

Python NumPy: Features of Numpy, NumPyndarray, Data Types, Functions of NumPy Array, Numpy Array Indexing, Mathematical Functions on Arrays in NumPy.

Python Pandas: Pandas Features, Install Pandas, Dataset in Pandas, Series, DataFrames, Panel, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames

Matplotlib: *Formatting the style of plot, plotting with keyword strings, plotting with categorical variables, controlling line properties.*

TEXTBOOKS

1. Core Python Programming, by R.NageswaraRao
2. ReemaThareja, Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction.

REFERENCE BOOKS

1. Kenneth A.Lambert, Fundamentals of Python
2. Charles Dierach, Introduction to Computer Science using Python

SUGGESTED LINKS

1. https://www.programiz.com/python-programming
2. https://www.javatpoint.com/python-tutorial
3. https://www.geeksforgeeks.org/python-programming-language/

PYTHON PROGRAMMING LAB

II B. TECH- I SEMESTER

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT05	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Language.
3. Know the Data Structures in Python Programming Language.
4. Use the reusability concepts in Python Programming Language.
5. Use Exception Handling mechanism in Python Programming Language.
6. Know the packages in Python Programming Language.

COURSE OUTCOMES:

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

1. Develop programs on data types, operators and expressions
2. Apply the data structures in real time scenarios
3. Write the programs on strings and functions
4. Implement programs on class and related issues.
5. Use of python exception handling and libraries.

LIST OF EXPERIMENTS

WEEK-1:

- Write a program to perform different Arithmetic Operations on numbers in Python
- Write a Python program which accepts the radius of a circle from the user and compute the area
- Write a Python program to get the Python version you are using.
- Write a Python program that accepts an integer (n) and computes the value of n+nn+nnn.

WEEK-2:

- Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]
- Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”
- A library charges a fine for every book returned late. For first 6 days the fine is 50 paisa, for 10-15 days fine is one rupee and above 15 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a python program to accept the number of days the member is late to return the book and display the fine or the appropriate message.

WEEK-3:

- Write a python function to find largest of three numbers
- Write a Python function that prints prime numbers in between 50 and 100
- Write a python program to find factorial of a number using Recursion.
- Write a function that receives marks received by a student in 6 subjects and returns the average and percentage of these marks. Call this function from main() and print the result in main

WEEK-4
• Write a program to demonstrate working with tuples and List in python • Write a program to demonstrate working with dictionaries in python
WEEK-5:
• Write a program to demonstrate working with Strings and string operations
WEEK-6:
• Write a script named hellow.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file. • Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order
WEEK-7:
• Write python programs to demonstrate class & object, static and instance method implementation
WEEK -8:
• Write python programs to demonstrate Inheritance and Polymorphism
WEEK-9:
• Write python programs to demonstrate Exception Handling in python
WEEK-10:
• Write python programs todemonstrate Numpy library and supporting functions
WEEK-11:
• Write python programs to demonstrate Pandas libraries' supported structures like series, dataframe and panel
WEEK-12:
• Write a python program to demonstrate matplotlib library and supporting functions
TEXTBOOKS
1. Core Python Programming, by R.NageswaraRao 2. ReemaThareja, Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction.

OBJECT ORIENTED PROGRAMMING LAB

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT02	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Practice object-oriented programs and build java applications.
2. Implement java programs for establishinginterfaces.
3. Implement sample programs for developing reusable software components.
4. Create database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

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

1. Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic buildingactivity.
2. Understand the use of different exception handling mechanisms and concept of multithreading for robust and efficient applicationdevelopment.
3. Understand and implement concepts on file streams and operations in java programming for a a given applicationprograms.
4. Develop java application to interact with database by using relevant software component (JDBC Driver).
5. Implement Collection Frameworks to retrieve and process data efficiently.

LIST OF EXPERIMENTS

WEEK-1 JAVA BASICS

a. 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.

b. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and1.Everysubsequentvalueisthesumofthetwovaluesprecedingit.Writeajavaprogramthat uses both recursive and non recursive functions.

WEEK- 2 ARRAYS

a. Write a java program to sort given list of integers in ascending order.

b. Write a java program to multiply two given matrices.

WEEK- 3 STRINGS

a. Write a java program to check whether a given string is palindrome.

b. Write a java program for sorting a given list of names in ascending order.

WEEK- 4 OVERLOADING & OVERRIDING

Write a java program to implement method overloading and constructors overloading.

a. Write a java program to implement method overriding.

WEEK- 5 INHERITANCE

Write a java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). 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 print Area () that prints the area of the given shape.

WEEK- 6	INTERFACES
a.	Write a program to create interface A in this interface we have two method meth1 and meth2. Implements this interface in another class named MyClass.
b.	Write a program to give example for multiple inheritance in Java.
WEEK- 7	**EXCEPTION HANDLING**
Write a program that reads two numbers Num1 and Num2. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception Display the exception.	
WEEK- 8	**I/O STREAMS**
a.	Write a java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file inbytes.
b.	Write a java program that displays the number of characters, lines and words in a textfile.
WEEK- 9	**MULTI THREADING**
Write a java program that implements a multi-thread 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	
WEEK-10	**GENERICS**
a.	Write a Java program to swap two different types of data using Generics.
b.	Write a Java program to find maximum and minimum of two different types of data using Generics.
WEEK-11	**COLLECTIONS**
Create a linked list of elements.	
a.	Delete a given element from the above list.
b.	Display the contents of the list after deletion
WEEK-12	**CONNECTING TO DATABASE**
Write a java program that connects to a database using JDBC and does add, delete, modify and retrieveoperations.	

TEXT BOOKS:

1. P. J. Deitel, H. M. Deitel, “Java for Programmers”, Pearson Education, PHI, 4th Edition,2007.
2. P. Radha Krishna, “Object Oriented Programming through Java”, Universities Press, 2nd Edition,2007
3. Bruce Eckel, “Thinking in Java”, Pearson Education, 4th Edition,2006.
4. Sachin Malhotra, Saurabh Chaudhary, “Programming in Java”, Oxford University Press, 5th Edition, 2010.

ENVIRONMENTAL STUDIES

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5MC03	MC	2	-	-	-	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations
4. Determine the Natural resources on which the structure of development is raised for sustainability of the society through equitable maintenance of natural resources.
5. Illustrate about biodiversity that raises an appreciation and deeper understanding of species, ecosystems and also the interconnectedness of the living world and thereby avoids the mismanagement, misuse and destruction of biodiversity.
6. Summarize a methodology for identification, assessment and quantification of global environmental issues in order to create awareness about the international conventions for mitigating global environmental problems.
7. Sustainable development that aims to meet raising human needs of the present and future generations through preserving the environment.
8. Outline green environmental issue provides an opportunity to overcome the current global environmental issues by implementing modern techniques like CDM, green building, green computing etc.

COURSE OUTCOMES:

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

1. Demonstrate an understanding of the Significance of environmental education.
2. Outline the context of environmentalism.
3. Comprehend the multidisciplinary nature of the course environmental Studies.
4. Illustrate the components of the environment and its interactions.
5. Outline the causes, effects and management options for various environmental problems related to Air, Water and land.

UNIT - I	ECOSYSTEMS	CLASSES: 07

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food web and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity.

UNIT - II	NATURAL RESOURCES & MINERAL RESOURCES	CLASSES: 10

Natural Resources: Classification of Resources: 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 - III	BIODIVERSITY AND BIOTIC RESOURCES	CLASSES: 08

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

UNIT - IV	ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES	CLASSES: 10

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture,. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Problems 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.

UNIT - V	ENVIRONMENTAL POLICY, LEGISLATION & EIA	CLASSES: 10

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Towards Sustainable Future: Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

II B.TECH II SEMESTER SYLLABUS

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credit s	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS06	HSMC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

To enable the student to understand and appreciate, with a particular insight, the importance of certain basic issues governing the business operations namely; demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting and financial accounting and financial analysis.

COURSE OUTCOMES:

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

1. Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
2. Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Develop an understanding of
4. Analyse how capital budgeting decisions are carried out.
5. Understanding the framework for both manual and computerised accounting process
6. Know how to analyse and interpret the financial statements through ratio analysis.

UNIT-I		CLASSES: 10

Introduction & Demand Analysis: Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT-II		CLASSES: 10

Production & Cost Analysis: Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT-III		CLASSES: 10

Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT-IV		CLASSES: 10
Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of return (ARR) and Net Present Value Method (simple problems).		
UNIT- V		**CLASSES: 08**
Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions - Introduction IFRS - Double - Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trasing Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.		

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

REFERENCE BOOKS:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi, 2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012.
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting - A Managerial Perspective, Pearson, 2012.
6. S.N. Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha: MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J.V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

DATA STRUCTURES USING PYTHON

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI01	ESC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Impart the basic concepts of data structures.
2. Understand concepts python Lists, Tuples, Dictionaries, Sets and Maps.
3. Understand basic concepts of stacks, queues and their applications.
4. Demonstrate sorting and searching algorithms with respect to time and space complexity.
5. Use advanced data structures like Binary Trees, AVL-trees etc., for efficient problem solving

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Create an Array and Implement different mathematical operations using Arrays.
2. Store and organize the data in an efficient manner and solve problems using Lists, Tuples, Dictionaries, Sets and Maps.
3. Design and implement applications of Stack and Queue ADT using List and Linked List.
4. Analyze searching and sorting techniques based on time and space complexity.
5. Construct and implement a nonlinear data structure Tree and Choose an appropriate search tree among BST and AVLTree to perform an efficient search operation based on time and space complexity.

UNIT I	ABSTRACT DATA TYPES	CLASSES: 10

Introduction: Abstract Data Types, Data Structures.
Date Abstract Data Type: Defining the ADT, Using the ADT, Preconditions and Post conditions, implementing the ADT.
Arrays: The Array Structure, Implementing the Array.
Two-Dimensional Arrays: The Array 2D Abstract Data Type, Implementing the 2-D Array.
Multi-Dimensional Arrays: The Multi array Abstract Data Type, Data Organization, Variable-Length Arguments, Implementing the Multi array

UNIT II	LISTS, TUPLES, DICTIONARIES, SETS AND MAPS	CLASSES: 10

The Python List: Creating a Python List, Appending Items, Extending a List, Inserting Items, List Slice.
Tuples and Dictionary: Creating a Tuple and Dictionary, Built in functions, Tuple and Dictionary operations and List comprehension.
Sets: The Set Abstract Data Type, List-Based Implementation.
Maps: The Map Abstract Data Type, List-Based Implementation.

UNIT III	STACKS AND QUEUES	CLASSES: 10

The Stack ADT: Stack operations, implementing the Stackusing a Python List.
Stack Applications: Balanced Delimiters, Evaluating Postfix Expressions.
The Queue ADT: Queue operations, implementing the Queue using a Python List,
Priority Queues: Priority Queue operations, The Priority Queue ADT Implementation

UNIT IV	SEARCHING, SORTING AND LINKED STRUCTURES	CLASSES: 10

Searching: The Linear Search, the Binary Search.
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick sort, Merge sort
The Singly Linked: Traversing the Nodes, Searching for a Node, Prepending Nodes, Removing Nodes.
Advanced Linked Lists: The Doubly Linked List: Organization, List Operations

UNIT V	BINARY TREES, SEARCH TREES AND AVL TREES	CLASSES: 08

Binary Trees: The Tree Structure, the Binary Tree, Properties, Implementation, Tree Traversals.
Search Trees: The Binary Search Tree, Min and Max Values, Insertions, Deletions, Efficiency of Binary Search Trees.
AVL Trees: Insertion, Deletion, Implementation.

TEXT BOOK:

1. Data Structures and Algorithms Using Python, Rance D. Necaise, JOHN WILEY & SONS, INC.
2. ReemaThareja, Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction.

REFERENCE BOOKS

1. Core Python Programming, by R.NageswaraRao
2. Kenneth A.Lambert, Fundamentals of Python
3. Charles Dierach, Introduction to Computer Science using Python

DATABASE MANAGEMENT SYSTEMS

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS05	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Discuss the basic database concepts, applications, data models, schemas and instances.
2. Design Entity Relationship model for a database.
3. Demonstrate the use of constraints and relational algebra operations.
4. Describe the basics of SQL and construct queries using SQL
5. Understand the importance of normalization in databases.
6. Demonstrate the basic concepts of transaction processing and concurrency control.
7. Understand the concepts of database storage structures and identify the access techniques.

COURSE OUTCOMES:

At the end of the course, students are able to:

1. Use the basic concepts of Database Systems in Database design
2. Design a Database using ER Modelling
3. Apply normalization on database design to eliminate anomalies
4. Apply SQL queries and PL/SQL queries to interact with Database
5. Analyze database transactions and can control them by applying ACID properties.

UNIT - I	INTRODUCTION	CLASSES: 09

INTRODUCTION: Introduction and applications of DBMS, Purpose of data base, Data Independence, Database System architecture- Levels, Database users and DBA.
DATABASE DESIGN: Database Design Process, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, extended ER features, Generalization, Specialization, Aggregation, Conceptual design with the E-R model.

UNIT - II	RELATIONAL MODEL &SCHEMA REFINEMENT	CLASSES: 09

THE RELATIONAL MODEL: Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views.
SCHEMA REFINEMENT AND NORMAL FORMS: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization, schema refinement in database design.

UNIT - III	RELATIONAL ALGEBRA AND CALCULS &SQL	CLASSES: 11

RELATIONAL ALGEBRA AND CALCULUS:Relational algebra operators, relational calculus - Tuple and domain relational calculus.
SQL: Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries.

UNIT - IV	SQL &PL/SQL	CLASSES: 11

SQL: Use of group by, having, order by clauses, join and its types, Exist, Any, All clauses . Transaction control commands – Commit, Rollback, Save point,

PL/SQL: Environment, block structure, variables, operators, data types, control structures; cursors, stored procedures, Triggers.

UNIT - V	TRANSACTION &CONCURRENCY CONTROL	CLASSES: 10

TRANSACTIONS MANAGEMENT: Transaction concept, transaction state, concurrent executions, Serializability, recoverability, testing for serializability.

CONCURRENCY CONTROL AND RECOVERY SYSTEM: Concurrency control,lock based protocols, time-stamp based protocols, validation based protocols, multiple granularity and deadlock handling. Recovery system - failure classification, storage structure, recovery and atomicity, log based recovery.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
2. Raghurama Krishnan, Johannes Gehrke, “Data base Management Systems”, TATA McGraw Hill, 3rd Edition, 2007.
3. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2013.
4. Michael McLaughlin, Oracle Database 11g PL/SQL Programming, Oracle press.

REFERENCE BOOKS:

1. Peter Rob, Carlos Coronel, Database Systems Design Implementation and Management, 7th edition, 2009.
2. Scott Urman, Michael McLaughlin, Ron Hardman, “Oracle database 10g PL/SQL programming “, 6th edition, Tata McGraw Hill,2010
3. S.K.Singh, “Database Systems Concepts, Design and Applications”, First edition, Pearson Education, 2006.
4. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson / Addisionwesley, 2007

WEB REFERENCES:

1. http://www.learndb.com/databases/how-to-convert-er-diagram-to-relational-database
2. https://www.w3schools.com/sql/sql_create_table.asp
3. http://www.edugrabs.com/conversion-of-er-model-to-relational-model/?upm_export=print
4. http://ssyu.im.ncnu.edu.tw/course/CSDB/chap14.pdf
5. http://web.cs.ucdavis.edu/~green/courses/ecs165a-w11/8-query.pdf

E-TEXT BOOKS:

1. http://www.freebookcentre.net/Database/Free-Database-Systems-Books-Download.html
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-11.pdf

MOOC COURSE:

1. https://www.mooc-list.com/tags/dbms-extensions
2. https://onlinecourses.nptel.ac.in/noc18_cs15/preview

DESIGN AND ANALYSIS OF ALGORITHMS

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS08	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Demonstrate performance of algorithms with respect to time and space complexity.
2. Explain graph and tree traversals.
3. Explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
4. Illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.
5. Familiarize the concepts of deterministic and non-deterministic algorithms.

COURSE OUTCOMES:

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

1. Analyze algorithms by calculating Time and Space complexities.
2. Apply DANDC and GreedyMethod to solve various real worldproblems
3. Apply Dynamic Programming concept to solve various problems
4. Apply Backtracking, Branch and Bound concept to solve various problems
5. Implement different performance analysis methods for non deterministic algorithms

UNIT-I	INTRODUCTION	CLASSES: 10

Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation- big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms.

UNIT-II	DIVIDE AND CONQUER & GREEDY METHOD	CLASSES: 12

DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.
GREEDY METHOD: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.

UNIT-III	DYNAMIC PROGRAMMING	CLASSES: 16

GRAPHS (Algorithm and Analysis): Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points.
DYNAMIC PROGRAMMING: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

UNIT-IV	BACK TRACKING & BRANCH AND BOUND	CLASSES: 12

BACKTRACKING: General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.
BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

UNIT- V	NP PROBLEMS	CLASSES: 10

NP-HARD AND NP-COMPLETE PROBLEMS: Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes.

TEXT BOOKS:

1. Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.

REFERENCE BOOKS:

1. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.
2. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.
3. Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson

WEB REFERENCES:

1. https://www.hackerrank.com/domains/algorithms
2. https://discuss.codechef.com/questions/48877/data-structures-and-algorithms
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algo rithms_tutorial.pdf
4. http://nptel.ac.in/courses/106101060/

E-TEXT BOOKS:

1. http://www.trips-to-morocco.com/introduction-to-algorithms-3rd-edition-mit-press-english.pdf
2. https://comsciers.files.wordpress.com/2015/12/horowitz-and-sahani-fundamentals-of-computer-algorithms-2nd-edition.pdf
3. https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/Algorithm%20Design_%20Foundations%2C%20Analysis%2C%20and%20Internet%20Examples%20%5BGoodrich%20%26%20Tamassia%202001%5D.pdf

MOOC COURSE:

1. https://onlinecourses.nptel.ac.in/noc17_cs27/preview
2. https://www.coursera.org/courses?languages=en&query=Algorithm+design+and+analysis

OPERATING SYSTEMS

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS13	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Explain main components of OS and their working
2. Familiarize the operations performed by OS as a resource Manager
3. Impart various scheduling policies of OS
4. Teach the different memory management techniques.

COURSE OUTCOMES:

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

1. Identify and analyze the different structures and services of operating system.
2. Compare various algorithms used for OS services with respect to defined/chosen criteria.
3. Solve the resource allocation and sharing problems.
4. Analyze File Management schemes for effective storage and implementation..
5. Use Disk & IO Management schemes for effective storage management.

UNIT-I		CLASSES: 12

OPERATING SYSTEMS OVERVIEW: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems.
OPERATING SYSTEMS STRUCTURES: Operating system services and systems calls, system programs, operating system structure, operating systems generations

UNIT - II		CLASSES: 13

PROCESS MANAGEMENT: Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows.
CONCURRENCY AND SYNCHRONIZATION: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris), atomic transactions, Comparison of UNIX and windows.

UNIT - III		CLASSES: 12

DEADLOCKS: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm.

MEMORY MANAGEMENT: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study - UNIX.

UNIT - IV		CLASSES: 13

FILE SYSTEM: Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. **File system implementation:** file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of UNIX and windows

UNIT - V		CLASSES: 10

MASS STORAGE STRUCTURE: overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure.

I/O: Hardware, application I/O interface, kernel I/O subsystem, transforming I/O requests to hardware operations, streams, performance

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.

REFERENCE BOOKS:

1. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
2. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India
3. Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.

DATA STRUCTURES USING PYTHON LAB

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI02	ESC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand basic data structures in pythonlike Lists, Tuples, Dictionaries, Sets and Maps
2. Design and analyze simple linear datastructures.
3. Identify and apply the suitable data structure for the given real world problem.
4. Design and analyze non linear datastructures.
5. Gain knowledge in practical applications of data structures

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Understand various data representation techniques in the real world.
2. Implement linear and non-linear data structures.
3. Analyze various algorithms based on their time and space complexity.
4. Develop real-time applications using suitable data structure.
5. Identify suitable data structure to solve various computing problems

WEEK 1

1. Write a python program to perform matrix operations.
   a. Addition of two matrices
   b. Multiplication of two matrices.

WEEK 2

2. Write a python program to implement a list.
   a. Create a list
   b. Add elements to a list
   c. Access elements from the list
   d. Remove elements from the list.

WEEK 3

3. Write a python program to perform set operations
   a. Union
   b. Intersection
   c. Difference

WEEK 4

4. a) Write a Python program to get the 4th element and 4th element from last of a tuple.
   b) Write a python program using the map function to calculate the length of a string in a list.
   c) Write a python Program to print cube of the first 10 natural numbers using the map function

WEEK 5

5. Implement the following stack operations in python
a. Insertion b. Deletion c. Display

WEEK 6
6. Implement the following Queue operations in python a. Insertion b. Deletion c. Display
WEEK 7
7. a. Write a python program to implement linear search. **b.** Write a python program to implement binary search
WEEK 8
8. Write a python program to sort the following data using bubble sort a. List of integers b. List of float numbers c. List of strings
WEEK 9
9. Write a python program to implement a singly linked list. a. Create a singly linked list b. Add elements to a singly linked list c. Access elements from the singly linked list d. Remove elements from the singly linked list.
WEEK 10
10. Write a python program to implement a doubly linked list. a. Create a doubly linked list b. Add elements to a doubly linked list c. Access elements from the doubly linked list d. Remove elements from the doubly linked list.
WEEK 11
11. Write a python program to implement Binary tree traversal a. Preorder b. Inorder c. Postorder
WEEK 12
a. Write a Python program to insert a node with the given key in a given Binary search tree (BST). b. Write a Python program to delete a node with the given key in a given Binary search tree (BST).
TEXT BOOKS:
1. Data Structures and Algorithms Using Python, Rance D. Necaise, JOHN WILEY & SONS, INC. 2. ReemaThareja, Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction.

DATABASE MANAGEMENT SYSTEMS LAB

II B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS06	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Apply the basic concepts of Database Systems and Applications.
2. Use the basics of SQL and construct queries using SQL in database creation and interaction
3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system.

COURSE OUTCOMES:

At the end of the course, students are able to:

1. Apply the basic concepts of Database Systems and Applications.
2. Develop an ER model for a given database.
3. Use the basics of SQL and construct queries using SQL in database creation and interaction.
4. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
5. Analyze and Select storage and recovery techniques of database system.
6. Develop Procedures, Cursors, and Triggers in database system.

LIST OF EXPERIMENTS

WEEK-1 DDL Commands

- Creation of Tables using SQL- Overview of using SQL tool and Data types in SQL
- Altering Tables and
- Dropping Tables

WEEK-2 Create Table with Primary key and Foreign Key& DML Commands

Creating Tables (along with Primary and Foreign keys),
Practicing DML commands-

- Insert,
- Update
- Delete.

WEEK-3 Selection Queries

Practicing Select command using following operations

- AND, OR
- ORDER BY
- BETWEEN
- LIKE
- Apply CHECK constraint

WEEK-4	AGGREGATE FUNCTIONS and Views

Practice Queries using following functions

- COUNT,
- SUM,
- AVG,
- MAX,
- MIN,

Apply constraint on aggregation using

- GROUP BY,
- HAVING,

VIEWS Create , Modify and Drop

WEEK-5	Nested QUERIES

Practicing Nested Queries using

- UNION,
- INTERSECT,
- CONSTRAINTS
- IN

WEEK-6	CO- RELATED NESTED QUERIES

Practicing Co – Related Nested Queries using

- EXISTS,
- NOT EXISTS. ANY, ALL

WEEK-7	JOIN QUERIES

Practicing Join Queries using

- Inner join
- Outer join
- Equi join
- Natural join

WEEK-8	TRIGGERS

Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger.

WEEK-9	PROCEDURES

Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure

WEEK-10	CURSORS

Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

WEEK-11	PL/SQL Part 1

. Practice PL/SQL –

- block structure,
- variables,
- data types,

WEEK-12	PL/SQL Part 2

. Practice PL/SQL –

- operators,
- control structures;
- aseca

Case study 1: College Management
Case study 2 : An Enterprise/Organization
Case study 3 : Library Management system
Case study 4: Sailors and shipment system

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
2. Raghurama Krishnan, Johannes Gehrke, “Data base Management Systems”, TATA McGraw Hill, 3rd Edition, 2007.

WEB REFERENCES:

1. http://www.learndb.com/databases/how-to-convert-er-diagram-to-relational-database
2. https://www.w3schools.com/sql/sql_create_table.asp
3. http://www.edugrabs.com/conversion-of-er-model-to-relational-model/?upm_export=print
4. http://ssyu.im.ncnu.edu.tw/course/CSDB/chap14.pdf
5. http://web.cs.ucdavis.edu/~green/courses/ecs165a-w11/8-query.pdf

GENDER SENSITIZATION

II B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5MC04	MC	-	-	2	-	30	70	100
Contact Classes: 16	Tutorial Classes: 0	Practical Classes: 00				Total Classes: 16		

COURSE OBJECTIVES:

The course should enable the students to:

1. Provide a critical perspective on the socialization of men and women.
2. Introduce students to information about some key biological aspects of genders.
3. Expose the students to debates on the politics and economics of work.
4. Help students reflect critically on gender violence.
5. Expose students to more egalitarian interactions between men and women.

COURSE OUTCOMES:

At the end of the course, students are able to:

1. Develop a better understanding of important issues related to gender in contemporary India.
2. Sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it
4. Men and Women students and professionals will be better equipped to work and live together as equals.
5. Reate a sense of appreciation of women in all walks of life.

UNIT - I	UNDERSTANDING GENDERS	CLASSES: 03

Introduction: Introduction to Gender, What is Gender, Why should we study it.. Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste: Different Masculinities.

UNIT - II	GENDER ROLES AND RELATIONS	CLASSES: 03

Two or Many? -Struggles with Discrimination- Missing Women-Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences- Gender Spectrum: Beyond the Binary

UNIT - III	GENDER AND LABOUR	CLASSES: 03

Valuation of Labour-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT - IV	GENDER - BASED VIOLENCE	CLASSES: 04

Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “Chupulu”. Domestic Violence: Speaking Out Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life….” Additional Reading: The Caste Face of Violence.

UNIT - V	GENDER AND COEXISTENCE	CLASSES: 03

Gender Issues- Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks The Brave Heart.

TEXT BOOKS:

1. All the five Units in the Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas 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/

WEB REFERENCES:

1. http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

E-TEXT BOOKS:

1. 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/

III B.TECH I SEMESTER SYLLABUS

DATA ANALYTICS

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS01	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Understand different techniques of Data Analysis.
2. Be familiar with concepts of data streams.
3. Be exposed to data analytics Visualization tools and techniques.
4. Implement statistical and analytical tools and techniques.
5. Analyze the visualization with R-programming.

COURSE OUTCOMES

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

1. Demonstrate data analytics fundamentals.
2. Create data models and analyze using R Programming
3. Use python libraries as a tool to analyze data
4. Research and justify data wrangling, data integration, and database techniques as relevant to data analytics
5. Perform data visualizations and integrate tableau with python

UNIT - I	INTRODUCTION TO DATA ANALYTICS	CLASSES: 12

Introduction To Data Analytics: Overview, Types Of Analysis And Key Steps, Components Of Modern Data Ecosystem, Role Of Data Analyst, Data Engineers, Data Scientist, Business Analyst And Business Intelligence Analyst.
Data Eco-System: Types of Data Structures, File Formats, Sources Of Data, Data Professional Languages, Various Data Repositories, ETL Process, Introduction To Big Data, Big Data Ecosystem.

UNIT - II	R & DATA MODELLING	CLASSES: 12

Introduction to R-Programming: Overview, visualization using R, simulation, Code profiling, Statistical Analysis with R, data manipulation, visualization tools with R (Ggplot , Lattice, etc.,)
Data Modelling: SQL Best Practices, Advanced Excel, NoSQL Databases, / Visualization Using Tableau, Visualisation Using PowerBI, Visualization Using Plotly

UNIT - III	DATA ANALYSIS USING SQL	CLASSES: 12

Data Analysis using SQL, Python for Data Science, Visualization in Python, Exploratory Data Analysis, Maths for Data Science, Inferential Statistics, Hypothesis Testing, Advanced SQL.

UNIT - IV	GATHERING AND WRANGLING DATA	CLASSES: 12

Gathering And Wrangling Data: Identifying, Gathering And Importing Data From Desperate Sources, Wrangling And Cleaning Data, Tools For Gathering, Importing, Wrangling And Cleaning, Characteristic, Applications And Limitations.

UNIT - V	DATA VISUALIZATION	CLASSES: 12

Tableau: Introduction to Tableau, connecting to Excel, CSV Text Files, Product Overview, Connecting to Databases, Working with Data, Analyzing and Generating reports , TabPy Combining Python and Tableau.

TEXT BOOKS

1. Data Analytics Made Accessible by Dr. Anil Maheshwari
2. Principles of Data Wrangling, by Joseph M. Hellerstein, Tye Rattenbury, Jeffrey Heer, Sean Kandel, Connor Carreras, Released July 2017
3. Visual Analytics with Tableau by Alexander Loth , Nate Vogel, et al.

REFERENCE BOOKS

1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analyzing, and Manipulating Data With SQL by Walter Shields
2. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic

AUTOMATA AND COMPILER DESIGN

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT04	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Construct an insight of fundamental principles of designing compilers
2. Illustrating different phases of compilation.
3. Describe the steps and algorithms used by language translators and features.
4. Enumerating top down and bottom up parsing techniques used in compilation process.
5. Learning the effectiveness of optimization.
6. Introducing the syntax directed translation and type checking.

COURSE OUTCOMES

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

1. Understand the concept of abstract machines and their power to recognize the languages.
2. Analyze phases of compilation, particularly lexical analysis, parsing, semantic analysis and code generation.
3. Construct parsing tables for different types of parsing techniques and syntax directed translations.
4. Apply code optimization techniques to different programming languages.
5. Generate object code for natural language representations.

UNIT – I	FORMAL LANGUAGE AND REGULAR EXPRESSIONS	CLASSES: 08

Formal Language and Regular Expressions: Languages, Definition: regular expressions, Finite Automata-DFA, NFA. Conversion of regular expression to NFA, Conversion of NFA to DFA, Equivalence of NFA and DFA.

UNIT – II	INTRODUCTION TO COMPILERS	CLASSES: 12

INTRODUCTION TO COMPILERS: Definition of compiler, interpreter and its differences, the phases of a compiler, pass and phases of translation, bootstrapping, LEX-lexical analyzer generator.
PARSING: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, classes of parsing, top down parsing - LL(1) grammars.

UNIT – III	BOTTOM UP PARSING	CLASSES: 12

BOTTOM UP PARSING: Definition of bottom up parsing, handles, handle pruning, stack implementation of shift-reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR, canonical LR (CLR) and Look Ahead LR (LALR) parsers, YACC-automatic parser generator.

UNIT – IV	SYNTAX DIRECTED TRANSLATION	CLASSES: 16

SYNTAX DIRECTED TRANSLATION: Syntax directed definition, construction of syntax trees, S-Attributed and L-Attributed definitions.
INTERMEDIATE CODE GENERATION: intermediate forms of source programs– abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements.
TYPE CHECKING: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, equivalence of type expressions, type conversions.

UNIT – V	RUN TIME ENVIRONMENTS	CLASSES: 10

RUN TIME ENVIRONMENTS: Source language issues, Storage organization, storage-allocation Strategies, parameter passing, and symbol tables.
CODE OPTIMIZATION: basic blocks and flow graphs, optimization of basic blocks, principal sources of optimization, directed a cyclic graph (DAG) representation of basic block.
CODE GENERATION: Machine dependent code generation, object code forms, peephole optimization.

TEXT BOOKS

1. K. L. P Mishra, N. Chandrashekaran, Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India, 2003.
2. Aho, Ullman, Ravisethi,Compilers Principles, Techniques and Tools, Pearson Education.

REFERENCE BOOKS

1. Introduction to Theory of computation.Sipser,2nd Edition, Thomson., 2009.
2. Modern Compiler Construction in C, Andrew W.Appel Cambridge University Press.
3. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1st edition, PWS Publishing.
4. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
5. Principles of Compiler Design, V. Raghavan, TMH.

WEB PROGRAMMING

B. TECH- SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS03	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Comprehend the advanced concepts of web programming and internet
2. Apprehend one or more of the tools to develop interactive, client-side, server-side executable web applications using advanced technologies and evaluate its effectiveness.
3. Build scalable web apps quickly and efficiently using appropriate toolkits and framework
4. Build practical and real world web applications

COURSE OUTCOMES

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

1. Design and implement dynamic web page with validation and event handling using Java Script.
2. Design web application using Angular JS.
3. Design and implement Server-side Programming using PHP
4. Design and implement client side webpage using jQuery.
5. Design and implement web application using Flask.

UNIT – I	HTML AND JAVASCRIPT	CLASSES: 12

HTML: Basic Syntax, Standard structure, Basic Text markup, Images, Hypertext links, Lists, Tables, Frames, Forms.
JavaScript: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations.

UNIT - II	ANGULAR JS	CLASSES: 14

Why We Need Frameworks: What Is a Framework, Downloading and Installing AngularJS, First AngularJS Application
Filters: Introduction, Built-in Filters: The Number Filter, The Date Filter, The limitTo Filter.
AngularJS Modules: What Is a Module. Bootstrapping AngularJS, Creating a Custom Filter.
Directives: The Basics of Directives, Using Directives, Built-in Directives
Working with Forms: AngularJS Forms, Validating Forms.

UNIT – III	PHP	CLASSES: 12

Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc., Connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies

UNIT - IV	JQUERY	CLASSES: 12

JQUERY: Introduction to jQuery – Selectors – Elements: Manipulations, Changing and Setting elements – EventModels: Event handlers – Animations & Effects – Functions – Plugins

UNIT - V	FLASK	CLASSES: 12

FLASK Basics: FLASK installation, Basic Structure of application, Routing, variable rules, URL building, HTTP methods, Template, static files.
FLASK Advance: Request object, Response object, sending form data to template, Redirect errors, message flashing, file uploading, define and access database.

TEXT BOOKS

1. Web Technologies, Uttam K Roy, Oxford University Press
2. Beginning Angular JS, Grant, Andrew— A Press 2014
3. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill
4. Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.
5. Flask Web Development, 2nd Edition, Miguel Grinberg, March 2018, O'Reilly Media, Inc.,

REFERENCE BOOKS

1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World WidWeb - How ToProgram”, Fifth Edition, Pearson Education, 2011.

2. Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.

EXPLORATORY DATA ANALYTICS
(PROFESSIONAL ELECTIVE - I)

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS07	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Exploratory techniques for summarizing data.
2. Typically applied before formal modeling commences and can help inform the development of more complex statistical models
3. Analyze plotting systems
4. Understand the EDA analysis using R
5. Implement the clustering dimension reduction

COURSE OUTCOMES

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

1. Identify and execute the basic data format.
2. Formulate the computations with Excel and pdf files.
3. Inspect the outliers if any in the data set.
4. Organize the appropriate feature selection and dimensionality reduction.
5. Explore and analyze the Image and video data

UNIT - I	INTRODUCTION TO DATA	CLASSES: 10

Introduction to Data: Introduction to Data, Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Collection Strategies, Measuring Data Similarity.
Exploratory Data Analysis: Data Analytics life cycle, Exploratory Data Analysis (EDA) –Definition, Motivation, Steps in data exploration, The basic data types, Data Type Portability.

UNIT - II	DATA STORAGE	CLASSES: 12

Introduction to databases, Data Warehouses, Three tier architecture, Data Cube, Storing data in cloud, Retrieving data from cloud, Types of storages in cloud, Storing bigdata into HDFS and No SQL Databases

UNIT - III	MISSING DATA AND OUTLIERS	CLASSES: 12

Introduction to Missing data: Traditional methods for dealing with missing data, Basics, Missing data handling, Improving the accuracy of analysis Reading Datasets, Working with different file types, txt, csv etc Practical Issues in Multiple Imputation, Data Modeling, Schema Design.

UNIT - IV	DATA WRANGLING	CLASSES: 10

Data Wrangling- Importance of Data Wrangling - How is Data Wrangling performed?- Tasks of Data Wrangling- Data Wrangling Tools-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data

UNIT - V	WORKING WITH DATA	CLASSES: 12

EXPLORATORY DATA ANALYSIS Demonstrate the range, summary, mean, variance, median, standard deviation, histogram, box plot, scatter plot using population dataset

TEXT BOOKS

1. Exploratory Data Analysis. Using R. Ronald K. Pearson
2. Student's Handbook for Associate Analytics
3. Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

REFERENCE WEB LINKS:
https://www.tutorialspoint.com/excel_data_analysis/excel_data_analysis_visualization.htm

1. S. van Buuren. *Flexible Imputation of Missing Data*. Chapman & Hall/CRC Interdisciplinary Statistics. CRC Press LLC, 2018. ISBN 9781138588318
2. Jean-Francois Mas. *Análisis espacial con R: Usa R como un Sistema de Información Geográfica*. European Scientific Institute, 2018. ISBN 978-608-4642-66-4.
3. Thomas Rahlf. *Data Visualisation with R*. Springer International Publishing, New York, 2017. ISBN 978-3-319-49750-1

NOSQL DATABASES
(PROFESSIONAL ELECTIVE - I)

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS09	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Demonstrate competency in designing NoSQL database management systems.
2. Demonstrate competency in describing how NoSQL databases differ from relational databases from a theoretical perspective.
3. Demonstrate competency in selecting a particular NoSQL database for specific use cases.
4. Use the data control, definition, and manipulation languages of the NoSQL databases covered in the course
5. Understand Master-Slave Replication

COURSE OUTCOMES

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

1. Interpret, compare and use the four types of NoSQL Databases.
2. Evaluate NoSQL database development tools and programming languages.
3. Adapt Knowledge on MongoDB query language.
4. Examine the difference of NoSQL key value database and Document database
5. Prioritize the data modeling techniques.

UNIT-I	INTRODUCTION	CLASSES: 12

Basic concepts of a Database: What is NoSQL, NoSQL Database Environment, Overview and History of NoSQL Databases and how is it different from traditional databases, Types of NoSQL Database, NoSQL vs. SQL Comparison, ACID & Base Property, Benefit over RDBMS

UNIT-II	NOSQL DATA BASE	CLASSES: 12

Data Management with Distributed Databases- ACID and BASE- Types of NOSQL Databases: Key Value Databases, Column Database, Graph Database, Document Data Base

UNIT-III	DOCUMENT DATABASE	CLASSES: 10

Overview of MongoDB, Design Goals for MongoDB Server and Database, MongoDB tools - Creating and Querying through Indexes Document-Oriented, principles of schema design- Constructing queries on Databases- collections and Documents- MongoDB QueryLanguage.

UNIT-IV	WORKING WITH MONGODB	CLASSES: 12

Different MongoDB data types, understand read and write concepts of MongoDB, CRUD operations in MongoDB.

UNIT-V	HADOOP NOSQL DATABASES	CLASSES: 12

HBASE: Architecture of HBase , HBase Shell Commands, Insert & Retrieve Data in HBase
Cassandra: Architecture, Data Model, Cassandra Table Operations, Cassandra CURD Operations
KAFKA: Architecture, key concepts, Cluster, Nodes, Kafka Brokers.
Comparison of NoSQL Databases HBase, Cassandra & MongoDB

TEXT BOOKS

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence , Pearson Education

REFERENCE BOOKS

1. Sadalage, P. & Fowler, M. (2012). NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. (1st Ed.). Upper Saddle River, NJ: Pearson Education, Inc. ISBN- 13: 978-0321826626 ISBN-10: 0321826620
2. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10: 1934356921
3. Robinson, I. Webber, J. & Eifren, E. (2013). Graph Databases. (1st ed.). Sebastopol, CA: O'Reilly Media, Inc. ISBN-13: 978-1-449-35626-2.

DATA MINING TECHNIQUES
(PROFESSIONAL ELECTIVE – I)

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI07	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Learn data mining concepts understand association rules mining.
2. Discuss classification algorithms learn how data is grouped using clustering techniques.
3. Develop the abilities of critical analysis to data mining systems and applications.
4. Implement practical and theoretical understanding of the technologies for data mining
5. Understand the strengths and limitations of various data mining models

COURSE OUTCOMES

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

1. Perform the preprocessing of data and apply mining techniques on it.
2. Identify the association rules, classification and clusters in large data sets.
3. Solve real world problems in business and scientific information
4. Classify web pages, extracting knowledge from the web
5. Apply supervised learning techniques on given data sets

UNIT - I	INTRODUCTION TO DATA MINING	CLASSES: 14

INTRODUCTION TO DATA MINING: Introduction, What is Data Mining, Definition, Knowledge Discovery from Data (KDD), What Kinds of Data can be Mined, Data Mining Tasks, Integration of Data Mining System With A Database or Data Warehouse System, Types of Data Sets and Attribute Values
PREPROCESSING: Data Quality, Major Tasks in Data Pre-processing, Data Cleaning and Data Integration, Data Reduction, Data Transformation and Data Discretization, Measures of Similarity and Dissimilarity-Basics.

UNIT - II	ASSOCIATION RULES	CLASSES: 12

ASSOCIATION RULES: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.

UNIT – III	CLASSIFICATION	CLASSES: 14

CLASSIFICATION: Problem Definition, General Approaches to solving a classification problem ,Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction , Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbor classification-Algorithm and Characteristics.

UNIT – IV	CLUSTERING	CLASSES: 10

CLUSTERING: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms**,** Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection.

UNIT - V	WEB AND TEXT MINING	CLASSES: 10

WEB AND TEXT MINING: Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

TEXT BOOKS

1. Data Mining: Concepts and Techniques - Jiawei Han, Micheline Kamber, Jian Pei, 3rd edition, Elsevier, United States of America, 2012.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education
3. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing

REFERENCE BOOKS

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.
3. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press

WEB PROGRAMMING LAB

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS04	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Understand basic concepts of HTML and CSS to create static web pages
2. Facilitate students to build dynamic, responsive web pages using Angular JS
3. Familiarize basics of server side scripting using PHP
4. Understand the concepts of JQuery to design client side webpage
5. Familiarize various concepts Flask framework to implement web applications.

COURSE OUTCOMES

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

1. Apply the concepts of JavaScript to perform client side validation and create dynamic web pages.
2. Create web application using AngularJS that depend on MVC architecture.
3. Create server side applications using PHP.
4. Design and implement client side webpage using jQuery.
5. Design and implement web application using Flask.

WEEK-I

Design a home page which will display your information, i.e. Bio data, using Image Link and File Link to upload images and necessary documents.

WEEK-2

Create a webpage with four frames (Picture, table, list, and hyperlink).

WEEK-3

Write a program to demonstrate Event Handling -Validation of registration form -Open a Window from the current window -Change color of background at each click of button or refresh of a page -Display calendar for the month and year selected from combo box OnMouseover event

WEEK-4

Write an HTML page including any required Javascript that takes a number from one text field in the range of 0 to 999 and shows it in range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show “out of range” and if it is not a number, it should show “not a number” message in the result box.

WEEK-5

Implement the following web applications using AngularJS: A simple calculator web application that takes two numbers and an operator (+, -, /, * and %) from an HTML page and returns the result page with the operation performed on the operands.

WEEK-6	
Implement the following web applications using AngularJS: A user validation web application, where the user submits the login name and password to the server. The name and password are checked if the data matches, a successful login page is returned. Otherwise a failure message is shown to the user.	
WEEK-7	
Write an HTML page including required PHP code that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).	
WEEK-8	
Write an HTML page including any required PHP that takes a number from one text field in the range of 0 to 999 and shows it in range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show “out of range” and if it is not a number, it should show “not a number” message in the result box.	
WEEK-9	
Implement the following web applications using PHP: A user validation web application, 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 a failure message is shown to the user.	
WEEK-10	
Create a div using jQuery with style tag	
WEEK-11	
Create a Zebra Stripes table effect using jQuery	
WEEK-12	
Develop web application using Flask.	

TEXT BOOKS

1. Web Technologies, Uttam K Roy, Oxford University Press
2. Beginning Angular JS, Grant, Andrew— A Press 2014
3. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill
4. Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.
5. Flask Web Development, 2nd Edition, Miguel Grinberg, March 2018, O'Reilly Media, Inc.

REFERENCE BOOKS

1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World WidWeb - How ToProgram”, Fifth Edition, Pearson Education, 2011.
2. Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.
3. DJango Web Development with python by by Arun Ravindran Samuel Dauzon Aidas Bendoraitis, 2017
4. Django for Beginners: Build Websites with Python and Django by by William S Vincent, 2020

DATA ANALYTICS LAB

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS02	PCC	-	-	2	1	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. The objective of this course is to provide comprehensive knowledge of python programming paradigms required for Data Analytics.

COURSE OUTCOMES

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

1. Make efficient use of the data structures built into Python
2. Demonstrate handling of missing data
3. Implement data-analytic tasks in Python using external libraries such as Pandas
4. Implement numerical programming, data handling and visualization through NumPy, Pandas modules
5. Apply analytics for business situations

WEEK-I WORKING WITH R

- Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.
- Reading Excel data sheet in R.
- Reading XML dataset in R.

WEEK-2 LEARNING NUMPY

- Creating arrays
- Using arrays and scalars
- Indexing Arrays
- Transposition
- Array Processing
- Array Input and Output

WEEK-3 INTRODUCTION TO PANDAS PART-I

- Series
- DataFrames
- Index objects
- Reindex
- Drop Entry
- Selecting Entries

WEEK-4 INTRODUCTION TO PANDAS PART-II

- Data Alignment
- Rank and Sort
- Summary Statistics
- Missing Data
- Index Hierarchy

WEEK-5	WORKING WITH DATA PART-I

- Reading and Writing Text Files
- JSON with Python
- HTML with PythonMicrosoft
- Excel files with Python
- Microsoft Excel files with Python

WEEK-6	WORKING WITH DATA PART-II

- Merge
- Combining DataFrames
- Pivoting
- Duplicates in DataFrames
- Mapping
- Binning
- Outliers

WEEK-7	WORKING WITH DATA PART-III

- GroupBy on DataFrames
- Splitting Applying and Combining
- Cross Tabulation

WEEK-8	DATA VISUALIZATION

- Installing Seaborn
- Histograms
- Combining Plot Styles

WEEK-9	DATA VISUALIZATION

- Box and Violin Plots
- Regression Plots
- Heatmaps and Clustered Matrice
- TabPy: Tableau with python

WEEK-10	USE CASES

- Data Project - Stock Market Analysis
- Data Project - Customer Segmentation
- Data Project - Credit Card Fraud Detection

TEXT BOOKS

1. DJANGO Web Development with python by by Arun Ravindran Samuel Dauzon Aidas Bendoraitls, 2017
2. Django for Beginners : Build Websites with Python and Django by by William S Vincent 2020

REFERENCE BOOKS

1. Lightweight Django by Julia Elman,2014
2. Django Design pattems and Best Practices – second Edition by Arun Ravindran ,2018

III B.TECH II SEMESTER SYLLABUS

MACHINE LEARNING

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI19	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.
4. Be familiar with basic machine learning algorithms with classification and clustering.
5. Gain experience of doing independent study and research.

COURSE OUTCOMES

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

1. Recognize the characteristics of machine learning that makes it useful to solve real-world problems.
2. Evaluate exploratory data analysis and Data preparation and preprocessing on different datasets.
3. Design and implement machine learning solutions of classification, regression problems.
4. Choose an appropriate clustering technique to solve real world problems.
5. Choose a suitable machine learning model, implement and examine the performance of the chosen model for a given real world problems.

UNIT-I	INTRODUCTION	CLASSES: 12

Machine Learning Foundations: Introduction to machine learning, learning problems and scenarios, need for machine learning, types of learning, standard learning tasks, the Statistical Learning Framework, Probably Approximately Correct (PAC) learning.

UNIT-II	DESCRIPTIVE STATISTICS	CLASSES: 12

Data representation, types of data- nominal, ordinal, interval and
continuous, central tendency- calculating mean mode median, mean vs median, variability,
variance, standard deviation, Mean Absolute Deviation using sample dataset, finding thepercentile, interquartile range, Box Plot, Outlier, whisker, calculating correlation, covariance, causation.
Exploratory data analysis, Data preparation and preprocessing, Data visualization

UNIT-III	SUPERVISED LEARNING	CLASSES: 14

Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification,
Perceptron: – multilayer neural networks – back propagation - learning neural networks structures –
support vector machines: – soft margin SVM – going beyond linearity – generalization and over fitting – regularization – validation.
Decision Trees:ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression,Logistic Regression.

UNIT-IV	UNSUPERVISED LEARNING	CLASSES: 12

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis,
Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and NonLinear, Kernel Functions, K-Nearest Neighbors.

UNIT- V	ENSEMBLE AND PROBABILISTIC LEARNING	CLASSES: 12

Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Gradient Boosting,Xg boost, Stacking
Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks, Mining Frequent Patterns

TEXT BOOKS

1. Giuseppe Bonaccorso, —Machine Learning Algorithms‖, 2nd Edition, Packt, 2018,
2. Tom Mitchel —Machine Learning‖, Tata McGraW Hill, 2017.

REFERENCE BOOKS

1. Ethem Alpaydin, —Introduction to Machine Learning‖, PHI, 2004
2. StephenMarshland, —Machine Learning: An Algorithmic Perspective‖,CRCPressTaylor& Francis, 2nd Edition, 2015
3. Abhishek Vijavargia —Machine Learning using Python‖, BPB Publications, 1 st Edition, 2018 NTRODUCTION TO MACHINE LEARNING

COMPUTER NETWORKS

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS15	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students :

1. Introduce the fundamental s of various types of computer networks
2. Demonstrate the TCP/IP and OSI models with merits and demerits
3. Explore the various layers of OSI model
4. Introduce UDP and TCP models
5. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

COURSE OUTCOMES

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

1. Identify computer networks and its components.
2. Identify the different types of network topologies and protocols.
3. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
4. Select and use various sub netting and routing mechanisms.
5. Design a network diagram for a given scenario.

UNIT-I	INTRODUCTION	CLASSES: 12

INTRODUCTION: Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay.
THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

UNIT-II	THE DATA LINK LAYER	CLASSES: 12

THE DATA LINK LAYER: Design issues, error detection and correction, elementary data link protocols, sliding window protocols.
THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

UNIT-III	THE NETWORK LAYER	CLASSES: 12

THE NETWORK LAYER: Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

UNIT-IV	THE TRANSPORT LAYER	CLASSES: 12

THE TRANSPORT LAYER: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

UNIT- V	THE APPLICATION LAYER	CLASSES: 12

THE APPLICATION LAYER: Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http.
APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

TEXT BOOKS

1. Computer networks-Andrew S Tanenbaum, 4th edition,
2. Pearson education Data communication and networking-Behrouz. A. Forouzan , fifth edition, TMH, 2013 .
3. Computer Networking With Internet Protocols and Technology fifth Edition ,William Stallings, Pearson education Data communication and networking, 2003

REFERENCE BOOKS

1. Behrouz A. Forouzan , Data communication and Networking, 4th Edition, Mc Graw-Hill, India, 2006.
2. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

BIG DATA ANALYTICS

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS17	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students :

1. Introduce the terminology, technology and its applications
2. Introduce the concept of Analytics and Visualization
3. Apply analytics on Structured, Unstructured Data.
4. Demonstrate the usage of various Big Data tools and Data Visualization tools
5. Introduce the tools, technologies & programming languages which is used in day to day analytics cycle

COURSE OUTCOMES

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

1. Compare various file systems and **use** an appropriate file system for storing different types of data.
2. Demonstrate the concepts of Hadoop ecosystem for storing and processing of unstructured data.
3. Apply the knowledge of programming to process the stored data using Hadoop tools and generate reports.
4. Connect to web data sources for data gathering, Integrate data sources with hadoop components to process streaming data.
5. Tabulate and examine the results generated using hadoop components

UNIT-I INTRODUCATION TO BIG DATA — CLASSES: 12

INTRODUCATION TO BIG DATA: Data and its importance, Big Data - definition, implications of Big Data, addressing Big Data implications using Hadoop, Hadoop Ecosystem

HADOOP ARCHITECTURE:

Hadoop Storage : HDFS, Hadoop
Processing : Map Reduce Framework
Hadoop Server Roles : Name Node, Secondary Name Node and Data Node, Job Tracker, Task Tracker

HDFS-HADOOP DISTRIBUTED FILE SYSTEM: Design of HDFS, HDFS Concepts, HDFS Daemons, HDFS High Availability, Block Abstraction, FUSE: File System in User Space. HDFS Command Line Interface (CLI), Concept of File Reading and Writing in HDFS.

UNIT-II MAPREDUCE PROGRAMMING MODEL — CLASSES: 12

MAPREDUCE PROGRAMMING MODEL: Introduction to Map Reduce Programming model to process Big Data, key features of Map Reduce, Map Reduce Job skeleton, Introduction to Map Reduce API, Hadoop Data Types, Develop Map Reduce Job using Eclipse, built a Map Reduce Job export it as a java archive(.jar file).

MAPREDUCE JOB LIFE CYCLE: Understanding Mapper, Combiner, Partitioner, Shuffle & Sort and Reduce phases of Map Reduce Application, Developing Map Reduce Jobs based on the requirement using given datasets like weather dataset.

UNIT-III INTRODUCTION TO PIG — CLASSES: 12

INTRODUCTION TO PIG: Understanding pig and pig Platform, introduction to Pig Latin Language and Execution engine, running pig in different modes, Pig Grunt Shell and its usage.

PIG LATIN LANGUAGE –SEMANTICS –DATA TYPES IN PIG: Pig Latin Basics, Key words, Pig Data types, Understanding Pig relation, bag, tuple and writing pig relations or statements using Grunt Shell, expressions, Data processing operators, using Built in functions.

WRITING PIG SCRIPTS USING PIG LATIN: Writing pig scripts and saving them text editor, running pig scripts from command line.

UNIT-IV	INTRODUCATION TO HIVE	CLASSES: 12

INTRODUCATION TO HIVE: Understanding Hive Shell, Running Hive, Understanding Schema on read and Schema on write.
HIVE QL DATA TYPES, SEMANTICS: Introduction to Hive QL (Query Language), Language semantics, Hive Data Types.
HIVE DDL, DML AND HIVE SCRIPTS: Hive Statements, Understanding and working with Hive Data Definition Languages and Manipulation Language statements, Creating Hive Scripts and running them from hive terminal and command line.

UNIT-V	SQOOP	CLASSES: 12

SQOOP: Introduction to Sqoop tool, commands to connect databases and list databases and tables, command to import data from RDBMS into HDFS, Command to export data from HDFS into required tables of RDBMS.
FLUME: Introduction to Flume agent, understanding Flume components Source, Channel and Sink.
OOZIE: Introduction to Oozie, Understanding work flow Management.

TEXT BOOKS

1. Hadoop: The Definitive Guide, 4th Edition - O'Reilly Media
2. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

REFERENCE BOOKS

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

PYTHON FOR DATA SCIENCE
(PROFESSIONAL ELECTIVE - II)

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS08	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Provide with the necessary knowledge of Data Science Concepts.
2. Learns how to collect, store and manage data from different sources.
3. Provide the concepts and need of Data Visualization.
4. Introduce the important data science modules NumPy, and Matplotlib
5. Introduce the input/output with files in Python and statistical processing of a data using Pandas

COURSE OUTCOMES

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

1. Identify the various steps of Data Science project development.
2. Understand the need of data collection, storage and processing of data for better insights.
3. Identify the appropriate techniques for understanding data through Visualization
4. Implement data collection and management scripts using Python Pandas
5. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.

UNIT - I INTRODUCTION TO DATA SCIENCE — CLASSES: 10

Introduction to Data Science: Introduction to Data Science, Data Science Terminology, Data Science Process, Data Science Project Roles.

Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management-Distributed Storage and Retrieval- noSQL, GraphDB, Cloud based storage and computing environment practices like Azure, Amazon and IBM based services, Using multiple data sources.

UNIT – II STATISTICS — CLASSES: 12

Statistics: Important statistical concepts used in data science, Difference between population and sample Types of variables, Measures of central tendency, Measures of variability, Coefficient of variance, Skewness and Kurtosis.

UNIT – III NUMPY BASICS: ARRAYS AND VECTORIZED COMPUTATION — CLASSES: 16

NumPy Basics: Arrays and Vectorized Computation:

The NumPy and array: A Multidimensional Array Object, creating and arrays , Data Types for and arrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes

Universal Functions: Fast Element-wise Array Functions, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting,

UNIT – IV GETTING STARTED WITH PANDAS — CLASSES: 12

Getting Started with pandas:

Introduction to pandas Data Structures, Series, Data Frame, Index Objects, Essential Functionality, Reindexing,Dropping entries from an axis, Indexing, selection, and filtering, Arithmetic and data alignment, Function application and mapping, Sorting and ranking, Axis indexes with duplicate values, Summarizing and Computing Descriptive Statistics, Correlation and Covariance, Unique Values, Value Counts, and Membership, Handling Missing Data, Filtering Out Missing Data, Filling in Missing Data, Hierarchical Indexing, Reordering and Sorting Levels, Summary Statistics by Level, Using a Data Frame's Columns.

UNIT – V	PLOTTING AND VISUALIZATION	CLASSES: 10

Plotting and Visualization : A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Histograms and Density Plots, Scatter Plots

TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
3. Python For Data Analysis (O Reilly, Wes Mckinney)

REFERENCE BOOKS

1. Joel Grus, Data Science from Scratch, O'Reilly Publications.
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, DreamTech Publications.
3. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education 2. Head First Python, Paul Barry, O'Reilly.

DATA WRANGLING
(PROFESSIONAL ELECTIVE - II)

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS18	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Provide with the necessary knowledge of Data Science Concepts.
2. Learns how to collect, store and manage data from different sources.
3. Provide the concepts and need of Data Visualization.
4. Introduce the important data science modules NumPy, and Matplotlib
5. Introduce the input/output with files in Python and statistical processing of a data using Pandas

COURSE OUTCOMES

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

1. Inspect and execute the basic data format.
2. Determine the computations with Excel and pdf files
3. Prioritize the concepts of data cleanup
4. Originate and analyze the Image and video data
5. Elaborate the concepts web scraping

UNIT - I	INTRODUCTIONTO DATA WRANGLING	CLASSES: 10

What Is Data Wrangling?- Importance of Data Wrangling -How is Data Wrangling performed?- Tasks of Data Wrangling-Data Wrangling Tools-Introduction to Python-Python Basics-Data Meant to Be Read by Machines-CSV Data-JSON Data-XML Data.

UNIT – II	WORKING WITH EXCEL FILES AND PDFS	CLASSES: 12

Installing Python Packages-Parsing Excel Files-Parsing Excel Files -Getting Started with Parsing-PDFs and Problem Solving in Python-Programmatic Approaches to PDF Parsing-Converting PDF to Text-Parsing PDFs Using pdf miner-Acquiring and Storing Data-Databases: A Brief Introduction-Relational Databases: MySQL and PostgreSQL-Non-Relational Databases: NoSQL-When to Use a Simple File-Alternative Data Storage.

UNIT – III	DATA CLEANUP	CLASSES: 16

Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String manipulations – Regular Expression

UNIT – IV	DATA EXPLORATION AND ANALYSIS	CLASSES: 12

Exploring Data-Importing Data-Exploring Table Functions-Joining Numerous Datasets-Identifying Correlations-Identifying Outliers-Creating Groupings-Analyzing Data-Separating and Focusing the Data Presenting Data-Visualizing the Data-Charts-Time-Related Data-Maps-Interactives-Words-Images, Video, and Illustrations-Presentation Tools-Publishing the Data-Open Source Platforms.

UNIT – V	WEB SCRAPING	CLASSES: 10

What to Scrape and How-Analyzing a Web Page-Network/Timeline-Interacting with JavaScript-In-Depth Analysis of a Page-Getting Pages-Reading a Web Page-Reading a Web Page with LXML-XPath-Advanced Web Scraping-Browser-Based Parsing-Screen Reading with Selenium-Screen Reading with Ghost. PySpidering the Web-Building a Spider with Scrapy-Crawling Whole Websites with Scrapy.

TEXT BOOKS

1. Jacqueline Kazil & Katharine Jarmul," Data Wrangling with Python", O'Reilly Media, Inc,2016

REFERENCE BOOKS

1. Dr. Tirthajyoti Sarkar, Shubhadeep," Data Wrangling with Python: Creating actionable data from raw sources", Packt Publishing Ltd,2019.
2. Stefanie Molin," Hands-On Data Analysis with Pandas", Packt Publishing Ltd,2019
3. Allan Visochek," Practical Data Wrangling", Packt Publishing Ltd,2017 4. Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras,"

ARTIFICIAL INTELLIGENCE
(PROFESSIONAL ELECTIVE - II)

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI03	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. The difference between optimal reasoning vs human like reasoning
2. Understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
3. Different knowledge representation techniques
4. Understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

COURSE OUTCOMES

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

1. Apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning.
2. Formulate an efficient problem space for problem solving and Represent knowledge using the appropriate technique
3. Design and develop expert systems using Prolog and solve uncertainty problems.
4. Analyze real world problems and implement using ANN, CNN and AI techniques.
5. Implement the concepts of AI in Healthcare, Robotics and Agriculture

UNIT- I	INTRODUCTION & PROBLEM SOLVING	CLASSES: 14

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications. Problem Solving – State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction, Game Playing, Alpha-Beta Pruning

UNIT - II	LOGIC PROGRAMMING & KNOWLEDGE REPRESENTATION	CLASSES: 12

Logic Concepts and Logic Programming: Introduction, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - III	EXPERT SYSTEMS & PROLOG	CLASSES: 16

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Application of Expert Systems, **Uncertainty Measure**: Bayesian Belief Networks, Certainty Factor Theory, Dempster - Shafer Theory.
Prolog: Basics of Prolog, Applications of Prolog, Representation, Structure, Backtracking, Type of Prolog, variables in Prolog, Operators in Prolog, Input and Output Terms in Prolog.

UNIT - IV	ANN, CNN	CLASSES: 14

Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.
Convolutional Neural Networks: Pooling, Padding, Layers used to build ConvNets,Working of CNN, Python Libraries used for AI: Tensor flow, Keras, Theano, Pytorch, Scikit Learn, Pandas, Image

Classification using CNN with Python		
UNIT - V	**APPLICATIONS AND CASE STUDIES OF AI**	**CLASSES: 12**

Applications of AI in real world, Future of AI, Benefits and Risks of AI.
Case Studies: *AI in Healthcare*: Medical Imaging and Diagnostic, *AI in Agriculture:* Autonomous Tractors, Controlling Pest Infestations, Soil and Crops Health Monitoring, AI in Robotics: Use of Artificial Intelligence in Robotics

TEXT BOOKS

1. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004

REFERENCE BOOKS

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Introduction to Artificial Intelligence by Eugene Charniak, Pearson.
3. Introduction to Artificial Intelligence and expert systems Dan W.Patterson. PHI.
4. Artificial Intelligence by George Fluger rearson fifth edition.

MACHINE LEARNING LAB

III B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI20	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES

The course should enable the students :

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Impart knowledge on the basic concepts underlying machine learning.
4. Acquaint with the process of selecting features for model construction.
5. Familiarize different types of machine learning techniques.

COURSE OUTCOMES

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

1. Design and implement machine learning solutions to classification, regression problems.
2. Analyze the complexity of Machine Learning algorithms and their limitations.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems
5. Apply supervised and unsupervised techniques on various data sets.

WEEK – I **BASICS**

Write a program to demonstrate the following

a) Operation of data types in Python.

b) Different Arithmetic Operations on numbers in Python.

c) Create, concatenate and print a string and access substring from a given string.

d) Append, and remove lists in python.

e) Demonstrate working with tuples in python.

f) Demonstrate working with dictionaries in python.

WEEK- II **STATISTICAL OPERATIONS**

Using python write a NumPy program to compute the
a) Expected Value
b) Mean
c) Standard deviation
d) Variance
e) Covariance
f) Covariance Matrix of two given arrays.

WEEK- III **DATA PREPROCESSING – CONTINUOUS / DISCRETE DATA**

For a given set of training data examples stored in a .CSV file, demonstrate Data Preprocessing in Machine learning with the following steps
a) Getting the dataset.
b) Importing libraries.
c) Importing datasets.

d) Finding Missing Data.
e) Finding Outliers
f) Splitting dataset into training and test set.
g) Feature scaling.

WEEK- IV	DATA PREPROCESSING – CATEGORICAL DATA	

For a given set of training data examples stored in a .CSV file, demonstrate Data Preprocessing in Machine learning with the following steps
a) Getting the dataset.
b) Importing libraries.
c) Importing datasets.
d) Finding Missing Data.
e) Encoding Categorical Data.
f) Splitting dataset into training and test set.
g) Feature scaling.

WEEK- V	DECISION TREE	

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample

WEEK- VI	LINEAR REGRESSION	

Build a linear regression model using python for a particular data set by
a) Splitting Training data and Test data.
b) Evaluate the model (intercept and slope).
c) Visualize the training set and testing set
d) predicting the test set result
e) compare actual output values with predicted values

WEEK- VII	MULTIPLE LINEAR REGRESSION	

Build a multiple linear regression model using python for a particular data set by

a) Splitting Training data and Test data.

b) Evaluate the model (intercept and slope).

c) Visualize the training set and testing set

d) predicting the test set result

e) compare actual output values with predicted values

WEEK- VIII	LOGISTIC REGRESSION	

The dataset contains information of users from a company‘s database. It contains information about UserID, Gender, Age, EstimatedSalary, and Purchased. Use this dataset for predicting that a user will purchase the company‘s newly launched product or not by Logistic Regression model.

User ID	Gender	Age	EstimatedSalary	Purchased
15624510	Male	19	19000	0
15810944	Male	35	20000	0
15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	0
15728773	Male	27	58000	0
15598044	Female	27	84000	0
15694829	Female	32	150000	1
15600575	Male	25	33000	0
15727311	Female	35	65000	0
15570769	Female	26	80000	0
15606274	Female	26	52000	0
15746139	Male	20	86000	0
15704987	Male	32	18000	0
15628972	Male	18	82000	0
15697686	Male	29	80000	0
15733883	Male	47	25000	1
15617482	Male	45	26000	1
15704583	Male	46	28000	1

WEEK- IX	CLUSTERING	

A python program to implement K-Means, Hierarchical Clustering and PCA.

WEEK- X	**KNN & SVM**	
Write a Python program to implement KNN and SVM		
WEEK- XI	**NAIVE BAYES**	
Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.		
WEEK- XII	**RANDOM FOREST**	
Implement Random Forest Algorithm using Python.		

Text Books:

1. Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. September 21019, O'Reilly Media, Inc., ISBN: 9781492032649.
2. Tom Mitchel "Machine Learning", Tata McGraW Hill, 2017.

BIG DATA ANALYTICS LAB

III B. TECH. - II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS18	PCC	-	-	2	1	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Introduce the terminology, technology and its applications
2. Introduce the concept of Analytics for Business
3. Introduce the tools, technologies & programming languages this is used in day to day analytics cycle.
4. Apply analytics on Structured, Unstructured Data.
5. Demonstrate the usage of various Big Data tools and Data Visualization tools

COURSE OUTCOMES

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

1. Connect to hadoop cluster, **experiment** with various Linux and HDFS commands to store data.
2. **Apply** the knowledge of MapReduce programming to process the stored data in HDFS.
3. **Make use of** database operations to store results in tables and generate reports.
4. **Connect** to web data sources for data gathering, **Integrate** data sources with hadoop components to process streaming data.
5. **Generate** reports using data visualization tools.
6.

LIST OF EXPERIMENTS:

WEEK 1

i) Perform setting up and installing Vmware for Hadoop and Linux.
ii) Basic Linux Commands

WEEK 2

Run basic HDFS shell commands

WEEK 3

Implement the following file management tasks in Hadoop:

- Adding files and directories
- Retrieving files
- Deleting files and directories.

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

WEEK 4

Write the steps to export JAR using eclipse.
Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm

WEEK 5

Write a Map Reduce program that mines weather data.
(Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented).

WEEK 6
Run Pig and perform basic PIG commands.

WEEK 7
Write Pig Latin scripts to sort, group, join, project, and filter your data.

WEEK 8
Run HIVE and perform basic HIVE commands to create a table and enter data into tables.

WEEK 9
Use Hive to create, alter, and drop databases, tables, views, functions, and indexes

WEEK 10
Use CDH and HUE to analyze data and generate reports for sample datasets

WEEK 11
Importing and exporting Data in HDFS using Sqoop from MySql database

WEEK 12
Use data visualization tool to generate reports on sample datasets

TEXT BOOKS

1. Hadoop: The Definitive Guide, 4th Edition - O'Reilly Media
2. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

IV B.TECH I SEMESTER SYLLABUS

DEEP LEARNING

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS05	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Learn Deep learning techniques and their applications.
2. Acquire the knowledge of neural network architectures, Deep learning methods and algorithms.
3. Understand CNN and RNN algorithms and their applications.
4. Learn various types of Neural Networks.
5. Understand the data needs of deep learning

COURSE OUTCOMES

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

1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Understand approximate reasoning using Convolution Neural Networks.
4. Analyze and design Deep learning algorithms in different applications.
5. Ability to apply CNN and RNN techniques to solve different applications.

UNIT - I	MACHINE LEARNING BASICS	CLASSES: 12

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.

UNIT - II	INTRODUCTION TO DEEP LEARNING	CLASSES: 12

Historical context and motivation of Deep Learning, Gradient-Based Learning, Multi-layer perceptron, Back-propagation, Vanishing Gradient Problem, Capacity, Overfitting and Underfitting, Activation Functions: RELU, LRELU, ERELU, Regularization-dropout, drop connect, optimization methods for neural networks- Adagrad, adadelta, rmsprop, adam, NAG.

UNIT - III	AUTO ENCODERS & REGULARIZATION	CLASSES: 12

Auto encoders : Autoencoders, Regulraized Autoencoders, Denoising Autoencoders, Representational Power, Layer, Size, and Depth of Autoencoders, Stochastic Encoders and Decoders, Contractive Encoders.

Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - IV	CONVOLUTION NEURAL NETWORKS	CLASSES: 12

Overview of Convolutional Neural Networks Architecture-Motivation, Layers, Kernels, Convolution operation, Padding, Stride, Pooling, Non-linear layer, Stacking Layers, Popular CNN Architectures: LeNet, AlexNet, ZFNet, VggNet..

UNIT - V	RECURRENT NEURAL NETWORKS	CLASSES: 12

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures, Deep Recurrent Networks, Recursive Neural Networks, Long Short Term Memory Networks.

TEXT BOOKS

Goodfellow. I., Bengio. Y. and Courville. A., " Deep Learning", MIT Press, 2016.

REFERENCE BOOKS

1. Tom M. Mitchell, "Machine Learning", MacGraw Hill, 1997.
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.
3. LiMin Fu, "Neural Networks in Computer Intelligence", McGraw-Hill edition, 1994.

HUMAN COMPUTER INTERACTION

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT11	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students:

1. The human components functions.
2. The Computer components functions.
3. The Interaction between the human and computer components.
4. Interaction design basics
5. HCI in the software process
6. Design rules and Evaluation techniques

COURSE OUTCOMES:

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

Upon successful completion of the course, the student is able to

1. Explain the human components functions regarding interaction with computer
2. Explain Computer components functions regarding interaction with human
3. Demonstrate Understanding of Interaction between the human and computer components.
4. Implement Interaction design basics
5. Use HCI in the software process

UNIT-I	INTRODUCTION	Classes: 12

Importance of user Interface – definition, importance of good design, Benefits of good design. A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT-II	DESIGN PROCESS	Classes: 15

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-III	WINDOWS	Classes: 12

New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT-IV	SOFTWARE TOOLS	Classes: 08

Specification methods, interface – Building Tools.

UNIT-V	INTERACTION DEVICES	Classes: 08

Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dreamtech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

Reference Books:

1. Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEAL,PEARSON.
2. Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.

SOCIAL NETWORK ANALYTICS
(PROFESSIONAL ELECTIVE - III)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS22	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Analyze master theories of social networks and social behavior
2. Acquire techniques for analyzing social network data
3. Apply analytical skills to social network data
4. Apply social network analysis to marketing research
5. To understand Semantic Web Applications, Services and Technology

COURSE OUTCOMES

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

1. Illustrate a social network analysis
2. Demonstrate he Web data and semantics in social network applications
3. Model and aggregate the social network data
4. Develop social–semantic applications
5. Evaluate the social network extraction with case studies

UNIT-I	SOCIAL NETWORK ANALYSIS	CLASSES: 10

Network analysis- Development of Social network analysis- Key concepts and measures in network analysis -The global structure of networks - The macro-structure of social networks - Personal networks.

UNIT-II	WEB SEMANTICS IN SOCIAL NETWORK APPLICATIONS	CLASSES: 10

Electronic sources for network analysis - Electronic discussion networks - Blogs and online communities - Web-based networks - Knowledge Representation on the Semantic Web - Ontologies and their role in the Semantic Web Ontology languages for the Semantic Web - The Resource Description Framework (RDF) and RDF Schema - The Web Ontology Language (OWL)

UNIT-III	MODELLING AND AGGREGATING SOCIAL NETWORK DATA	CLASSES: 10

State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Representing identity - On the notion of equality - Determining equality - Reasoning with instance equality - Evaluating smushing

UNIT-IV	DEVELOPING SOCIAL-SEMANTIC APPLICATIONS	CLASSES: 08

Building Semantic Web applications with social network features - The generic architecture of Semantic Web applications -Sesame – Elmo – GraphUtil - The features of Flink - System design – open academia: distributed, semantic-based publication management - The features of open academia - System design.

UNIT- V	APPLICATIONS	CLASSES: 10

Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

TEXT BOOKS
1. Peter Mika , Social Networks and the Semantics Web", Springer, 2007
REFERENCE BOOKS
1. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

TIME SERIES ANALYSIS AND FORECASTING
(PROFESSIONAL ELECTIVE - III)

IV. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS20	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Compute and interpret a correlogram and a sample spectrum
2. Derive the properties of ARIMA and state-space models
3. Choose an appropriate ARIMA model for a given set of data and fit the model using an appropriate package
4. Compute forecasts for a variety of linear methods and models.
5. Analyze the spectral density function

COURSE OUTCOMES

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

1. Describe the fundamental advantage and necessity of forecasting in various situations
2. Identify how to choose an appropriate forecasting method in a particular environment.
3. Apply various forecasting methods, which include obtaining the relevant data and carrying out the necessary computation using suitable statistical software .
4. Evaluate forecasting with better statistical models based on statistical analysis.
5. Make use of concise decisions based on forecasts obtained

UNIT-I	INTRODUCTION	CLASSES: 10

An Introduction to Forecasting: Forecasting and Data. Forecasting Methods. Errors in Forecasting. Choosing a Forecasting Technique. An Overview of Quantitative Forecasting Techniques.
Regression Analysis: The Simple Linear Regression Model. The Least Squares Point Estimates. Point Estimates and Point Predictions. Model Assumptions and the Standard Error. Testing the Significance of the Slope and y Intercept. Confidence and Prediction Intervals. Simple Coefficients of Determination and Correlation. An F Test for the Model.

UNIT-II	MULTI LINEAR REGRESSION AND MODEL BUILDING	CLASSES: 12

Multiple Linear Regressions: The Linear Regression Model. The Least Squares Estimates, and Point Estimation and Prediction. The Mean Square Error and the Standard Error. Model Utility: R2, Adjusted R2, and the Overall F Test. Model Building and Residual Analysis:
Model Building and the Effects of Multicollinearity. Residual Analysis in Simple Regression. Residual Analysis in Multiple Regression. Diagnostics for Detecting Outlying and Influential Observations

UNIT-III	TIME-SERIES REGRESSION	CLASSES: 11

Time Series Regression: Modelling Trend by Using Polynomial Functions. Detecting Autocorrelation. Types of Seasonal Variation. Modelling Seasonal Variation by Using Dummy Variables and Trigonometric Functions. Growth Curves. Handling First-Order Autocorrelation.
Decomposition Methods: Multiplicative Decomposition. Additive Decomposition. The X-12-ARIMA Seasonal Adjustment Method. Exercises.
Exponential Smoothing: Simple Exponential Smoothing. Tracking Signals. Holt's Trend Corrected Exponential Smoothing. Holt-Winters Methods. Damped Trends and Other Exponential

UNIT-IV	TIME SERIES AND SURVIVAL ANALYSIS	CLASSES: 08

Survival Curves, Hazard Function, Estimating Survival Curves, Kaplan-Meier Estimation, The Marriage Curve, Estimating the Survival Function, Confidence Intervals, Normal Distributions, Sampling Distributions, Representing Normal Distributions, Central Limit Theorem, Testing the CLT, Applying the CLT, Correlation Test, Chi-Squared Test

UNIT-V	BOX-JENKINS MODELLING	CLASSES: 9

Box-Jenkins Seasonal Modelling: Transforming a Seasonal Time Series into a Stationary Time Series. Examples of Seasonal Modelling and Forecasting. Box-Jenkins Error Term Models in Time Series Regression.

Advanced Box-Jenkins Modelling: The General Seasonal Model and Guidelines for Tentative Identification. Intervention Models. A Procedure for Building a Transfer Function Model Causality in time series: Granger causality. Hypothesis testing on rational expectations. Hypothesis testing on market efficiency

TEXT BOOKS

1. "Bruce L. Bowerman, Richard O'Connell, Anne Koehler, "Forecasting, Time Series, and Regression, 4th Edition", Cengage Unlimited Publishers 2. Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995
2. Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995

REFERENCE BOOKS

1. Mills, T.C. The Econometric Modelling of Financial Time Series. Cambridge University Press, 1999
2. Andrew C. Harvey. Time Series Models. Harvester wheatsheaf, 1993
3. P. J. Brockwell, R. A. Davis, Introduction to Time Series and Forecasting. Springer, 1996
4. Cryer, Jonathan D.; Chan, Kung-sik, "Time series analysis : with applications in R", ed.: New York: Springer, cop. 2008

CLOUD COMPUTING
(PROFESSIONAL ELECTIVE - III)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS23	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Inculcate the concept of Virtualization
2. Familiarize the concepts of cloud computing and services
3. Explain cloud mechanisms and architecture
4. Explain cloud security and disaster recovery
5. Describe the cloud real time platforms

COURSE OUTCOMES

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

1. Implement the concept of Virtualization to meet the needs of cloud computing
2. Illustrate the concepts of cloud and demonstrate their use in storage systems, cloud models.
3. Analyze various cloud models and apply them to solve problems on the cloud.
4. Make use of Cloud security and disaster recovery mechanisms to resolve the issues in cloud.
5. Examine the real world problems and select an appropriate cloud mechanism to provide an effective solution

UNIT - I	INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES	CLASSES: 10

INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES: Introduction to Virtualization: Definition, Objectives, Characteristics, Benefits of virtualization, Taxonomy of virtualization technologies, Pros and cons of virtualization. Virtualization Technologies: VMware, Hyper-V, Zen and virtual iron.

UNIT - II	FUNDAMENTAL CLOUD COMPUTING AND MODELS	CLASSES: 10

FUNDAMENTAL CLOUD COMPUTING AND MODELS: Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges. Cloud Models, roles and boundaries, Cloud characteristics, Cloud delivery models, Cloud deployment models.

UNIT - III	CLOUD COMPUTING MECHANISMS AND ARCHITECTURE	CLASSES: 10

CLOUD COMPUTING MECHANISMS AND ARCHITECTURE: Cloud-Enabling Technology: Broadband networks and internet architecture, Data center technology, Virtualization technology, Web technology, Multitenant technology, Service technology. Cloud Architectures: Architecture - Workload distribution, Resource pooling, Dynamic scalability, Elastic resource capacity, Service load balancing, Cloud bursting, Elastic disk provisioning, Redundant storage.

UNIT - IV	CLOUD SECURITY AND DISASTER RECOVERY	CLASSES: 10

CLOUD SECURITY AND DISASTER RECOVERY: Cloud Security: Data, Network and host security, Cloud security services and cloud security possible solutions. Cloud Disaster Recovery: Disaster recovery planning, Disasters in the cloud, Disaster management, Capacity planning and cloud scale.

UNIT - V	CLOUD CASE STUDIES	CLASSES: 08

CLOUD CASE STUDIES: Case Studies: Software-as-a-Service (SaaS) - Salesforce.com, Facebook, Platform–as-a-Service (PaaS) - Google App Engine, MS-Azure and IBM Blue mix; Infrastructure-as-a-Service (IaaS) - Amazon EC2, Amazon S3 and Netflix.

TEXT BOOKS

1. Thomas Erl and RicardoPuttini Cloud Computing Concepts, Technology and Architecture, Pearson, 2013.
2. .Ivanka Menken and Gerard Blokdijk, Cloud Computing Virtualization Specialist Complete Certification Kit-Study Guide Book, Lightning Source, 2009

REFERENCE BOOKS

1. Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt Ltd, 2011.
2. Rajkumar Buyya, James Broberg and Andrzej Goscinski, Cloud Computing Principles and Paradigms, John Wiley and Sons, 2011.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing Implementation, Management and Security, CRC Press, Taylor & Francis Group, 2010.

BIG DATA MANGEMENT
(PROFESSIONAL ELECTIVE - IV)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS10	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Understand the background of big data
2. Learn basic data mining and warehouse problems over big data
3. Understand Map Reduce/Hadoop basics
4. Learn Hadoop and Map Reduce programming
5. Learn machine learning problems over big data
6. Learn graph processing algorithms via Map Reduce

COURSE OUTCOMES

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

1. Rephrase the big data basics.
2. Estimating of the problems over big data.
3. Be proficient with Hadoop and Map Reduce programming
4. Organize the Use of Hadoop and Map Reduce programming to tackle big data problems
5. Formulate programs to process big data
6. Demonstrate with team members to complete a project related to big data

UNIT-I	STREAM PROCESSING	CLASSES: 12

Stream Processing: What, Why, How? History of Stream Processing and its Frameworks , Batch Processing vs Stream processing, From SQL to Streaming SQL, Key Components of a Streaming Data Architecture

Big Data Design: Schemaless databases; Key-value stores; Wide-column stores; Document-stores.

UNIT-II	DATA MANAGEMENT	CLASSES: 12

Distributed Data Management

Transparency layers; Distributed file systems; File formats; Fragmentation; Replication and synchronization.

In-memory Data Management: NUMA architectures; Columnar storage; Late reconstruction; Light-weight compression.

UNIT-III	DISTRIBUTED DATA PROCESSING	CLASSES: 11

Distributed Data Processing: Distributed Query Processing; Sequential access; Pipelining; Parallelism; Synchronization barriers; Multitenancy; MapReduce; Resilient Distributed Datasets; Spark.

UNIT-IV	STREAM MANAGEMENT AND PROCESSING	CLASSES: 15

Stream management and processing:

One-pass algorithms; Sliding window; Stream to relation operations; Micro-batching; Sampling; Filtering; Sketching

UNIT-V	BIG DATA ARCHITECTURES & GRAPH ALGORITHMS	CLASSES: 12

Centralized and Distributed functional architectures of relational systems; Lambda architecture
Graph Algorithms: Graphs and network organization, The simplicity of the graph model, Graph Analytics Algorithm, Graph Algorithm Features, Pagerank algorithm.

TEXT BOOKS

1. Thomas Erl / Wajid Khattak / Paul Buhler Erl / Khattak / Buhler (2016). Big Data Fundamentals: Concepts, Drivers, and Techniques. Crawfordsville, Indiana: Prentice Hall. 0134291077 978-0-134-29107-9
2. Pearson Education LTD. David Stephenson (2018). Big Data Demystified: How to use big data, data science and AI to make better business decisions and gain competitive advantage. London: Pearson Education.
3. Sadalage, Pramod J; Fowler, Martin, Addison-Wesley, (2013). NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence . Crawfordsville, Indiana: RR Donnelley. 978-0-321-82662-6

REFERENCE BOOKS

1. Wilfried Lemahieu, Seppe vanden Broucke, Bart Baesens (2018). Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data. Cambridge: Cambridge University Press. 1107186129 978-1-107-18612-5
2. Kuan-Ching Li,Hai Jiang,Albert Y Zomaya (2017). Big Data Management and Processing. Boca Raton, Florida: CRC Press. 1498768075 978-1-498-76807-8
3. Arun K. Somani and Ganesh Chandra Deka (2018). Big Data Analytics. Tools and Technology for Effective Planning. Boca Raton, Florida: CRC Press. 978-1-138-03239-2

TEXT ANALYTICS AND NATURAL LANGUAGE PROCESSING
(PROFESSIONAL ELECTIVE - IV)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS21	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Text analytics concepts and applications
2. Fundamental of Information retrieval and natural language processing
3. Text analytics framework
4. Theoretical techniques and applications in text analytics (e.g. social media)

COURSE OUTCOMES:

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

1. Perform text analytics in a variety of contexts
2. Analyze large text collections by selecting and applying suitable statistical NLP approaches
3. Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, parts-of-speech tagging, parsing and semantic analysis.
4. Implement natural language processing (NLP) on different types of text data
5. Enhanced the knowledge about practical implementation.

UNIT – I	INTRODUCTION	CLASSES: 10

Basics of Text Analytics: Introduction, Applications of Text Analytics, Approaches in Text analytics, Functions of Text Analytics & Text Mining, The Text Analytics Process, Types of Text Analysis. Text Analysis: Techniques, Applications & Examples

UNIT – II	BASIC LINGUISTICS AND TERMS	CLASSES: 10

Drill down into : synonym, metonym, homonym, hypernym ,and hyponym entries- Parts of speech: Noun vs. verb and other “senses” of a word and their effect on analytics-‘Nyms’ – homonyms, synonyms, troponyms, meronyms , and other variants-Stopwords, dictionaries, and taxonomies-Stemming, Lemmas.

UNIT – III	LANGUAGE ANALYSIS	CLASSES: 12

Extracting meaning from text - How do humans parse language? - Understanding complexity Preparing to analyze texts-The process of text analysis- Sentence parsing and interpretation-What NLP can and can’t do!
N-grams: individual words vs. multi-word phrases and context.
Sentiment Analysis: Introduction, Tools and techniques-Limitations, examples.

UNIT – IV	EXPANDING OPPORTUNITIES WITH LINGUISTIC FORMS	CLASSES: 10

Modeling: Extracting topics from a document corpus-Strategies, methods, and outcomes Query Expansion using synonyms, metonyms, hypernyms –Narrow (vs) broad queries and the use of hyponyms or hypernyms- Extracting topics from a document corpus-Strategies, methods, and outcomes		
UNIT – V	**TEXT ANALYTICS APPLICATIONS/ USE-CASES USING NLP**	**CLASSES: 10**
Text Analytics Applications: Text Summarizations, Text Analytics using Power BI, Social Media Analysis, Customer Care Service. **NLP Use-cases:** Grammar correction Tools, Chat-Bots, Market Research and Market Intelligence, Topic Modelling and Content Themes, Email Classification.		
TEXT BOOKS		
1. srinivasa-Desikan, Bhargav, *Natural Language Processing and Computational Linguistics*, Pakt 2018 2. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit (O'Reilly 2009, website 2018)		
REFERENCE BOOKS		
1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" , 6 th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003		
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.		

COMPUTER VISION
(PROFESSIONAL ELECTIVE - IV)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AI12	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing
2. Understand Feature Extraction algorithms
3. Understand Visual Geometric Modeling and Stochastic Optimization
4. Analyze Context and scene understanding.
5. Discover the various representations.

COURSE OUTCOMES

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

1. Appraise the basic principles of image processing and its significance in real world.
2. Interpret and evaluate various approaches for image. transformation, segmentation, and restoration.
3. Inspect object, scene recognition and categorization algorithms for real time images
4. Formulate images and videos for problems such as tracking and structure from motion
5. Measure and Determine recovery of 3D structure of ill-posed scenes

UNIT-I	IMAGE FORMATION AND DESCRIPTION & IMAGE TRANSFORMS	CLASSES 14

Image Formation and Description: Fundamental steps of image processing, the image model and Image acquisition, Sampling and quantization, Relationship between pixels. Sampling & Quantization, Elements of Digital Image Processing Systems.
Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT-II	IMAGE ENHANCEMENTS & NORMALIZED CUTS	CLASSES 14

Image Enhancements: Histogram Equalization, Image Smoothing, Image Sharpening, Edge Detection. Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts. **Feature-based alignment:** 2D and 3D feature-based alignment, Pose estimation

UNIT-III	STRUCTURE FROM MOTION & DENSE MOTION ESTIMATION	CLASSES 10

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT-IV	RECOGNITION	CLASSES 10

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT-V	3D RECONSTRUCTION	CLASSES 12

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, Volumetric representations, Model-based reconstruction.

TEXT BOOKS

1. R. C. Gonzalez and R. E. Woods “Digital Image Processing” Addison Wesley 2008.
2. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

REFERENCE BOOKS

1. “Pattern Recognition: Statistical. Structural and Neural Approaches”; Robert J. Schallkoff; John Wiley and Sons; 1992.
2. “Computer Vision: A Modern Approach”; D. A. Forsyth and J. Ponce; Pearson Education; 2003.
3. "Multiple View geometry". R. Hartley and A. "Zisserman. 2002 Cambridge university Press".
4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; "Introduction to Statistical Pattern Recognition", Second Edition, AcademicPress, Morgan Kaufmann, 1990

DEEP LEARNING LAB

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS06	PCC	-	-	2	1	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. The objective of this lab is to get an overview of the various Deep learning techniques and can able to demonstrate those using python.
2. Implement classification of linearly separable Data using Perceptron
3. Implement Back Propagation methods.
4. Implement a Recurrent Neural Network for IMDB movie review classification problem.
5. Implement Activation Functions.

COURSE OUTCOMES

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

1. Implement deep neural networks to solve real world problems
2. Choose appropriate pre-trained model to solve real time problem
3. Interpret the results of two different deep learning models.
4. Understand Back Propagation Classifications.
5. Explain Convolution Neural Networks in Python.

WEEK-I	**SINGLE LAYER PERCEPTRON**	
Implement Single Layer Perceptron in Python		
WEEK-II	**MULTI LAYER PERCEPTRON**	
Implement Multi Layer Perceptron in Python		
WEEK-III	**ACTIVATION FUNCTIONS**	
Demonstrate normalization of input data, basic activation functions such as the softmax, sigmoid, dsigmoid , etc		
WEEK-IV	**NEURAL NETWORK**	
Build a neural network for logistic regression to minimize the cost function and update the parameters.		
WEEK-V	**BACKWORD PROPAGATION**	
Implement backward propagation neural network for a two class classification with a single hiddenlayer , non-linear activation function like tanh and compute the cross entropy loss.		
WEEK-VI	**DEEP NEURAL NETWORK – ReLU**	
Build a deep neural network with more than one hidden layer, non-linear functions like ReLU.		
WEEK-VII	**DEEP NEURAL NETWORK**	
Build deep neural network to any classification problem and compare its accuracy to logistic regression.		

WEEK-VIII	REGULARIZATION	
Apply Regularization techniques in deep learning model with backward propagation		
UNIT – IX	**MINI BATCH**	
Implement mini batch optimization technique to improve the performance of deep learning model.		
UNIT – X	**CONVOLUTION NEURAL NETWORKS**	
Implement Convolution Neural Networks in Python		
UNIT – XI	**RECURRENT NEURAL NETWORKS**	
Implement a Recurrent Neural Network for IMDB movie review classification problem		
UNIT – XI	**LONG SHORT TERM MEMORY NETWORKS**	
Implement LSTM in Python		

Software Packages required:

- Keras
- Tensorflow
- PyTorch

TEXT BOOKS

1. Reza Zadeh and BharathRamsundar, “Tensorflow for Deep Learning”, O’Reilly publishers, 2018.

REFERENCES

1. https://github.com/fchollet/deep-learning-with-python-notebooks

IV B.TECH II SEMESTER SYLLABUS

DATA COLLECTION AND ANALYSIS WITH IOT
(PROFESSIONAL ELECTIVE - V)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS11	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Learn the concepts of big data analytics
2. Learn the concepts about Internet of things
3. Understand and implement smart systems
4. Implement the Big Data Metadata Management in Smart Grids
5. Understand the sustainability data and analytics

COURSE OUTCOMES

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

1. Illustrating of IoT value chain structure (device, data cloud), application areas and Technologies involved.
2. Experiment with Web Enhanced Building Automation Systems in real world.
3. Prioritize Adaptive Pipelined Neural Network Structures.
4. Inference the use of Social Networking approaches and Social Media systems.
5. Organize complex relationships of data and analytics.

UNIT – I	BIG DATA PLATFORMS FOR THE INTERNET OF THINGS	CLASSES: 12

Big Data Platforms for the Internet of Things: Network protocol- data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive.
Environments - Big Data challenges and requirements coming from different Smart City applications.

UNIT – II	RFID FALSE AUTHENTICATIONS	CLASSES: 12

On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self-aware Internet of Things: self-healing systems- Role of adaptive neural network-
Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models.

UNIT – III	FOG COMPUTING	CLASSES: 12

Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies – role of metadata.

UNIT – IV	WEB ENHANCED BUILDING	CLASSES: 12

Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine.

UNIT – V	SUSTAINABILITY DATA AND ANALYTICS	CLASSES: 12

Sustainability Data and Analytics in Cloud-Based M2M Systems – potential stakeholders and their complex relationships to data and analytics applications – Social Networking Analysis - Building a useful understanding of a social network – Leveraging
Social Media and IoT to Bootstrap Smart Environments : lightweight Cyber Physical Social Systems - citizen actuation

TEXT BOOKS

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.
2. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015
3. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.

REFERENCE BOOKS

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.
2. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015

PREDICTIVE MODELING AND ANALYTICS
(PROFESSIONAL ELECTIVE - V)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS19	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Analyze concept of data mining
2. Understand the data and relationship among variables
3. Learn how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.
4. Know the use of the binary classifier and numeric predictor nodes to automate model selection.
5. Advice on when and how to use each model. Also learn how to combine two or more models to improve prediction

COURSE OUTCOMES:

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

1. Outline the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
2. Compare the underlying predictive modeling techniques.
3. Select appropriate predictive modeling approaches to identify cases to progress with.
4. Apply predictive modeling approaches using a suitable package such as SPSS Modeler.
5. Perceive Predictive Analysis in R Programming.

UNIT – I	DATA PREPARATION	CLASSES: 10

Introduction to Analytics, Why Analytics, Business Analytics : The Science of Data Driven Decision making ,Concept of Descriptive, Predictive and Prescriptive Analytics, Big Data Analytics,Web and Social Media Analytics, Framework, Challenges and Future of Data Driven Decision Making.

UNIT – II	Regression Models	CLASSES: 10

Regression Analysis Simple Regression Analysis(SLR) : Introduction,SLR Model Building, Estimation of parameters using Ordinary Least Squares. Multiples Linear Regression (MLR) : Introduction, Ordinary Least Squares Estimation of MLR, MLR Model Bulding, Part Correlation and Regression Model Building, Interpretation of MLR Coefficients,

Logistics Regression (LR) : Introduction- Classification Problems,Introduction to Binary LR, Estimation and Interpretation of Parameters of LR, LR Model Diagnostics: Omnibus Test,Wald's Test, Hosmer-Lemeshow Test ,Psedo R Square.

UNIT – III	MODEL DEVELOPMENT AND TECHNIQUES	CLASSES: 12

Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

UNIT – IV	MODEL EVALUATION AND DEPLOYMENT	CLASSES: 10

Model Evaluation and Deployment Introduction: Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta-Level Modeling, Deploying Model, Assessing Model Performance, Updating a Model

UNIT – V	DATA PREDICTION USING R	CLASSES: 10

Predictive Analysis in R Programming, Process of Predictive Analysis, Need of Predictive Analysis,Applications of Predictive Analysis, Linear Regression Decision Tree,Random Forest

TEXT BOOKS

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, “Predictive Analytics For Dummies”, Wiley Publisher, 2nd Edition, 2016.

REFERENCE BOOKS

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Predictive & Advanced Analytics (IBM ICE Publication)

3.Aurelien,”Hands-On Machine Learning with Scikit-Learn & TensorFlow”, O’Reilly Publisher, 5th Edition, 2017.

4.Max Kuhn, Kjell Johnson, “ Applied Predictive Modeling” Springer, 2013.

BIT COINS
(PROFESSIONAL ELECTIVE – V)

IV B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CY23	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students :

1. Understand how blockchain systems (mainly Bitcoin and Ethereum) work
2. Securely interact with networks
3. Analyze the mathematical analysis of properties of Bitcoin
4. IntegrateEthereum Virtual Machine
5. Understand how SNARK works

COURSE OUTCOMES

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

1. Build principles of Bitcoin and Ethereum.
2. Analyze and apply Nakamoto consensus.
3. Formulate mathematical properties of Bitcoin
4. Construct Ethereum virtual machine
5. Originate zk-SNARK in ZCash

UNIT-I	BIT COIN	CLASSES 14

Bitcoin - The big picture of the industry – size, growth, structure, players - Bitcoin versus,Cryptocurrencies versus Block chain - Distributed Ledger Technology (DLT) – Strategic,analysis of the space –Major players: Block chain platforms, regulators, application providers,etc. - Bitcoin, HyperLedger, Ethereum, Litecoin, Zcash .

UNIT-II	CONSENSUS	CLASSES 14

The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)

UNIT-III	WALLET	CLASSES 10

Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.

UNIT-IV	ETHEREUM	CLASSES 10

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts

UNIT-V	TRENDS	CLASSES 12

Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.

TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,
2. itcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

REFERENCE BOOKS

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

DATA VISUALIZATION
(PROFESSIONAL ELECTIVE – VI)

IV B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS12	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Be familiar with the concept of data visualization
2. Be exposed to exploratory data analysis using visualization
3. Design and evaluate color palettes for visualization based on principles of perception.
4. Apply data transformations such as aggregation and filtering for visualization.
5. Analyse the Building a Migrant Deaths Dashboard

COURSE OUTCOMES

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

1. Design and create data visualizations.
2. Conduct exploratory data analysis using visualization.
3. Craft visual presentations of data for effective communication.
4. Make Use of perception and cognition to evaluate visualization design alternatives.
5. Identify opportunities for application of data visualization in various domains.
6. Critique existing visualizations based on data visualization theory and principles.

UNIT – I	OVERVIEW OF DATA VISUALIZATION	CLASSES: 12

Overview Of Data Visualization: Why Visualize Data?, Introduction To SVG And CSS, Introduction To JavaScript, Introduction To Vizhub, Making A Face With D3.Js, Data Abstraction, Task Abstraction.
Shapes Of Data: Input For Visualization: Data And Tasks, Loading And Parsing Data With D3.Js

UNIT – II	MARKS AND CHANNELS	CLASSES: 12

Marks and Channels: Encoding Data with Marks and Channels, Rendering Marks and Channels with D3.js and SVG, Introduction to D3 Scales, Creating a Scatter Plot with D3.js
Common Visualization Idioms: Reusable Dynamic Components using the General Update Pattern, Reusable Scatter Plot, Common Visualization Idioms with D3.js, Bar Chart, Vertical & Horizontal, Pie Chart and Coxcomb Plot, Line Chart, Area Chart

UNIT – III	VISUALIZATION OF SPATIAL DATA	CLASSES: 12

Visualization Of Spatial Data: Making Maps, Visualizing Trees and Networks.
Using Color And Size In Visualization: Encoding Data using Color, Encoding Data using Size, Stacked & Grouped Bar Chart, Stacked Area Chart & Streamgraph, Line Chart with Multiple Lines

UNIT – IV	INTERACTION TECHNIQUES	CLASSES: 12

Interaction Techniques: Adding Interaction with Unidirectional Data Flow, Using UI Elements to Control a Scatter Plot, Panning and Zooming On A Globe, Adding Tooltips
Multiple Linked Views: Small Multiples, Linked Highlighting with Brushing, Linked Navigation: Bird's Eye Map

UNIT – V	DATA REDUCTION	CLASSES: 12

Data Reduction: Histograms, Aggregating data with group by, Hexbin Mapping, Cross filtering
Focus+Context: Building a Migrant Deaths Dashboard

TEXT BOOKS

1. Visualization Analysis and Design by Tumara Munzar(2014).

REFERENCE BOOKS

1. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)
2. D3.js in Action by Elijah Meeks 2nd Edition (2017)
3. Semiology of Graphics by Jacques Bertin (2010)
4. The Grammar of Graphics by Leland Wilkinson
5. ggplot2 Elegant Graphics for Data Analysis by Hadley Wickham

BUSINESS INTELLIGENCE AND ANALYTICS
(PROFESSIONAL ELECTIVE-VI)

IV B. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5DS13	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students:

1. Introduce the concepts and components of Business Intelligence (BI)
2. Evaluate the technologies that make up BI (data warehousing, OLAP)
3. Define how BI will help an organization and whether it will help yours
4. Identify the technological architecture that makes up BI systems
5. Plan the implementation of a BI system

COURSE OUTCOMES

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

1. Prioritize the essentials of BI & data analytics and the corresponding terminologies
2. Demonstrate the steps involved in the BI - Analytics process
3. Illustrate competently on the topic of analytics
4. Formulate & Implement the K-Means Clustering with Iris Dataset
5. Determine the real time scenario (Case study) by using BI & Analytics techniques

UNIT-I	BUSINESS INTELLIGENCE – INTRODUCTION	CLASSES: 12

BUSINESS INTELLIGENCE – INTRODUCTION

Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System

UNIT-II	B I - DATA MINING & WAREHOUSING	CLASSES: 12

B I - DATA MINING & WAREHOUSING

Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works(Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies. Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modeling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL

UNIT-III	BI – DATA PREPARTTION	CLASSES: 12

BI – DATA PREPARTTION

Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization

UNIT-IV	BI – DATA ANALYTICS PROCESS	CLASSES: 12

BI – DATA ANALYTICS PROCESS

ANALYTICS PROCESS - Introduction to analytics process, Types of Analytical Techniques in BI – Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets

UNIT-V	IMPLEMENTATION OF BI – ANALYTICS PROCESS	CLASSES: 12

IMPLEMENTATION OF BI – ANALYTICS PROCESS

Operational Intelligence: Technological – Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.

TEXT BOOKS

1. Carlo-Vercellis, “Business Intelligence Data Mining and Optimization for Decision-Making”, First Edition Link :
2. Drew Bentely, “Business Intelligence and Analytics” ,@2017 Library Pres., ISBN: 978-1-9789-2136-8
3. Larissa T. Moss & Shaku Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications”, First Edition, Addison-Wesley Professional,2003
4. Kimball, R., Ross, M., Thornthwaite, W., Mundy, J., and Becker, B. John, “The Data Warehouse Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems”, Second Edition, Wiley & Sons, 2008.

REFERENCE BOOKS

1. Cindi Howson, “Successful Business Intelligence”, Second Edition, McGraw-Hill Education, 2013

INFORMATION RETRIEVAL SYSTEM
(PROFESSIONAL ELECTIVE – VI)

IV. TECH- II SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT25	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. Impart the important concepts, algorithms, and data/file structures that are
2. Facilitate design, and implementation of Information Retrieval (IR) systems.
3. Implement the user search techniques
4. Understand the search algorithms and system evaluation
5. Implement this IR in multimedia and digital library

COURSE OUTCOMES

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

1. Understand the information retrieval strategies.
2. Analyze and use the various retrieval utilities for improving searching concepts
3. Apply various retrieval utilities on crossing language barrier
4. Evaluate space and time efficiency using indexing and compressing the documents
5. Comprehend and appreciate the different applications of information retrieval techniques in the Internet or Web Environment.

UNIT-I	INTRODUCTION TO INFORMATION RETRIEVAL SYSTEMS	CLASSES: 12

INTRODUCTION TO INFORMATION RETRIEVAL SYSTEMS: Definition, Objectives, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses. INFORMATION RETRIEVAL SYSTEM CAPABILITIES: Search, Browse and Miscellaneous

UNIT-II	CATALOGING AND INDEXING	CLASSES: 12

CATALOGING AND INDEXING: Objectives, Indexing Process, Automatic Indexing, Information Extraction.
DATA STRUCTURES: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hidden Markov Models.
AUTOMATIC INDEXING: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept , Indexing, Hypertext Linkages.

UNIT-III	DOCUMENT AND TERM CLUSTERING	CLASSES: 12

DOCUMENT AND TERM CLUSTERING: Introduction, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.
USER SEARCH TECHNIQUES: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the Internet and Hypertext.
INFORMATION VISUALIZATION: Introduction, Cognition and Perception, Information Visualization Technologies.

UNIT-IV	TEXT SEARCH ALGORITHMS	CLASSES: 12

TEXT SEARCH ALGORITHMS: Introduction, Software Text Search Algorithms, Hardware Text Search Systems.
INFORMATION SYSTEM EVALUATION: Introduction, Measures used in System Evaluation, Measurement Example -TREC results.

UNIT-V	MULTIMEDIA INFORMATION RETRIEVAL	CLASSES: 12

MULTIMEDIA INFORMATION RETRIEVAL: Models and Languages, Data Modeling Query Languages, Indexing and Searching.
LIBRARIES AND BIBLIOGRAPHICAL SYSTEMS: Online IR Systems, OPACs, Digital Libraries.

TEXT BOOKS

1. Gerald J. Kowalski, Mark T. Maybury (2000), Information Storage and Retrieval Systems: Theory andImplementation, 2nd edition, Springer International Edition, USA.
2. Ricardo Baeza Yates, Berthier Ribeiro Neto (2009), Modern Information Retrieval, Pearson Education, India.

REFERENCE BOOKS

1. Robert R. Korfhage (1997), Information Storage and Retrieval, John Wiley & Sons, India Edition, India.

OPEN ELECTIVES
OFFERED BY
AERONAUTICAL DEPARTMENT

OE1		OE2	
A5AE62	Fundamentals of Avionics	A5AE64	Introduction to jets and rockets
A5AE63	Introduction to Aerospace Technology	A5AE65	Non-Destructive Testing Methods
OE3		**OE4**	
A5AE66	Introduction to Aircraft Industry	A5AE68	Fundamentals of Wind Power Technology
A5AE67	Unmanned Aerial Vehicles	A5AE69	Guidance and Control of Aerospace Vehicles

FUNDAMENTALS OF AVIONICS

OPEN ELECTIVE - I

V Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE62	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The purpose of this subject is to provide the students with the theoretical background and engineering applications.

1. Overview on Aviation using Electronics
2. Basic understanding about major electronics systems used for communication
3. Basic understanding about major devices, display and flight controls used in aircraft

UNIT-I BASICS & FLIGHT DECK AND DISPLAY SYSTEMS

BASICS: Basic principles of Avionics, Typical avionics sub system in civil/ military aircraft and space vehicles.
FLIGHT DECK AND DISPLAY SYSTEMS: Flight deck display technologies, CRT, LED, LCD, Touch screen, Head up display, electronic instrumentation systems.

UNIT-II COMMUNICATION SYSTEMS

AUDIO AND COMMUNICATION SYSTEMS: Aircraft audio systems, basic audio transmitter and receiver principles, VHF communication system, UHF communication systems.

UNIT-III FREQUENCY RANGING SYSTEM

RANGING AND LANDING SYSTEMS: VHF Omnirange, VOR receiver principles, distance maturity equipment, principles of operation, Instrument landing system, and localizer and glide slope.
POSITIONG SYSTEM: Global positioning system principles, triangulation, position accuracy, applications in aviation

UNIT-IV NAVIGATION SYSTEM

INERTIAL NAVIGATION SYSTEM: Principle of Operation of INS, navigation over earth, components of inertial Navigation systems, accelerometers, gyros and stabilized platform.
SURVELLIENCE SYSTEM: ATC surveillance systems principles and operation interrogation and replay standards, Collision avoidance system, ground proximity warning system

UNIT-V AUTO FLIGHT SYSTEM

AUTO FLIGHT SYSTEM: Automatic flight control systems fly by wire and fly by light technologies, flight director systems, flight management systems.

Text Books:

1. N. S. Nagaraja(1996),Elements of electronic navigation, 2nd edition, Tata McGraw Hill, New Delhi.

2. Janes W. Wasson, Jeppesen Sandersen(1994), Avionic systems Operation and maintenance

Reference Books:

1. Albert Hel Frick (2010), Principle of Avionics, 6th edition, Avionics Communications Inc, India.
2. H. J. Pallet (2010), Aircraft Instrumentation and Integrated systems, Pearson Education, New Delhi.
3. J. Powell (1998), Aircraft Radio Systems, Pitman publishers, London

COURSE OUTCOMES:

At the end of the course the students are able to:

1. To explain the instrumentation used in avionics.
2. To classify various ranges of the communication techniques used in aircraft.
3. To distinguish between network systems, controlling parts & surfaces
4. To compare various principles of navigation systems
5. To build phenomena of auto pilot control system

INTRODUCTION TO AEROSPACE TECHNOLOGY
OPEN ELECTIVE - I

V Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE63	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To introduce the basic concepts of Aerospace technology and the current developments in the field.
2. To provide knowledge on the basic principles on which the development of aerodynamics, Structures, propulsion and satellite systems.

UNIT-I HISTORY OF FLIGHT- THE AEROSPACE ENVIRONMENT

Balloons and dirigibles, heavier than air aircraft, commercial air transport, introduction of jet aircraft, helicopters, missiles, conquest of space, commercial use of space, exploring solar system and beyond. Earth's atmosphere, the temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity. The near earth radiative environment. The magnetosphere. Environmental impact on spacecraft. Meteoroids and micrometeoroids, space debris. Planetary environments

UNIT-II AERODYNAMICS AND FLIGHT VEHICLE PROPULSION

Anatomy of the airplane, helicopter, launch vehicles and missiles, space vehicles. Static forces and moments on the vehicle. Understanding engineering models. Aerodynamics of wings and bodies. Generation of lift. Sources of drag. Force and moment coefficients, centre of pressure. Thrust for flight, the propeller, the jet engine, rocket engines- description, principles of operation. Governing equations.

UNIT-III FLIGHT VEHICLE PERFORMANCE AND STABILITY

Performance parameters. Performance in steady flight, cruise, climb, range, endurance; accelerated flight- symmetric manoeuvres, turns, sideslips, take off and landing. Flight vehicle stability- longitudinal, lateral and directional- static, dynamic; trim, control. Handling qualities of airplanes

UNIT-IV SATELLITE SYSTEMS ENGINEERING- HUMAN SPACE EXPLORATION

Satellite missions, an operational satellite system, elements of satellite, satellite subsystems. Satellite structures, mechanisms and materials. Power systems. Communication and telemetry. Thermal control. Attitude determination and control. Propulsion and station keeping. Space missions. Mission objectives. Case studies. Human space flight missions- goals, historical background. The Soviet and US missions. The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle. International Space Station, extravehicular activity

UNIT-V INTRODUCTION TO ENGINEERING DESIGN, AIR TRANSPORTATION

Design as a critical component of engineering education- as a skill- the process, design thinking, design drawing. Design for mission, performance and safety requirements. Concurrent engineering. Computer aided engineering, design project. Example: the lighter-than – air vehicle student design project at MIT. Air Transportation Systems- civil, military- objectives- principal constituents- the vehicle, the ground facilities, the organization- role. Regulation- national and international. Indian effort- civil and military- in the field of Aerospace Engineering.

Text Books:

1. Newman, D., Interactive Aerospace Engineering and Design, (with software and reference material on CD), McGraw-Hill, 2002, ISBN 0-07-112254-0.
2. Anderson, J.D., Introduction to Flight, fifth edition, Tata McGraw-Hill, 2007, ISBN: 0-07-006082

Reference Books:

1. Russell Mikel, Aerospace and Aeronautical Engineering, Willford press, 2017.
2. Ajoykumar Kundu, Mark A Price and David Riordan, Conceptual Design: An Industrial Approach, Wiley-Blackwell, 2019.

COURSE OUTCOMES:

Students should able to

1. Compare the atmosphere conditions of different altitudes for spacecraft system
2. Analyze how lift, drag and thrust are generated and understand which components constitute them
3. Analyze the flight performance parameters with respective stability condition
4. Distinguish the different systems used in a satellite mission
5. Design lighter than air vehicle using Catia software

INTRODUCTION TO JETS AND ROCKETS
OPEN ELECTIVE - II

VI Semester:

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE64	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The course is intended to serve as an introduction to air breathing propulsion systems and Rocket Propulsion Systems.

b) Illustrate an overview of aerospace propulsion system.
c) Identify the foundation in fundamentals of thermodynamics.
d) Compare the ideal components and characteristics of jet engine
e) Interpret the performance of nozzles
f) Simplify the ideal performance analysis of rocket engines.
g) Select appropriate fuel for aerospace application.

UNIT-I INTRODUCTION TO AEROSPACE PROPULSION

Propulsion system, Propulsive Systems – Evolution, Development, Growth and Challenges. Fundamentals of Thermodynamics – Variables, Thermodynamic Process, Introduction to IC Engines and Reciprocating Engines, Propellers and Working of Propellers.

UNIT-II PRINCIPLES OF JET PROPULSION

Fundamentals of jet propulsion, Working Principle, Analysis of Ideal Jet Engine cycle, Engine components- merit- significance- ideal component characteristics, Classification – turbo jet, turbo fan, turbo prop and Ramjet engines. Basic Problems based on Engine Cycle.

UNIT-III RAMJET, SCRAMJET ENGINES AND NOZZLES

Speed limitations of gas turbines, Basics of Ramjets, Combustors for liquid fuel ramjet engines, Combustion Instability and its Suppression, Solid fuel Ramjet Engines, SCRAM jet engines, Applications of RAM Jet and SCRAM Jet Engines to Missiles with Examples, Nozzles- Types of Nozzles, Converging-Diverging Nozzle, Variable Nozzle and Effects of Pressure Ratios on Engine Performance.

UNIT-IV ROCKET THEORY

Applications of Rockets, Types of Rockets, Basics of Thermal Rocket Engine-Thermodynamics and Ideal Performance Analysis, Equations of motion-Rocket Motion in free space, Tsiokovsky's equation, Rocket Parameters, Burnout range, Burnout Velocity. Practical Problems

UNIT-V PROPELLANT ROCKETS

Solid Propulsion-Solid Propellant Rockets, Basic Configuration and Performance, Propellant Grain and Configuration, Propellant Characteristics Combustion Chamber, Ignition Process Liquid Propulsion - Design consideration of liquid rocket combustion chamber, injector, and propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems-.BIO Fuels and Impact on the Atmosphere, Aviation turbine fuels - Requirements of aviation fuels of kerosene type.

Text Books:

1. Mechanics and Thermodynamics of Propulsion – Philip G Hill & Carl R Peterson , Pearson Publication – 2ndEdt

2. Rocket Propulsion Elements, Sutton, G.P., John Wiley, 1993.

Reference Books:

1. The Jet Engine – Rolls Royce

2. Gas Turbines and Jet and Rocket Propulsion, M. L. Mathur, R. P. Sharma, Standard

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Explain the complexity in working of various engines
2. Interpret the elementary principles of thermodynamic cycles as applied to propulsion analysis
3. Analyze the process involved in individual components
4. Compare the nozzles with various operating conditions.
5. Determine Equations of motion in free space, Tsiokovsky's equation.
6. Classify the types of fuel in aviation and aerospace engineering.

NON-DESTRUCTIVE TESTING METHODS

OPEN ELECTIVE - II

VI Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE65	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

1. To impart knowledge about the non-destructive testing methods.
2. To provide knowledge on the selection of NDT methods for application in engineering industries.
3. Classify the various NDT methods for detecting defects in the structural components.
4. Judge defects basing on data representation of testing

UNIT-I SURFACE TECHNIQUES

Introduction to non-destructive testing (NDT) - importance of NDT techniques - types of NDT techniques - visual testing (direct and remote visual inspection) - principle and types of liquid penetrant tests (LPT) - - advantages and limitations of LPT - applications of LPT.

UNIT-II MAGNETIC PARTICLE TESTING

Introduction to magnetic particle testing (MPT) – principle, magnetization methods - demagnetization – advantages, limitations and applications of MPT, eddy current testing (ECT) method- principle advantages, limitations and applications

UNIT-III ULTRASONIC TESTING

Introduction to ultrasonic testing (UT) -- principle of UT – UTprobes - UT inspection methods (pulse echo, transmission and phased array techniques) - advantages, limitations and applications

UNIT-IV RADIOGRAPHY TESTING

Introduction to radiography testing (RT) - sources of X-rays and Gamma rays - characteristics of Xrays and Gamma rays (absorption, scattering) - filters and screens - film radiography and digital radiography (shadow formation, exposure factors, film handling and storage) --exposure charts - penetrameters - safety issues.

UNIT-V SPECIAL TECHNIQUES

Acoustic emission testing (AET) principle, advantages, limitations - instrumentation and application of AET - infra red thermography (IRT) - contact and non-contact inspection methods - acoustic holography.

Text Books:

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu, "Practical Non-Destructive Testing", Narosa Publishing, London, 2012.
2. Paul E. Mix, "Introduction to Non Destructive Testing", A Training Guide, Wiley- Interscience, New Jersey, USA, June 2005.

Reference Books:

1. ASM Metals Handbook, V-17, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 2001
2. W.T. Mc Gonnagle, "Non-Destructive Testing", McGraw Hill Book Co., USA, 2013.

COURSE OUTCOMES:

1. Recognize various non-destructive techniques for engineering industries.
2. Select appropriate non-destructive technique for defects detection in manufactured/operating parts.
3. Perform inspection using major non-destructive testing methods.
4. Understand the importance and application of NDT in Aerospace structural analysis
5. Determine the defects basing on the principal of radiography

INTRODUCTION TO AIRCRAFT INDUSTRY
OPEN ELECTIVE - III

VII Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE66	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The aim is to introduce students the overview of the Aircraft Industry. The course covers basic design process, Aircraft Stability & control and different mechanical systems.

1. Familiarize students with major types of aircraft industry.
2. Illustrate the role of regulatory bodies and its business context
3. Exemplify the organisational structure of airlines and airports
4. Illustrate the importance of air navigation services and its types.
5. Familiarize students with air safety and security as a means for ensuring passenger safety.

UNIT-I AIRCRAFT INDUSTRY OVERVIEW

Flying machine to airline alliances, Types of Aerospace Industry, Introduction to ages of engineering, Aerospace Manufacturing, Introduction to the space environment & human space exploration.

UNIT-II REGULATORY AND BUSINESS CONTEXT

Regulatory bodies, Introduction to standardisation, Standards and recommended practices (SARPS), Freedoms of the air, Role of governments, Major agreements and treaties, Business side of the industry – Key performance indicators (revenue passenger kilometre, yield etc.,), Industry characteristics of passenger airlines.

UNIT-III AIRLINES AND AIRPORTS

Introduction to airlines, Organisational structure, Types of airline personnel, Flight crew and cabin crew, Role of training with airlines, Organisational culture of an airline
Introduction to airports – Airport personnel, Processing passengers and freight, Security

UNIT-IV AIR NAVIGATION SERVICES

Introduction to air navigation services, Types of navigation services, Air traffic control (ATC) services, Structure of controlled airspace, Air traffic and control services, Classifications of airspace, Flight information services and alerting services, Air navigation facilities and air navigation service (ANS) providers

UNIT-V AIR SAFETY AND SECURITY

Introduction to air safety and security, Manufacturer responsibilities, Maintenance procedures, Airside safety, Safety in the air, Issues in air safety, Accident and incident investigation, Security – Response of International Civil Aviation Organization (ICAO).

Text Books:

1. Peter Belobaba, Amedeo Odoni and Cynthia Barnhart (2015), The Global Airline Industry (Aerospace Series), John Willey & Sons, Ltd, United Kingdom.

2. Connor R Walsh, Airline Industry – Strategies, Operations and Safety, Nova Science Publishers, New York.

Reference Books:

1. Andrew R Thomas (2011), Soft Landing: Airline Industry Strategy, Service and Safety, Apress, New York

2. Ahmed Abdelghany, Khaled Abdelghany (2009), Modeling Applications in the Airline Industry, Ashgate Publishing Ltd, England.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Discuss the types of aerospace industry and evolution of flying machine to airline alliances.
2. Explain standardisation and the importance of regulatory bodies.
3. Outline the organisational structure of airlines and airports.
4. Demonstrate major types of air navigation services and air traffic control services.
5. Illustrate the major processes involved in air safety and security.

UNMANNED AERIAL VEHICLES
OPEN ELECTIVE - III

VII Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE67	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To understand the evolution and applications of unmanned aerial vehicles.
2. To illustrate the subsystems of UAVs.
3. To explain the process involved in design of UAVs.

UNIT-I INTRODUCTION TO UAV

Historical Development, Overview of UAV Systems and sub-systems, Classification, Informal Categories, The Tier System, Classification Change.

UNIT-II BASIC AERODYNAMICS AND PERFORMANCE of UAV

Basic Aerodynamic Equations, Air foils, lift, drag, moments, Aircraft Polar, The Real Wing and Airplane, Induced Drag, Total Air-Vehicle Drag, Flapping Wings, Rotary wings. Climbing Flight, Range, Endurance, Gliding Flight

UNIT-III PROPULSIVE SYSTEMS, STRUCTURES AND LOADS, PAYLOAD

Thrust Generation and basic thrust equation, Sources of Power, Loads, types of loads, Materials, construction techniques. Payloads-Reconnaissance/Surveillance Payloads, Weapon Payloads, Other payloads

UNIT-IV UAV SUBSYSTEMS

Mission Planning and Control Station- Types, Physical Configuration, Planning and Navigation, MPCS Interfaces, Modes of control, piloting and controlling mission, Autopilot system Launch Systems- Basic Considerations, launch Methods for Fixed, rotary wing UAV Recovery Systems

UNIT-V BASICS DESIGN AND CASE

Introduction to Design and Selection of the System - Conceptual Phase, Preliminary Design, Detail Design, Selection of the System Case study on Indian UAVs(Rustom, Lakshya, AURA) Case study on Israeli-Heron, US- MQ9 Reaper

Text Books:

1. Paul Fahlstrom, Thomas Gleason - Introduction to UAV Systems-Wiley (2012)
2. Reg Austin, "Unmanned Air Systems: UAV Design, Development and Deployment", First Edition, Wiley Publishers, 2015.

Reference Books:

1. Mirosaw Adamski, "Power units and power supply systems in UAV", New Edition, Taylor and Francis Group publishers, 2014.
2. Skafidas, "Microcontroller Systems for a UAV", KTH, TRITA-FYS 2002:51 ISSN 0280-316X. 34, 2002.

COURSE OUTCOMES

1. Classify the Unmanned Aerial Vehicles.
2. Calculate the basic performance parameters for aircraft.
3. Identify and illustrate various payloads and propulsive systems.
4. Explain the functioning of subsystems in UAVs.
5. Illustrate the design process for a UAV..

FUNDAMENTALS OF WIND POWER TECHNOLOGY
OPEN ELECTIVE - IV

VIII Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE68	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To learn how wind is generated and possible ways of extracting the same.
2. To estimate the resource potential.
3. To learn the operation of a wind electric generator and wind turbine.

UNIT-I	INTRODUCTION TO WIND ENERGY

Background, Motivations, and Constraints, Historical perspective, Wind speed variation -Modern wind turbines, Components and geometry.

UNIT-II	WIND CHARACTERISTICS AND RESOURCES

General characteristics of the wind resource, Atmospheric boundary layer characteristics, Wind data analysis and resource estimation.

UNIT-III	AERODYNAMICS OF WIND TURBINES

Forces from wind, Lift and drag forces - Airfoils, 1-D Momentum theory, Ideal horizontal axis wind turbine with wake rotation, Blade element theory -General rotor blade shape performance prediction.

UNIT-IV	WIND TURBINE DESIGN AND CONTROL

Brief design overview - Introduction - Wind turbine control systems -Typical grid-connected turbine operation -Basic concepts of electric power- Power transformers.

UNIT-V	ENVIRONENTAL AND SITE ASPECTS

Overview- Wind turbine siting - Installation and operation- Wind farms- Overview of wind energy economics- Electromagnetic interference-noise.

Text Books:

1. Emil Simiu& Robert H Scanlan, "Wind effects on structures - Fundamentals and Applications to Design", John Wiley & Sons Inc New York, 2019.
2. Ahmad Hemami, "Wind Turbine Technology", Cengage learning,Cananda, 2012.

Reference Books:

1. Tom Lawson, "Building Aerodynamics", Imperial College Press London, 2001.
2. G P Russo, "Aerodynamic Measurements: From Physical Principles to Turnkey Instrumentation", Woodhead publishing, 2011.

COURSE OUTCOMES

1. Exemplify the historical development of wind turbine, its components and classifications
2. Interpolate the characteristics of winds and atmospheric boundary layers.
3. Outline the methods to measure the performance of wind turbines using different theories.
4. Demonstrate the wind turbine and its sub system design required for the operation of wind turbine
5. Evaluate the environmental factors which infer the operation of wind farms and methods for sustainable operations.

GUIDANCE AND CONTROL OF AEROSPACE VEHICLES

VIII Semester: OPEN ELECTIVE -IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE69	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The purpose of this subject is to provide the students with the theoretical background and engineering applications.

- To introduce the concepts of Navigation, guidance and control
- To familiarize with various ways in which aerospace vehicles are guided and controlled
- The dynamic objectives which students also learn to achieve by designing flight control systems.
- Familiarize with the control principles of rockets and missiles
- To give Insight into the manoeuvres of the space craft

COURSE OUTCOMES:

At the end of the course the students are able to:

- Formulate the navigational equations of the space vehicle
- Describe the guidance of the vehicle with state feed back
- Explain the automatic control and guidance of the aircraft
- Evaluate the control techniques of the rockets and missiles
- Describe major manoeuvres of the space aircraft.

UNIT-I NAVIGATION

Introduction, Basic Principles and Definitions; Dead reckoning and Position Fixing, Celestial, Radio, Inertial Navigation; Principle and Construction of Accelerometers, Mechanical Gyros and Ring Laser Gyros, Inertial Measurement Units, Navigation Equations, Sensor Error Models, Kalman Filter, Attitude Heading Reference System, GPS, Terrain Reference Navigation.

UNIT-II GUIDANCE

Optimal Terminal Guidance of Interceptors, Optimal Terminal Guidance - planar and non-planar, Robust and Adaptive Guidance, Guidance with State Feedback , Guidance with Normal Acceleration Input , Minimum Energy Orbital Transfer.

UNIT-III GUIDANCE AND CONTROL OF AIRCRAFT

Powered Flying Controls, Helicopter Flight Controls, Fly-by-Wire Flight Control, Control laws, Redundancy and Failure Survival, Digital Implementation, Fly-by-Light Flight Control, Auto Pilot, Flight Management Systems, Unmanned Aerial Vehicle.

UNIT-IV CONTROL TECHNIQUES/ CONTROL OF ROCKETS AND MISSILES

Open-loop and Closed Loop Control Systems, Multi-variable Optimization, Optimal Control of Dynamic Systems, Hamiltonian and Minimum Principle and Jacobi-Bellman Equation, Linear Time-Varying System with Quadratic Performance Index..

UNIT-V CONTROL OF SPACECRAFT

Launch of Satellite/ Spacecraft, Terminal Control of Spacecraft Attitude, Optimal Single-Axis Rotation of Spacecraft, Multi-axis Rotational Manoeuvres of Spacecraft, Spacecraft Control Torques, Rocket Thrusters, Reaction Wheels, Momentum Wheels and Control Moment Gyros, Torque.

Text Books:

c) Tewari, A.—Advanced Control of Aircraft, Spacecraft and Rocketsǁ, John Wiley & Sons, Ltd, Chichester, UK, 2011

d) Nelson R. C - Flight Stability and Automatic Control, SIE edition, McGraw Hill, New York, 2007.

Reference Books:

1. Noton,M. —Spacecraft navigation and Guidance‖, Springer-Verlag, Germany, 1998
2. Mc. Cormic 2. B. W - Aerodynamics, Aeronautics and Flight Mechanics, Wiley India Pvt. Ltd, USA, 2010.

OPEN ELECTIVES
OFFERED BY
CSE DEPARTMENT

OE1		OE2	
A5CS30	Core Java Programming	A5CS31	Fundamentals of DBMS
A5CS22	Introduction to Data Analytics	A5CS07	Introduction to Design & Analysis of Algorithms
OE3		**OE4**	
A5CS33	Introduction to Cloud Computing	A5CS20	Distributed Databases
A5CS34	Computer Organization & Operating Systems	A5CS29	Software Project Management

CORE JAVA PROGRAMMING

V SEMESTER - OPEN ELECTIVE – I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS30	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce the object oriented programming concepts.
2. To understand object oriented programming concepts, and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
4. To introduce the implementation of packages and interfaces
5. To introduce the concepts of exception handling and multithreading.
6. To introduce the design of Graphical User Interface using applets and swing controls.

COURSE OUTCOMES:

At the end of the course students are able to

1. Demonstrate object oriented programming concepts, and apply them in solving problems.
2. Demonstrate principles of inheritance and polymorphism and how they relate to the design of abstract classes
3. Explain concepts of packages, exception handling and multithreading.
4. Develop multithreaded applications with synchronization
5. Design GUI based applications

UNIT-I OPEN CONCEPTS AND JAVA PROGRAMMING

Oops concepts- Procedural and objects oriented programming paradigms, classes and objects,Data abstraction, encapsulation, polymorphism, inheritance, benefits of inheritance.
Java Programming- History of java, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expression, type conversion and casting , control flow- block scope, condition statements, loops, break, and continue statements, simple java stand alone programs, arrays, constructors, methods, parameter passing, static keyword, access control, this pointer, overloading methods and constructor, recursion, garbage collection, exploring string class

UNIT-II INHERITANCE AND POLYMORPHISM

Inheritance- Inheritance hierarchies super and sub classes, member access rules, super keyword, final keyword, the Object class.
Polymorphism- dynamic binding, method overriding, abstract classes and methods. Interface- Interfaces vs. Abstract classes, defining an interface, implementing interfaces, implementing multiple inheritance using interfaces, extending interfaces.
Inner classes- Uses of inner classes, local inner classes, anonymous inner classes, static inner classes.

UNIT-III PACKAGES, EXCEPTION HANDLING AND FILES

Packages- Defining, Creation and Accessing Packages, Understanding CLASSPATH, importing packages.
Exception handling- Types of errors, benefits of exception handling, classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception sub classes.
Files- streams- byte streams, character streams, text input/output, binary input/output, File management

UNIT-IV MULTITHREADING AND AWT CONTROLS

Multithreading- Difference between multiprocessing and multithreading, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem.
AWT CONTROLS: The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, ScrollBar. Working with Frame class, Colour, Fonts and layout managers.

UNIT-V	GUI PROGRAMMING WITH JAVA AND EVENT HANDLING	

GUI Programming with Java-Introduction to Swing, Hierarchy for Swing components, Swing vs.AWT, Containers- JFrame, JApplet, JDialog, JPanel, JButton,JLabel, JTextField,JtextArea
Event Handling- Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

TEXT BOOKS:

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH
2. Java A Beginner's Guide Sixth Edition , Herbert Schildt

REFERENCE BOOKS:

1. Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M. Deitel, PHI.
2. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Peason Education
4. Programming in Java, S. Malhotra and S. Choudary, Oxford Univ. Press.

WEB REFERENCES:

1. http://www.math.hcmuns.edu.vn/~hvthao/courses/java_programming/lecture_notes/
2. http://people.alari.ch/derino/Teaching/Java/JavaLectureNotes-Derin.pdf

E-TEXT BOOKS:

1. https://books.google.co.in/books?id=pnwTLvCJKh0C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=8qFDDAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC COURSE

1. http://moocfi.github.io/courses/2013/programming-part-1/
2. https://www.edx.org/learn/java

INTRODUCTION TO DATA ANALYTICS
(OPEN ELECTIVE-I)

V SEMESTER - OPEN ELECTIVE – I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS22	OEC	3	1	-	4	30	70	100

COURSE OBJECTIVES

6. Understand different techniques of Data Analysis.
7. Be familiar with concepts of data streams.
8. Be exposed to data analytics Visualization tools and techniques.
9. Implement statistical and analytical tools and techniques.
10. To analyze the visualization with R-programming.

COURSE OUTCOMES

1. Demonstrate data analytics fundamentals.
2. Create data models and analyze using R Programming
3. Use python libraries as a tool to analyze data
4. Research and justify data wrangling, data integration, and database techniques as relevant to data analytics
5. Perform data visualizations and integrate tableau with python

UNIT - I	INTRODUCTION TO DATA ANALYTICS	CLASSES: 12

Introduction To Data Analytics: Overview, Types of Analysis And Key Steps, Components Of Modern Data Ecosystem, Role Of Data Analyst, Data Engineers, Data Scientist, Business Analyst And Business Intelligence Analyst.
Data Eco-System: Types of Data Structures, File Formats, Sources of Data, Data Professional Languages, Various Data Repositories, ETL Process, Introduction To Big Data, Big Data Ecosystem.

UNIT - II	R & DATA MODELLING	CLASSES: 12

Introduction to R-Programming: Overview, visualization using R, simulation, Code profiling, Statistical Analysis with R, data manipulation, visualization tools with R (Ggplot, Lattice,etc.,)
Data Modelling: SQL Best Practices, Advanced Excel, NoSQL Databases, / Visualization Using Tableau, Visualisation Using PowerBI, Visualization Using Plotly.

UNIT - III	DATA ANALYSIS USING SQL	CLASSES: 12

Data Analysis using SQL, Python for Data Science, Visualization in Python, Exploratory Data Analysis, Maths for Data Science, Inferential Statistics, Hypothesis Testing, Advanced SQL for Data Science.

UNIT - IV	GATHERING AND WRANGLING DATA	CLASSES: 12

Gathering And Wrangling Data: Identifying, Gathering and Importing Data From Desperate Sources, Wrangling And Cleaning Data, Tools For Gathering, Importing, Wrangling And Cleaning, Characteristic, Applications And Limitations.

UNIT - V	DATA VISUALIZATION	CLASSES: 12

Tableau: Introduction to Tableau, connecting to Excel, CSV Text Files, Product Overview, Connecting to Databases, Working with Data, Analyzing and Generating reports, TabPy: Combining Python and Tableau.

TEXT BOOKS

1. Data Analytics Made Accessible by Dr. Anil Maheshwari
2. Principles of Data Wrangling, by Joseph M. Hellerstein, Tye Rattenbury, Jeffrey Heer, Sean Kandel, Connor Carreras, Released July 2017
3. Visual Analytics with Tableau by Alexander Loth , Nate Vogel, et al.

REFERENCE BOOKS

1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analyzing, and Manipulating Data With SQL by Walter Shields
2. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic

FUNDAMENTALS OF DBMS
OPEN ELECTIVE - II

VI SEMESTER - OPEN ELECTIVE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS31	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. **Discuss** the basic database concepts, applications, data models, schemas and instances.
2. **Design** Entity Relationship model for a database.
3. **Demonstrate** the use of constraints and relational algebra operations.
4. **Describe** the basics of SQL and construct queries using SQL
5. **Understand** the importance of normalization in databases.
6. **Demonstrate** the basic concepts of transaction processing and concurrency control.
7. **Understand** the concepts of database storage structures and identify the access techniques.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Use the basic concepts of Database Systems in Database design
2. Apply SQL queries to interact with Database
3. Apply normalization on database design to eliminate anomalies
4. Analyze database transactions and can control them by applying ACID properties
5. Analyze physical database storage system of database.

UNIT-I

Introduction: Database system applications, Database system Vs file systems, Advantage of a DBMS, Describing and storing data in a DBMS, Structure of a DBMS, People who work with databases.
Entity Relationship Model (ER Model): Database Design and ER Diagrams, Entities Attributes and Entity sets, Features of ER Model, Conceptual design with the ER model.

UNIT-II

Introduction to relational model: Structure of Relational Databases, Database Schema,Types of Keys, Schema Diagrams, Relational Query Languages, Relational Operations.
Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition language, Basic Structure of SQL Queries, Basic operations, Set Operations, NULL Values, Aggregate Functions, Nested Sub Queries, JOIN Expressions, Views, Transactions, Integrity Constraints, SQL Data types and Schemas, Functions , Triggers.

UNIT-III

Relational Algebra and Calculus: Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.
Schema Refinement and Normal Forms:
Introduction to schema refinement, Functional Dependencies, Reasoning about FDs, Normal Forms: 1NF, 2NF, 3NF, Boyce Codd Normal Form, Properties of decompositions, Multi valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT-IV

Transaction Management: Transaction Concept, A simple transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation.
Concurrency Control and Recovery System: Lock based protocols, Deadlock handling, Multiple granularity, Time stamp based protocols, Validation based protocols. Failure Classification, Storage, Recovery and Atomicity, Failure with Non-volatile Storage, Remote backup systems.

UNIT-V

Storage and File Structure: Overview of Physical Storage Media, Magnetic Disk and Flash Storage, RAID, Tertiary Storage, File Organization, Organization of Records in Files, Data Dictionary storage.
Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple Key access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2. Raghurama Krishnan, Johannes Gehrke, "Data base Management Systems", TATA McGraw Hill, 3rd Edition, 2007.
3. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2013.

REFERENCE BOOKS:

1. Peter Rob, Carlos Coronel, Database Systems Design Implementation and Management, 7th edition, 2009.
2. Scott Urman, Michael McLaughlin, Ron Hardman, "Oracle database 10g PL/SQL programming ", 6th edition, Tata McGraw Hill,2010
3. .K.Singh, "Database Systems Concepts, Design and Applications", First edition, Pearson Education, 2006.
4. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson / Addision wesley, 2007.

WEB REFERENCES:

1. http://www.learndb.com/databases/how-to-convert-er-diagram-to-relational-database
2. https://www.w3schools.com/sql/sql_create_table.asp
3. http://www.edugrabs.com/conversion-of-er-model-to-relational-model/?upm_export=print
4. http://ssyu.im.ncnu.edu.tw/course/CSDB/chap14.pdf
5. http://web.cs.ucdavis.edu/~green/courses/ecs165a-w11/8-query.pdf

E-TEXT BOOKS:

1. http://www.freebookcentre.net/Database/Free-Database-Systems-Books-Download.html
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-11.pdf

MOOC Course

1. https://www.mooc-list.com/tags/dbms-extensions
2. https://onlinecourses.nptel.ac.in/noc18_cs15/preview

INTRODUCTION TO DESIGN & ANALYSIS OF ALGORITHMS

VI SEMESTER - OPEN ELECTIVE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS07	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To demonstrate performance of algorithms with respect to time and space complexity.
2. To explain graph and tree traversals.
3. To explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
4. To illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.

COURSE OUTCOMES:

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

1. Identify various Time and Space complexities of various algorithms
2. Apply Divide and conquer and Greedy Algorithms to solve various problems
3. Understand Tree Traversal method and Apply Dynamic Programming concept to solve various problems
4. Apply Backtracking concept to solve various problems
5. Apply Branch and Bound concept to solve various problems

UNIT-I	INTRODUCTION	CLASSES: 10

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis ofcomplexity bounds – best, average and worst-case behavior; Performance measurements ofAlgorithm, Time and space trade-offs, Analysis of recursive algorithms throughrecurrence relations: Substitution methodand Masters' theorem.

UNIT-II	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part I	CLASSES: 10

DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.
GREEDY METHOD: Heuristics –characteristics, Applications-job sequencing with deadlines, 0/1 knapsack problem, minimum cost spanning trees, Single source shortest path problem.

UNIT-III	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part II	CLASSES: 10

GRAPHS (Algorithm and Analysis): Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points.
DYNAMIC PROGRAMMING: General method, applications - 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

UNIT-IV	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part III	CLASSES: 10

BACKTRACKING: Heuristics –characteristics, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.

UNIT- V	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part IV	CLASSES: 10

BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

TEXT BOOKS:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

REFERENCE BOOKS:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading, MA.

WEB REFERENCES:

1. https://www.hackerrank.com/domains/algorithms
2. https://discuss.codechef.com/questions/48877/data-structures-and-algorithms
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algo rithms_tutorial.pdf
4. http://nptel.ac.in/courses/106101060/

E-TEXT BOOKS:

1. http://www.trips-to-morocco.com/introduction-to-algorithms-3rd-edition-mit-press-english.pdf
2. https://comsciers.files.wordpress.com/2015/12/horowitz-and-sahani-fundamentals-of-computer-algorithms-2nd-edition.pdf
3. https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/Algorithm%20Design_%20Foundations%2C%20Analysis%2C%20and%20Internet%20Examples%20%5BGoodrich%20%26%20Tamassia%202001%5D.pdf

MOOC COURSE:

1. https://onlinecourses.nptel.ac.in/noc17_cs27/preview
2. https://www.coursera.org/courses?languages=en&query=Algorithm+design+and+analysis

INTRODUCTION TO CLOUD COMPUTING
(OPEN ELECTIVE – III)

VII SEMESTER - OPEN ELECTIVE – III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS33	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

6. To inculcate the concepts of distributed computing
7. To familiarize the concepts of cloud computing and services
8. To explain cloud platform and types of cloud
9. To explain resource management in cloud

COURSE OUTCOMES

1. Analyze the principles of distributed computing
2. Create virtual machines and virtual templates.
3. Create Cloud platform using Virtual machines
4. Apply suitable business models of cloud computing
5. Analyze various case studies on cloud computing.

UNIT-I	INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES	CLASSES: 12

INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES: Introduction to Virtualization: Definition, Objectives, Characteristics, Benefits of virtualization, Taxonomy of virtualization technologies, Pros and cons of virtualization. Virtualization Technologies: VMware, Hyper-V, Zen and virtual iron.

UNIT-II	FUNDAMENTAL CLOUD COMPUTING AND MODELS	CLASSES: 12

FUNDAMENTAL CLOUD COMPUTING AND MODELS: Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges. Cloud Models, roles and boundaries, Cloud characteristics, Cloud delivery models, Cloud deployment models.

UNIT-III	CLOUD COMPUTING MECHANISMS AND ARCHITECTURE	CLASSES: 14

CLOUD COMPUTING MECHANISMS AND ARCHITECTURE: Cloud-Enabling Technology: Broadband networks and internet architecture, Data center technology, Virtualization technology, Web technology, Multitenant technology, Service technology. Cloud Architectures: Architecture - Workload distribution, Resource pooling, Dynamic scalability, Elastic resource capacity, Service load balancing, Cloud bursting, Elastic disk provisioning, Redundant storage.

UNIT-IV	CLOUD SECURITY AND DISASTER RECOVERY	CLASSES: 12

CLOUD SECURITY AND DISASTER RECOVERY: Cloud Security: Data, Network and host security, Cloud security services and cloud security possible solutions. Cloud Disaster Recovery: Disaster recovery planning, Disasters in the cloud, Disaster management, Capacity planning and cloud scale.

UNIT-V	CLOUD CASE STUDIES	CLASSES: 10

CLOUD CASE STUDIES: Case Studies: Software-as-a-Service (SaaS) - Salesforce.com, Facebook; Platform–as-a-Service (PaaS) - Google App Engine, MS-Azure and IBM Bluemix; Infrastructure-as-a-Service (IaaS) - Amazon EC2, Amazon S3 and Netflix.

TEXT BOOKS

1. Cloud ComputingConcepts, Technology and Architecture, Thomas Erl and RicardoPuttini Pearson, 2013.
2. Cloud Computing Virtualization Specialist Complete Certification Kit-Study Guide Book, Ivanka Menken and Gerard Blokdijk, Lightning Source, 2009

REFERENCE BOOKS

1. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt Ltd, 2011.
4. Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej Goscinski, John Wiley and Sons, 2011.
5. Cloud Computing Implementation, John W. Rittinghouse and James F. Ransome, Management and Security, CRC Press, Taylor & Francis Group, 2010.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.ibm.com/in-en/cloud/learn/cloud-computing

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

V Semester: OPEN ELECTIVE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS34	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To understand the basic structure and operation of a digital computer.
2. To discuss in detail the operation of the arithmetic unit including the algorithms & Implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
3. To study different ways of communicating with I/O devices and standard I/O interfaces.
4. To study hierarchical memory system including cache memories and virtual memory.
5. To demonstrate the knowledge of functions of operating system memory management Scheduling, file system and interface, distributed systems, security and dead locks.
6. To implement a significant portion of an Operating System

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Describe the fundamental organisation of a computer system.
2. Identify addressing modes, instruction formats and program control statements and Input-Output Organization.
3. Identify and analyse the different structures and services of operating system.
4. Analyse the memory management approaches of operating systems.
5. Assess different methods to solve Deadlock and learn concepts of File system Interface.

UNIT-I	BASIC STRUCTURE OF COMPUTERS	15 classes

Computer Types, Functional UNIT, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation.

Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle. Memory - Reference Instructions, Input - Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation.

UNIT-II	MICRO PROGRAMMED CONTROL	10 classes

Control Memory, Address Sequencing, Micro Program Examples, Design of Control Unit, Hard Wired Control, Micro Programmed Control. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP).

UNIT-III	OPERATING SYSTEMS OVERVIEW	10 classes

Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating System Generation. Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT-IV	MEMORY MANAGEMENT	10 classes
Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies -UNIX, Linux, Windows.		
UNIT-V	**PRINCIPLES OF DEADLOCK**	**15 classes**
System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock. File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. Allocation Methods, Free-Space Management.		

TEXT BOOKS:

1. Computer Organization - Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
2. Computer System Architecture - M. morismano, 3rd edition, Pearson
3. Operating System Concepts - AbrehamSilberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

REFERENCE BOOKS:

1. Computer Organization and Architecture - William Stallings 6th Edition, Pearson
2. Structured Computer Organization - Andrew S. Tanenbaum, 4th Edition, PHI
3. Fundamentals of Computer Organization and Design - SivaraamaDandamudi, Springer Int. Edition
4. Operating Systems - Internals and Design Principles, Stallings, 6th Edition - 2009, Pearson Education.
5. Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI
6. 6. Principles of Operating System, B. L. Stuart, Cengage Learning, India Edition

WEB REFERENCES:

6. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
7. https://www.tutorialspoint.com/operating_system/os_overview.htm

E-TEXT BOOKS:

1. https://www.academia.edu/7727578/Operating_System_Concepts_5th_ed_BY_GALVIN
2. http://www.gpkhutri.in/BOOK/COMPUTER/Computer%20Organization%20and%20Architecture%20Designing%20for%20Performance%20(8th%20Edition)%20-%20William%20Stallings.pdf

MOOC Course

1. https://nptel.ac.in/courses/106/105/106105163/
2. https://nptel.ac.in/courses/106/106/106106144/
3. https://www.coursera.org/learn/comparch
4. https://www.coursera.org/learn/os-pku

DISTRIBUTED DATABASES

IV Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS20	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To understand the theoretical and practical aspects of the database technologies.
2. To understand the need for distributed database technology to tackle deficiencies of the centralized database systems.
3. To introduce the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.
4. To familiarize the emerging database technology

COURSE OUTCOMES

1. Analyze database with distributed database concepts and its structures.
2. Apply methods and techniques for Distributed query processing and Optimization
3. Apply the concepts of Distributed Transaction process and concurrency control.
4. Illustrate reliability and providing security in the distributed databases
5. Summarize the concepts of Distributed Object Database Management Systems

UNIT- I	INTRODUCTION	CLASSES: 12

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

UNIT - II	QUERY PROCESSING	CLASSES: 12

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.
Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

UNIT - III	TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL	CLASSES: 14

The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions
Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT - IV	RELIABILITY AND SECURITY IN THE DISTRIBUTED DATABASES	CLASSES: 14

Reliability, Basic Concepts, Non blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection

UNIT - V	DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS	CLASSES: 12

Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects

TEXT BOOKS

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri &Navathe; Pearson Education; Asia Database System Concepts; Korth & Sudarshan; TMH

REFERENCE BOOKS

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin C Desai; Galgotia
3. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

WEB LINKS

1. https://www.digimat.in/nptel/courses/video/106106168/L01.html
2. https://nptel.ac.in/courses/106/106/106106168/

SOFTWARE PROJECT MANAGEMENT
(OPEN ELECTIVE – IV)

VI Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS29	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. The main goal of software development projects is to create a software system with a predetermined functionality and quality in a given time frame and with given costs.
2. For achieving this goal. models are required for determining target values and for continuously controlling these values.
3. This course focuses on principles, techniques, methods & tools for model-based engagement of software projects.
4. Assurance of product quality and process adherence (quality assurance), as well as experience-based creation & improvement of models (process management).

COURSE OUTCOMES

1. Apply the specific roles within a software organization as related to project and process management
2. Analyze the basic infrastructure competences (e.g., process modeling and measurement)
3. Apply the steps of project planning, project management. Quality assurance, and process management and their relationships
4. Determine the importance of project management from the perspectives of planning, tracking and completion of project.
5. Compare and differentiate organization structures and project structures.
6. Implement a project to manage project schedule, expenses and resources with the application of suitable protect management tools.

UNIT-I CONVENTIONAL SOFTWARE MANAGEMENT — CLASSES: 12

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-II THE OLD WAY AND THE NEWWAY — CLASSES: 12

THE OLD WAY AND THE NEWWAY - The principles of conventional software engineering. Principles of modem software management, transitioning to an iterative process.

ARTIFACTS OF THE PROCESS: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT-III WORK FLOWS OF THE PROCESS — CLASSES: 12

WORK FLOWS OF THE PROCESS: Software Process Workflow, Inter Trans Workflows.

CHECKPOINTS OF THE PROCESS: Major Mile Stones, Minor Milestones, Periodic status assessments.

ITERATIVE PROCESS PLANNING: Work breakdown structures, planning guidelines, cost and scheduled estimating, Interaction, planning process, Pragmatic planning.

UNIT-IV PROCESS AUTOMATION — CLASSES: 12

PROCESS AUTOMATION: Automation Building blocks, 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.

UNIT-V	PROJECT CONTROL AND PROCESS INSTRUMENTATION	CLASSES: 12

PROJECT CONTROL AND PROCESS INSTRUMENTATION: The server care Metrics, Management indicators, and quality indicators. life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example.
FUTURE SOFTWARE PROJECT MANAGEMENT: Modem Project Profiles Next generation Software economics modem Process transitions.
Case Study: The Command Centre Processing and Display System, Replacement (CCPDS. R).

TEXT BOOKS

1. Software Project Management. Walker Royce, Pearson Education.
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, Tate McGraw Hd.

REFERENCE BOOKS

1. Applied Software Project Management, Andrew SteIbian 8 Jennifer Greene, O'Reilly. 2006
2. Head First PMP, Jennifer Greene & Andrew Steliman, ORoiHy.2007
3. Software Engineering Project Managent. Richard H. Thayer & Edward Yourdon, second edition, Wiley India, 2004.
4. Ale Project Management, Jim Highsniith. Pearson education, 2004
5. The art of Project management. Scott Berkun. O'Reilly, 2005.
6. Software Project Management in Practice. Pankaj Jalote. Pearson Educabon,2002.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2. https://www.smartzworld.com/notes/software-project-management-pdf-notes-spm-pdf-notes/

OPEN ELECTIVES
OFFERED BY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

OE1		OE2	
A5EC54	Microprocessors and Interfacing	A5EC58	Microcontrollers and Applications
A5EC55	Principles of Communications	A5EC61	Fundamentals of Image processing
OE3		**OE4**	
A5EC62	Introduction to Sensors and Actuators	A5EC64	Introduction to Mobile Communications
A5EC63	Introduction to Computer Vision	A5EC65	Basics of Embedded System Design

OPEN ELECTIVES- I

MICROPROCESSORS AND INTERFACING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC54	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basic of 8, 16 bit microprocessor architectures and its functionalities.
2. Develop an assembly language programming skills of various processors.
3. Interface different peripheral devices with microprocessors and microcontrollers.
4. Interface memory devices to 8086 processor.
5. Analyze Serial communication schemes of microprocessor based systems.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand the architecture of micro processor.
2. Understand the programming model of micro processors.
3. Interface different external peripherals with microprocessors.
4. Analyze a problem and formulate appropriate computing solution for processor based application.
5. Develop an assembly language program for specified application in communication.

UNIT-I	MICROPROCESSORS ARCHITECTURE	Classes: 09

Overview of 8085, 8086 architecture- functional diagram, Register organization, memory segmentation, Memory addresses, physical memory organization.

UNIT-II	SIGNAL DESCRIPTION OF 8086	Classes: 09

Signal description of 8086, timing diagrams, Interrupt structure of 8086, Vector interrupt table, Interrupts of 8086 Processor, Interrupt service routine.

UNIT-III	INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086	Classes: 09

Programming model, Addressing modes, Instruction set, Assembler directives, Programs involving logical, branch and call instructions, Sorting, evaluating arithmetic expressions, and string manipulations.

UNIT-IV	I/O INTERFACE	Classes: 09

Introduction to 8255 PPI, various modes of operation of 8255 PPI, interfacing 8255 to 8086, Stepper motor interfacing, D/A &A/D converter, Memory interfacing to 8086.

UNIT-V	SERIAL COMMUNICATION INTERFACE	Classes: 09

Serial communication standards, serial data transfer schemes, 8251 USART architecture, Interfacing of 8251/ USART to 8086 Processor.

Text Books:

1. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.
3. R.S.Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.

Reference Books:

1. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
2. Micro computer system 8086/8088 family architecture, programming and design- By Liu and GA Gibson, PHI, 2nd Ed.,

Web References:

1. http://www.freebookcentre.net/electronics-ebooks-download/Microprocessor-and-Microcontroller.html
2. http://coen.boisestate.edu/smloo/smloo-courses/ece-332-microprocessors-fall07/lecture-notes/
3.http://www.freebookcentre.net/electronics-ebooks-download/Introduction-to-Microcontrollers-Lecture-Notes.html

E-Text Books:

1. http://gen.lib.rus.ec/book/index.php?md5=67C5AC79DC8180A7F0641609D0C7800C
2. http://www.faadooengineers.com/threads/9039-8085-microprocessor-by-RAMESH-GANOKAR-ebook-pdf-download
3. https://e.edim.co/123389964/The_8051_Microcontroller_Architecture_Programming_And_Applications.pdf

https://e.edim.co/123389964/A.K._Ray_and_K.M._BhurchandiAdvanced_Microprocessors_and_Peripherals_3e-Tata_Mcgraw_Hill.pdf

MOOC Course

1. https://www.mooc-list.com/tags/microprocessors
2.https://www.coursera.org/courses?query=microprocessor

PRINCIPLES OF COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC55	OEC	3	-	-	3	30	70	100

PREREQUISITE: Knowledge on Electron devices and Electronic circuits

COURSE OBJECTIVES:

The students are able to:

1. Describe the basic concepts of analog communication
2. Significance of digital & analog communication
3. Compare the digital modulation techniques
4. Learn the various multiple access techniques
5. Understanding the Satellite and Optical fiber concepts.

COURSE OUTCOMES:

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

1. Understand the concepts of analog modulations
2. Illustrate the basic concepts of digital modulations.
3. Analyse the various digital modulation methodologies.
4. Distinguish the concepts of multiple access techniques.
5. Differentiate the various orbits and associated satellite launches.

UNIT I	FUNDAMENTALS OF ANALOG COMMUNICATION	Classes: 09

Modulation, Principles of Amplitude Modulation, AM modulator and Demodulator, Types of Amplitude modulation (DSBSC,SSBSC, VSB). Angle modulation FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation.

UNIT II	DIGITAL TRANSMISSION	Classes: 09

Introduction, Sampling theorem, Types of pulse modulations, PCM, companding, differential pulse code modulation, delta modulation, adaptive delta modulation, Inter symbol interference.

UNIT III	DIGITAL MODULATION TECHNIQUES	Classes: 09

Introductions, Shannon limit for information capacity, ASK FSK, BPSK QPSK and DPSK modulators and demodulators, comparison of digital modulation techniques.

UNIT IV	SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES	Classes: 09

Introduction, Pseudo noise sequence, DS spread spectrum with coherent binary PSK, FH spread spectrum, multiple access techniques-FDMA, TDMA and CDMA.

UNIT V	SATELLITE AND OPTICAL COMMUNICATION	Classes: 09

Satellite Communication Systems, Keplers Law, LEO, MEO and GEO Orbits, Link model Optical Communication Systems-Fiber losses-scattering, absorption attenuation and bending losses, types of optical Sources and Detectors.

TEXTBOOKS:

1. Wayne Tomasi, —Advanced Electronic Communication Systems||, 6/e, Pearson Education, 2007.
2. Simon Haykin, —Communication Systems||, 4th Edition, John Wiley & Sons., 2001.

REFERENCES:

1. H.Taub,D L Schilling, G Saha ,||Principles of Communication||3/e,2007.
2. B.P.Lathi,||Modern Analog And Digital Communication systems||, 3/e, Oxford University Press, 2007
3. Blake, —Electronic Communication Systems||, Thomson Delmar Publications, 2002.
4. Martin S.Roden, —Analog and Digital Communication System||, 3rd Edition, PHI, 2002.
5. B.Sklar,||Digital Communication Fundamentals and Applications||2/e Pearson Education 2007.

Web References:

1. https://personal.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf
2. Bricker G (2012) 2-D bar codes, Journal of Computing Sciences in Colleges, **28**:1, (25-32), Online publication date: 1-Oct-2012.

E-Text Books:

1. https://books.google.co.in/books/about/Principles_Of_Communication.html?id=6Zunu4Acfg8C

MOOC Course:

1.https://onlinecourses.nptel.ac.in/noc18_ee26/preview

OPEN ELECTIVES- II

MICROCONTROLLER & APPLICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC58	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce the students about architectural features of microcontrollers and its registers
2. To introduce about the instruction set of 8051
3. To know about the I/O Ports and Interrupts of 8051
4. To know about Timers/Counters of 8051
5. To introduce Arduino programming and interfacing of sensors

COURSE OUTCOMES:

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

1. Understand the architectural features of MCS-51 and select a suitable microcontroller to suit the application.
2. Develop programs for control applications using assembly language and embedded C
3. Use timers and counters for delay generation and event counting and Illustrate the use of interrupts and service routines
4. Write algorithms and develop programs for serial data communication applications.
5. Design microcontroller based-applications for simple real-world applications

UNIT I	8051 ARCHITECTURE	Classes: 9

Introduction to microcontrollers, RISC, CISC, Harvard and Von Neumann architectures. Architecture of 8051, Signal descriptions of 8051, General purpose registers of 8051, register banks, Memory organization.

UNIT II	INSTRUCTION SET OF 8051	Classes: 9

Assembly language Instruction format, 8051 Addressing modes, Instruction set of 8051: Classification, syntax and function of instructions, Simple programs.

UNIT III	I/O PORT AND INTERRUPT PROGRAMMING	Classes: 9

I/O Ports of 8051,Features of I/O ports, configuring I/O ports, interface I/O devices such as LED, buzzer, push-button switch, example programs with assembly & C. Interrupts of 8051 and its priorities, IE and IP registers, Interrupt enabling/disabling and priority setting, example programs in assembly and C.

UNIT IV	TIMERS /COUNTERS AND SERIAL I/O	Classes: 9

Bit structure and function of TMOD and TCON registers, Timer/Counter modes of operations, Timer/Counter programs in assembly and C. Bit structure and function of SCON, PCON registers, SBUF register, Serial Communication modes in 8051, programs on serial communication.

UNIT V	INTRODUCTION TO ARDUINO	Classes: 9

Introduction to Arduino-uno board, Analog and Digital pins, programming structure of Arduino, introduction to sensors and actuators , Sensor interfacing, programming to sensors, Motor interfacing, LCD interfacing

TEXTBOOKS:

1. The 8051 Microcontroller(3rd edition) - Kenneth J Ayala
2. The 8051 Microcontroller& Embedded systems using assembly and C (2ndEdition) –M.A.Mazidi , J.C. Mazidi & R.D.McKinlay ISBN: 81-317-1026-2

REFERENCES:

1. The 8051 Microcontroller(4th Edition)- MacKenzie , ISBN:81-317-2018-7
2. The 8051 Microcontroller(1st Edition) – Dr.Uma Rao & Andhe Paallavi, ISBN: 81-317-3252-5
3. Microcontrollers & applications, Ramani Kalpathi, & Ganesh Raja , ISBN: 81-888-4918-9
4. Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Edition – Simon Monk

Web References:https://www.the8051microcontroller.com/web-references

E-Text Books:

1. https://www.freebookcentre.net/Electronics/Microcontroller-Books.html
2. https://www.freebookcentre.net/Electronics/Microcontroller-Application-Books.html

MOOC Course 1.https://nptel.ac.in/courses/117/104/117104072/

FUNDAMENTALS OF IMAGE PROCESSING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC61	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The students are able to:

1. To become familiar with digital image fundamentals
2. To get exposed to image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition methods

COURSE OUTCOMES:

1. Know and understand the basics and fundamentals of digital image processing.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Apply the restoration concepts and filtering techniques on digital images.
4. Learn the basics of segmentation and features extraction.
5. Analyze the compression and recognition methods for color images.

UNIT I	INTRODUCTION OF IMAGE PROCESSING	Classes: 09

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures.

UNIT II	IMAGE ENHANCEMENT	Classes: 09

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Image Enhancement in Frequency Domain: Low Pass and High Pass Filters in Frequency Domain, Homomorphic filtering

UNIT III	IMAGE TRANSFORMS	Classes: 09

Image Transforms: 2 D- Discrete Fourier Transform and its properties, Discrete Cosine Transform (DCT), Haar Transform, Hadmard Transform, Hotelling Transform and Slant transform.

UNIT IV	IMAGE SEGMENTATION	Classes: 09

Introduction-Edge detection, Edge linking and boundary detection – Thresholding – Region based segmentation – Region growing – Region splitting and merging- Watershed segmentation algorithm.

UNIT V	IMAGE COMPRESSION	Classes: 09

Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXTBOOKS:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- Mc Graw Hill Edn., 2010.

REFERENCES:

1. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
2. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Web References:
1. http://homepages.inf.ed.ac.uk/rbf/BOOKS/VERNON/Chap004.pdf
E-Text Books:
1. https://books.google.co.in/books/about/Digital_Image_Processing.html?id=a62xQ2r_f8wC
MOOC Course:
1. *https://nptel.ac.in/courses/117105079/*

OPEN ELECTIVE –III

INTRODUCTION TO SENSORS AND ACTUATORS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC62	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding basic laws and phenomena on which operation of sensors and actuators-transformation of energy.
2. Create analytical design and development solutions for sensors and actuators.
3. To know the basic laws of behaviour of sensors and actuators.
4. To able to know about the Standards for Smart Sensor Interface
5. Analyse the development and application of sensors and actuators.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the fundamental physical and technical base of sensors and actuators,
2. Analyse various premises, approaches, procedures and results related to sensors and actuators
3. Analyse basic laws and phenomena that define behaviour of sensors and actuators.
4. Apply the Smart Sensor Interface in various applications
5. Develop the application of sensors and actuators

UNIT-I	SENSORS & TRANSDUCERS	Classes: 9

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Resistance Strain Gauge, Semiconductor Strain Gauges, Capacitive Sensors, Electrostatic Transducer, Ultrasonic Sensors.

UNIT-II	THERMAL SENSORS	Classes: 9

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Nuclear Thermometer, Thermo-EMF Sensors, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, Spectroscopic Thermometry, Noise Thermometry..

UNIT-III	RADIATION SENSORS	Classes: 9

Introduction – Basic Characteristics – Types of Photosensistors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Sensor Electrodes.

UNIT-IV	SMART SENSORS	Classes: 9

Introduction, Primary Sensors, Excitation, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors.

UNIT-V	ACTUATORS	Classes: 9

Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves.

Text Books:

1.D. Patranabis, "Sensors and Transducers", PHI Learning Private Limited.
2.W. Bolton, "Mechatronics", Pearson Education Limited.

Reference Books:

1. Patranabis, "Sensors and Actuators", 2nd Edition, PHI, 2013.

***Web Link*:**

1.https://www.journals.elsevier.com/sensors-and-actuators

E Text books:

1.https://www.sciencedirect.com/handbook/handbook-of-sensors-and-actuators

Moocs:

1.https://www.classcentral.com/course/swayam-sensors-and-actuators-14285

INTRODUCTION TO COMPUTER VISION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC63	OEC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To review image processing techniques for computer vision.
2. To understand the concepts of Image Enhancement.
3. To understand the basics of segmentation and its applications.
4. To know about the feature extraction and Hough Transform.
5. To understand three-dimensional image analysis techniques.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Implement fundamental image processing techniques required for computer vision.
2. Analyze the various spatial and frequency domain filtering.
3. Understand the idea about segmentation
4. Apply Hough Transform for line, circle, and ellipse detections.
5. Apply 3D vision techniques and motion related techniques.

UNIT-I	IMAGE PROCESSING FOUNDATIONS	Classes: 09

Fundamental steps in Digital Image Processing, Components of Digital Image Processing Image sensing and acquisition, Image formation model, Pixels, Basic relationship between pixels, Sampling and Quantization in Digital Image Processing

UNIT-II	IMAGE ENHANCEMENT	Classes: 09

Intensity transformations, contrast stretching, histogram equalization, Spatial filtering: Smoothing filters, sharpening filters, Frequency domain filtering, Homomorphic filtering,

UNIT-III	BAICS OF SEGMENTATION	Classes: 09

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour models, Texture feature based segmentation, Graph based segmentation, Wavelet based Segmentation - Applications of image segmentation.

UNIT-IV	FEATURE EXTRACTION	Classes: 09

First and second order edge detection operators, Phase congruency, Localized feature extraction - detecting image curvature, shape features, Introduction to Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors.

UNIT-V	3D IMAGE VISUALIZATION	Classes: 09

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiple connected surfaces, Image processing in 3D, Measurements on 3D images.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing',Pearson,Education, Inc.,Second Edition, 2004.
2 Mark Nixon, Alberto Aguado, “Feature Extraction and Image Processing”, Academic Press,2008.
3. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.

Web References:

1.https://machinelearningmastery.com/what-is-computer-vision/

E-Text Books:

1..https://machinelearningmastery.com/computer-vision-books/

MOOC Course

1.https://onlinecourses.nptel.ac.in/noc21_ee23/preview

OPEN ELECTIVES - IV

INTRODUCTION TO MOBILE COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC64	OEC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.
2. To fill the skill gap in the domain of Cellular Technology.
3. Get hands on practice in the field of cellular technology and related disciplines.
4. To appreciate the contribution of wireless Communication networks to overall technological growth.
5. To provide an overview of wireless Communication networks area and its applications in communication engineering.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Explain the basics of mobile telecommunication system
2. Illustrate the generations of telecommunication systems in wireless network
3. Demonstrate knowledge on : cellular concepts like frequency reuse, fading, equalization, and handoff strategies
4. Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks
5. Implement the functionality of Transport and Application layer

UNIT-I	INTRODUCTION TO MOBILE COMPUTING	Classes: 9

Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT-II	MOBILE TELECOMMUNICATION SYSTEM	Classes: 9

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture

UNIT-III	CELLULAR CONCEPT	Classes: 9

Limitations of conventional mobile system, concept of frequency reuse, cluster size, cellular system architecture, channel assignment strategies, call handoff strategies - hard handoff and soft handoff, prioritizing handoff.

UNIT-IV	WIRELESS NETWORKS	Classes: 9

Wireless networks – Advantages and applications of Wireless LAN, WLAN technology – RF and IR wireless LAN, diffuse, IEEE802.11 architecture, Physical layer, MAC layer, Introduction to WI-FI, Bluetooth architecture.

UNIT-V	MOBILE NETWORK AND TRANSPORT LAYER	Classes: 9

Introduction to Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimization, Reverse tunneling; Mobile adhoc networks – Routing, Destination sequence distance vector, Dynamic source routing.

Text Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andreas F.MOlisch - Wireless Communications,J ohn Wiley, 2nd Edition, 2006.

Reference Books:

1. Kamilo Feher - Wireless Digital Communications, PHI, 2003
2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.

BASICS OF EMBEDDED SYSTEMS DESIGN

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC65	OEC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Explains about the basic functions, structure, concepts and applications of embedded systems.
2. Describes the Core of the Embedded System
3. Explains about the tools used to develop in an embedded environment
4. Gives the knowledge about the development of embedded software using RTOS.
5. Gives the knowledge about the Advance Architectures

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1 Understand the selection procedure of Processors in the Embedded domain.
2. Design Procedure for Embedded Firmware.
3. Implement the Real time Operating Systems applications in Embedded Systems
4. Analyze the Correlation between task synchronization and latency issues
5. Understand the concepts of Advance architecture

UNIT-I	INTRODUCTIONTO EMBEDDED SYSTEMS	Classes: 09

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems

UNIT-II	TYPICAL EMBEDDED SYSTEM	Classes: 09

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Sensors and Actuators.

UNIT-III	EMBEDDED SOFTWARE DEVELOPMENT TOOLS	Classes: 09

Host and target machines, linker/locators for embedded software, getting embedded software into the target system, debugging techniques: Testing on host machine, using laboratory tools.

UNIT-IV	RTOS BASED EMBEDDED SYSTEM DESIGN	Classes: 09

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Message queues, mailboxes and pipes.

UNIT-V	INTRODUCTION TO ADVANCED ARCHITECTURES	Classes: 09

ARM and SHARC, processor and memory organization and instruction level parallelism; networked embedded systems: bus protocols, I2C bus and CAN bus.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference Books:

1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

Web References:

1. https://www.elprocus.com/embedded-system-design/

E-Text Books:

1. https://www.phindia.com/Books/BookDetail/9788120347304/embedded-system-design-chattopadhyay

MOOC Course

1.https://onlinecourses.nptel.ac.in/noc20_ee98/preview

OPEN ELECTIVES
OFFERED BY DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

OE1		OE2	
A5EE52	Electrical Wiring and Safety Measures	A5EE56	Analysis of Linear Systems
A5EE53	Electrical Materials	A5EE57	Neural Networks and Fuzzy Logic
OE3		**OE4**	
A5EE60	Solar Energy and Applications	A5EE61	Instrumentation and Control
		A5EE63	Energy Storage Systems

ELECTRICAL WIRING AND SAFETY MEASURES

(OPEN ELECTIVE – I)

III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE52	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To Study the wiring diagram of residential.
2. To understand the Safety measures of Electrical wiring
3. Apply the Different types of safety rules in Electrical Systems.
4. Design the Different types of Residential Electrification Methods.
5. Identifying Different types of Substations.

Course Outcomes:

The students should be able to

1. To Analyze the safety measures & state safety precautions.
2. To Understand the Different Methods of Earthlings.
3. Apply the Different types of safety rules in Electrical Systems.
4. Design the Different types of Residential Electrification Methods.
5. Identifying Different types of Substations.

SYLLABUS

UNIT-I	**BASICS OF ELECTRICAL INSTALLATIONS**	**Classes: 12**

Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, General requirements of electrical installations, testing of installations, Types of loads, Systems of wiring, Service connections, Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT-II	**EARTHING**	**Classes: 08**

Introduction & importance, Factors affecting Earth Resistance, Methods of earthling Substation and Transmission tower earthling, Neutral and Earth wire, Transformer Neutral Earthling.

UNIT-III	**SAFETY & PREVENTION OF ACCIDENTS**	**Classes: 08**

Definition of terminology used in safety, I.E. Act & statutory regulations for safety of persons &equipments working with electrical installation. Dos & don'ts for substation operators as listed in IS. Meaning & causes of electrical accidents factors on which severity of shock depends.

UNIT-IV	**RESIDENTIAL BUILDING ELECTRIFICATION**	**Classes: 10**

General rules guidelines for wiring of Residential Installation and positioning of equipments. Principles of circuit design in lighting and power circuits. Procedures for designing the circuits and deciding the number of sub- circuits. Method of drawing single line diagram & wiring diagram.

UNIT-V	**RULES : SUBSTATION AND METERS**	**Classes: 12**

Rule 28: Voltage level definitions. Rule 30: Service lines & apparatus on consumer premises.
Rule 31: Cut-out on consumer's premises.
Rule46: Periodical inspection & testing of consumer's installation.
Rule 47: Testing of consumer's installation.
Rule 54: Declared voltage of supply to consumer.
Rule 55: Declared frequency of supply to consumer.
Rule 56: Sealing of meters &cut-outs.
Rule 77: Clearances above ground of the lowest conductor.

Rule 79: Clearances between conductors & trolley wires.
Rule 87: Lines crossing or approaching each other.
Rule 88: Guarding.

Text Books:

1. K.B. Raina, S.K.Bhattacharya Electrical Design;Estimating and costing New Age International (p) Limited,
   New Delhi Surjit Singh.
2. Electrical Estimating and costing Dhanpat Rai and company, New Delhi .J.B.Gupta
3. A course in Electrical Installation, Estimating & costing S.K.Kataria&sons,S.L. Uappal .
4. Electrical wiringEstimating and costing Khanna Publication. ,A.K.Sawhney

Reference Books:

1. Electrical Machine Design Danpat Rai & co.
2. The Electricity Rule 2005Universal Law Publishing Co. Pvt. Ltd. N. AlagapanS. Ekambaram
3. Electrical Estimating and costing Tata Mc Graw Hill Publication, New Delhi ,Surjit Singh
4. TarlokSibgh Installation, Commissioning & Maintenance of Electrical Equipment S.K.Kataria& Sons
5. B.V.S.Rao Operation & Maintenance of Electrical Machines Vol I & II Media Promoters & Publisher Ltd. Mumbai

Web References:

1. https://electrical-engineering-portal.com › Technical Articles
2. https://www.st-andrews.ac.uk/staff/policy/healthandsafety/publications/electricalsafety/
2. https://www.cpwd.gov.in/Publication/Internal2013.pdf

E-Text Books:

1. https://books.google.co.in/books?isbn=0323170064
3. https://www.jove.com/science.../electrical-safety-precautions-and-basic-equipment

MOOC Course

1. https://nptel.ac.in/courses/103106071/5
2. https://nptel.ac.in/courses/108108099/28
3. https://nptel.ac.in/courses/124107001/

ELECTRICAL MATERIALS

(OPEN ELECTIVE – I)

III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE53	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To Analyze the various Conducting materials.
2. To Explain the various Semi conducting materials.
3. To Explain The Dielectrics and Insulators.
4. To Explain the Different Magnetic Materials.
5. To Describe the Optical properties of Fibers

Course Outcomes:

The students should be able to

1. Analyze the various Conducting materials.
2. Explain the various Semi conducting materials.
3. Explain The Dielectrics and Insulators.
4. Explain the Different Magnetic Materials.
5. Describe the Optical properties of Fibers.

UNIT-I	CONDUCTORS	Classes: 10

Classification: High conductivity, high resistivity materials, fundamental requirements of high conductivity materials and high resistivity materials, mobility of electron in metals, commonly used high conducting materials, copper, aluminum, bronze brass, properties, characteristics, constantan, platinum, nichrome, properties, characteristics and applications, materials used for contacts.

UNIT-II	SEMICONDUCTORS	Classes: 08

General concepts, energy bands, types of semiconductors, Fermi Dirac distribution, intrinsic Semi-conductors, extrinsic Semi-conductors, hall effect, drift, mobility, diffusion in Semiconductors, and their applications, superconductors.

UNIT-III	DIELECTRICS AND INSULATORS	Classes: 12

Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, electric conduction in gaseous, liquid and solid dielectric, breakdown in dielectric materials, mechanical and electrical properties of dielectric materials, effect of temperature on dielectric materials, polarization, loss angle and dielectric loss, petroleum based insulating oils, transformer oil, capacitor oils, properties, solid electrical insulating materials, fibrous, paper boards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling and bounding materials, fibrous, film, mica, rubber, mica based materials, ceramic materials, classification of insulation (solid) and application in AC and DC machines.

UNIT-IV	MAGNETIC MATERIALS	Classes: 10

Soft and hard magnetic materials, diamagnetic, paramagnetic and ferromagnetic materials, electric steel, sheet steel, cold rolled grain oriented silicon steel, hot rolled grain oriented silicon steel, hot rolled silicon steel sheet, hysteresis loop, hysteresis loss, magnetic susceptibility, coercive force, curie temperature, magneto-striction.

UNIT-V	OPTICAL PROPERTIES OF SOLIDS	Classes: 10

Photo emission, photo emission materials, electro luminPCCence junction diode, photo emitters, photo transistor, photo resistors, injunction lasers, optical properties of semiconductors, application of photo sensitive materials (CRT, Tube light, photo panels etc.)

Text Books:

1. “Electrical Engineering Materials”,Dekker,PHIPbs.
2. “Electrical Engineering Materials”, Indulkar,S.Chand

Reference Books:

1. “Electrical Engineering Materials”, Tareev
2. “Electrical Engineering Materials”, Yu. Koritsky.
3. “Electrical Engineering Materials”, R.K.Rajput, LaxmiPbs

Web References:

1. https://physics.info/dielectrics/
2. https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095631265
3. web.mit.edu/course/6/6.732/www/6.732-pt2.pdf

E-Text Books:

1. https://easyengineering.net/electrical-engineering-materials-by-dekker/
2. https://www.oreilly.com/library/view/dielectric-materials-for/9781118619780/

MOOC Course

1. https://nptel.ac.in/courses/108108076/
2. https://nptel.ac.in/courses/112104203/3
3. https://onlinecourses.nptel.ac.in/noc18_ee14/

ANALYSIS OF LINEAR SYSTEMS

(OPEN ELECTIVE – II)

III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE56	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To develop ability to analyze linear systems and signals
2. To develop critical understanding of mathematical methods to analyze linear systems and signals.
3. To Explain the Laplace Transformation techniques
4. To Explain the Sampling of Signals.
5. To Analyze the Z-Transforms.

Course Outcomes:

1. Explain the State Space Analysis of Simple Networks.
2. Analyze the Fourier series and Transformation.
3. Explain the Laplace Transformation techniques.
4. Explain the Sampling of Signals.
5. Analyze the Z-Transforms.

SYLLABUS

UNIT-I	STATE VARIABLE ANALYSIS	Classes: 08

Choice of state variables in Electrical networks-Formulation of state equations for Electrical networks Equivalent source method. Network topological method – Solution of state equations-Analysis of simple networks with state variable approach.

UNIT-II	FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION	Classes: 12

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function , Properties of Fourier Transform , Parseval's theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform. Applications of Fourier series and Fourier Transform Representation: Introduction, Effective value, and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT-III	LAPLACE TRANSFORM APPLICATIONS	Classes: 10

Application of Laplace transform Methods of Ananlysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications Testing of Polynomials: Elements of realisability – Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples. Network Synthesis: Network synthesis: Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods

UNIT-IV	SAMPLING	Classes: 10

Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural

and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.

UNIT-V	Z-TRANSFORMS	Classes: 10

Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z Transform of a discrete sequence. Distinction between Laplace, Fourier, and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.

Text Books:

1. B. P. Lathi", "Signals, Systems and Communications", BS Publications 2003.
2. "Umesh Sinha" "Network Analysis and Synthesis", Satya Prakashan Publications, 2013.

Reference Books:

1. "A. N. Tripathi", "Linear System Analysis", New Age International, 2nd Edition 1987.
2. "D. Roy Chowdhary", "Network and Systems", New Age International, 2005.
3. "Gopal G Bhise, Prem R. Chadha", Engineering Network Analysis and Filter Design, Umesh Publications 2009.
4. "A. Cheng", linear system analysis, Oxford publishers, 1999

Web References:

1. https://archive.org/details/introductiontoli00brow
2. https://ieeexplore.ieee.org/iel5/9/24171/01101971.pdf

E-Text Books:

1. www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete_04Mar10.pdf
2. https://www.springer.com/gp/book/9780387975733

MOOC Course:

1. www.nptelvideos.in/2012/11/estimation-of-signals-and-systems.html
2. https://nptel.ac.in/courses/108104100/6

NEURAL NETWORKS AND FUZZY LOGIC

(OPEN ELECTIVE – II)

III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE57	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications.
2. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
3. To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Course Outcomes:

The students should be able to

1. Comprehend the concepts of feed forward neural networks
2. Analyze the various feedback networks.
3. Understand the concept of fuzziness involved in various systems and fuzzy set theory.
4. Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
5. Analyze the application of fuzzy logic control to real time systems.

SYLLABUS

UNIT-I	**INTRODUCTION & ESSENTIALS TO NEURAL NETWORKS**	**Classes: 12**

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCullochPiUs Model, Historical Developments, Potential Applications of ANN. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN — Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

UNIT-II	**SINGLE & MULTI LAYER FEED FORWARD NEURAL NETWORKS**	**Classes: 10**

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training.

Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Credit Assignment Problem, Generalized Delta Rule, and Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT-III	**ASSOCIATIVE MEMORIES-I**	**Classes: 08**

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).

UNIT-IV	**ASSOCIATIVE MEMORIES-II**	**Classes: 10**

Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hoptield

Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications

UNIT-V	FUZZY LOGIC	Classes: 10

Classical & Fuzzy Sets: Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic System Components:Fuzzification, Membership value assignment, development of rule base and decision making system, Def uzzification to crisp sets, De—fuzzification methods.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, Rajasekharan and Pal, PHI.
2. Neural Networks and Fuzzy Logic, C. Naga Bhaskar, G. Vijay Kumar, BS Publicatior-is.

Reference Books:

1. Artificial Neural Networks, B. Yegnanarayana, PHI.
2. Artificial Neural Networks, Zaruda, PHI.
3. Neural Networks and Fuzzy Logic System, Bail Kosko, PHI.
4. Fuzzy Logic and Neural Networks, M. Amirthavalli, Scitech Publications India Pvt. Ltd.
5. Neural Networks, James A Freeman and Davis Skapura, Pearson Education.
6. Neural networks by satish Kumar, TIVIH, 2004
7. Neural Networks, Simon Hakins , Pearson Education.
8. Neural Engineering, C.Eliasmith and CH.Anderson, PHI.

Web References:

1. *users.monash.edu/~app/CSE5301/Lnts/LaD.pdf*
2. https://engineering.purdue.edu/~tsoukala/rational.html
3. https://pdfs.semanticscholar.org/5e31/c55a00eb3945e3e483caa2e146a95c12f5aa.pdf

E-Text Books:

2. https://www.mheducation.co.in/computer.../neural-networks-fuzzy-systems/text-book
4. www.crectirupati.com/sites/default/files/lecture_notes/NNFL.pdf
6. www.vssut.ac.in/lecture_notes/lecture1423723637.pdf

MOOC Course:

8. https://nptel.ac.in/noc/individual_course.php?id=noc19-ge07
10. https://nptel.ac.in/courses/108104049/16
12. https://nptel.ac.in/courses/117105084/
14. https://nptel.ac.in/syllabus/127105006/

SOLAR ENERGY AND APPLICATIONS

(OPEN ELECTIVE – III)

IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE60	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To Study about solar modules and PV system design and their applications
2. To Deal with grid connected PV systems
3. To Discuss about different energy storage systems

Course Outcomes:

The students should be able to

1. understanding of principles and technologies for solar thermal energy collection, conversion and utilization
2. Understanding of solar heating systems, liquid based solar heating systems for buildings.
3. Identify, formulate and solve simple to complex problems of solar thermal energy conversion and storage.
4. Identify and understand solar thermal systems'components and their function.
5. Analyze hot water load and solar resource data and use this information to properly size a solar thermal system

SYLLABUS

UNIT-I	**INTRODUCTION**	**Classes: 10**
Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection		
UNIT-II	**STAND ALONE PV SYSTEM**	**Classes: 10**
Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing		
UNIT-III	**GRID CONNECTED PV SYSTEMS**	**Classes: 10**
PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs		
UNIT-IV	**ENERGY STORAGE SYSTEMS**	**Classes: 10**
Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage		
UNIT-V	**APPLICATIONS**	**Classes: 10**
Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.		

Text Books:

1. Solanki C.S., “Solar Photovoltaics: Fundamentals, Technologies And Applications”, PHI Learning Pvt. Ltd.,2015.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, “Solar electricity engineering of photovoltaic systems”, Progensa,1994

Reference Books:

1. Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2011.
2. McNeils, Frenkel, Desai, “Solar & Wind Energy Technologies”, Wiley Eastern, 1990 5 S.P. Sukhatme , “Solar Energy”, Tata McGraw Hill,1987.

Web References:

1. https://www.loc.gov/rr/scitech/tracer-bullets/solar-updatetb.html
2. https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100516798
3. https://link.springer.com/journal/11949

E-Text Books:

1. https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
2. *bookstore.teri.res.in/books/9788179935736*

MOOC Course:

1. https://nptel.ac.in/courses/112105051/
2. https://nptel.ac.in/courses/121106014/18
3. https://nptel.ac.in/courses/112105050/
4. https://nptel.ac.in/syllabus/112105051/

INSTRUMENTATION AND CONTROL

(OPEN ELECTIVE – IV)

IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE61	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To introduce the basic principles of all measuring instruments
2. To deal with the measurement of voltage, current measurements
3. To understand students how different types of meters work and their construction
4. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
5. To assess the system performance using time domain analysis and methods for improving it

Course Outcomes:

The students should be able to

1. Identify the instruments suitable for typical measurements.
2. Apply the knowledge about transducers and instrument transformers to use them effectively.
3. Improve the system performance by selecting a suitable controller for a specific application
4. Apply various time domain techniques to assess the system performance

SYLLABUS

UNIT-I	INTRODUCTION TO MEASURING INSTRUMENTS	Classes: 10

Classification —deflecting, control and damping torques — Ammeters and Voltmeters — PMMC, moving iron type instruments — expression for the deflecting torque and control torque — Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type — Extension of range of E.S. Voltmeters.

UNIT-II	POTENTIOMETERS & INSTRUMENT TRANSFORMERS	Classes: 08

Principle and operation of D.C. Crompton's potentiometer—standardisation — Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types standardisation — applications. CT and PT — Ratio and phase angle errors.

UNIT-III	TRANSDUCERS & OSCILLOSCOPES	Classes: 12

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermo couples, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes.
CRO: Cathode ray oscilloscope-Cathode ray tube-time base generator- horizontal and vertical amplifiers-CRO probes-applications of CRO- Measurement of phase and frequency-lissajous patterns.

UNIT-IV	CLASSIFICATION OF CONTROL SYSTEMS	Classes: 10

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems
Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations – Impulse Response and transfer functions .Block diagram algebra – Representation by Signal flow graph – Reduction using mason's gain formula.

UNIT-V	TIME RESPONSE ANALYSIS	Classes: 10

Standard test signals – Time response of first order systems –Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications .Effects of proportional derivative, proportional integral systems.

Text Books:

1. Electrical and Electronic Measurements and Instrumentation, R. K. Rajput, S. Chand & Company Ltd.
2. Electrical Measuring Instruments and Measurements, S. C. Bhargava, BS Publications.
3. I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
4. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

Reference Books:

1. Electrical & Electronic Measurement & Instruments, A.K.Sawhney Dhanpat Rai & Co. Publications.
2. Electrical and Electronic Measurements, G. K. Banerjee, PHI Learning Pvt. Ltd.
3. Electrical Measurements and Measuring Instruments, Golding and Widdis, Reem Publications.
4. N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rdEdition, 1998.
5. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011.
6. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Web References:

1. home.mit.bme.hu/~virosztek/docs/mt.../Principles_of_electrical_measurement.pdf
2. https://www.mccdaq.com/handbook/chapt_4.aspx

E-Text Books:

1. *www.vssut.ac.in/lecture_notes/lecture1423813026.pdf*
2. www.vssut.ac.in/lecture_notes/lecture1423904331.pdf
3. www.ent.mrt.ac.lk/~rohan/teaching/EN5001/Reading/DORFCH1.pdf

MOOC Course:

1. https://nptel.ac.in/syllabus/108106070/
2. https://nptel.ac.in/courses/108105064/
3. https://nptel.ac.in/courses/108101037/

ENERGY STORAGE SYSTEMS

(OPEN ELECTIVE – IV)

IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE63	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To enable the student to understand the need for energy storage, devices and technologies available and their applications.
2. To Analyze the characteristics of energy from various sources and need for storage
3. To Classify various types of energy storage and various devices used for the purpose
4. To Explain the Pumped hydro Storage System.

Course Outcomes:

The students should be able to

1. Analyze the characteristics of energy from various sources and need for storage
2. Classify various types of energy storage and various devices used for the purpose
3. Explain the Pumped hydro Storage System.
4. Identify various real time applications.

SYLLABUS

UNIT-I	**ELECTRICAL ENERGY STORAGE TECHNOLOGIES**	**Classes: 12**

Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT-II	**NEEDS FOR ELECTRICAL ENERGY STORAGE**	**Classes: 08**

Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT-III	**FEATURES OF ENERGY STORAGE SYSTEMS**	**Classes: 08**

Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

UNIT-IV	**TYPES OF ELECTRICAL ENERGY STORAGE SYSTEMS**	**Classes: 10**

Electrical storage systems, Double-layer capacitors (DLC) ,Superconducting magnetic energy storage (SMES),Thermal storage systems, Standards for EES,Technical comparison of EES technologies.

UNIT-V	**APPLICATIONS**	**Classes: 12**

Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA– aggregation of many dispersed batteries.

Text Books:

1. "James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

Reference Books:

1. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

Web References:

1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118991978.hces212

E-Text Books:

1. https://www.pewtrusts.org/~/media/.../energy_storage-backs_up_power_supply.pdf
2. https://energy.mit.edu/wp-content/uploads/2018/04/Energy-Storage-for-the-Grid.pdf
3. https://www.adb.org/sites/default/files/.../handbook-battery-energy-storage-system.pdf

MOOC Course:

1. *nptel.ac.in/courses/112105221/56*
2. *nptel.ac.in/courses/108108036/9*
4. https://nptel.ac.in/courses/108102047/7

OPEN ELECTIVES
OFFERED BY
DEPARTMENT OF INFORMATION TECHNOLOGY

OE1		OE2	
A5IT21	Fundamentals of Data Structures	A5IT23	Basics of Python Programming
A5IT22	Introduction to Machine Learning	A5IT11	Human Computer Interaction
OE3		**OE4**	
A5IT24	Introduction to AI	A5IT26	Introduction to Mobile Application Development
A5IT25	Software Testing Fundamentals	A5IT27	Big Data

FUNDAMENTALS OF DATA STRUCTURES

III Year I Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT21	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. Impart the basic concepts of data structures and algorithms.
2. Understand concepts linked lists and their applications.
3. Understand basic concepts about stacks, queues and their applications.
4. Understand basic concepts of trees, graphs and their applications.
5. Enable them to write algorithms for sorting and searching and hashing.
6. Use advanced data structures like B-Trees, AVL-trees etc., for efficient problem solving.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Evaluate algorithms in terms of time and memory complexity.
2. Implement basic data structures such as arrays, linked lists, stacks and queues.
3. Solve problem involving graphs, trees and heaps
4. Apply Algorithms for solving problems like sorting and searching.
5. Implement advanced data structures such as B-Trees, Red-Black, and AVL-Trees

UNIT-I	INTRODUCTION TO DATA STRUCTURES	Classes: 12

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations

Introduction to Linear and Non Linear data structures-Singly Linked Lists- Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

UNIT-II	STACKS AND QUEUES	Classes: 10

Stacks-Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation.

Queues-Queue ADT, definition and operations, array and linked Implementations in C, Circular queues-Insertion and deletion operations, Dequeue (Double ended queue)ADT, array and linked implementations in C.

UNIT-III	TREESANDGRAPHS	Classes: 14

Trees – Terminology, Representation of Trees, binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals.

Max Priority Queue-ADT- implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap. Graphs , Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.

UNIT-IV	SEARCHINGAND SORTING	Classes: 12

Searching- Linear Search, Binary Search, Comparison of search techniques. **Sorting**-Insertion Sort,

Selection Sort, Radix Sort, Quick sort, Merge Sort, Heap Sort, Comparison of Sorting methods.

UNIT-V	BINARY SEARCH TREES	Classes: 12

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees- Definition and Examples, Insertion into an AVL Tree, B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Comparison of Search Trees.
Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only)

Text Books:

1. Fundamentals of Data Structures Ⅱ, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press

Reference Books:

1. Algorithms,DataStructures,andProblemSolvingwithC++Ⅱ,IllustratedEditionbyMarkAllenWeiss, Addison- Wesley Publishing Company
2. HowtoSolveitbyComputerⅡ,2ndImpressionbyR.G.Dromey,PearsonEducation

INTRODUCTION TO MACHINE LEARNING

III Year I Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT22	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

1. Understand Basic classification algorithms to classify multivariate data
2. Understand the Neural networks and genetic algorithm
3. Gain knowledge about reinforcement learning
4. Create new machine learning techniques.

COURSE OUTCOMES:

1. Develop and apply Basic classification algorithms to classify multivariate data.
2. Develop and apply regression algorithms for finding relationships between data variables.
3. Develop and apply reinforcement learning algorithms for learning to control complex systems.
4. Write scientific reports on computational machine learning methods, results and conclusions.

UNIT – I	**INTRODUCTION**	**CLASSES: 12**

Introduction: Basic Definitions, Types of Learning, Learning Problems Perspectives and Issues, Hypothesis, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias – Decision Tree learning – Representation – Algorithm, issues.

UNIT – II	**ARTIFICIAL NEURAL NETWORKS AND GENETIC ALGORITHMS**	**CLASSES: 12**

ARTIFICIAL NEURAL NETWORKS : Neural Network Representation Problems Perceptions Multilayer Networks and Back Propagation Algorithms-Remarks-Advanced Topics.
GENETIC ALGORITHMS : Genetic Algorithms Hypothesis Space Search

UNIT – III	**BAYESIAN CONCEPTS**	**CLASSES: 12**

BAYESIAN CONCEPTS: Bayes Theorem Concept Learning Maximum Likelihood Minimum Description Length Principle Bayes Optimal Classifier Gibbs Algorithm Naïve Bayes Classifier Bayesian Belief Network, EM Algorithm

UNIT – IV	**INSTANCE BASED LEARNING**	**CLASSES: 14**

K- Nearest Neighbor Learning-Remarks ,Locally weighted Regression, Radial Bases Function-, Case Based Learning-Remarks.

UNIT – V	**ADVACENED LEARNING CONCEPTS**	**CLASSES: 10**

Learning Sets of Rules Sequential Covering Algorithm Learning Rule Set First Order Rules Sets of First Order Rules, Reinforcement Learning Task Learning Temporal Difference Learning.

TEXT BOOKS

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 2010

REFERENCE BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition
2. Introduction to Machine Learning with Python-nora
3. INTRODUCTION TO MACHINE LEARNING
4. Introduction to Machine Learning The Wikipedia Guide

BASICS OF PYTHON PROGRAMMING

III Year II Semester: OPEN ELECTIVE – II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT23	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To Describe the basic elements of the Python language and the Python interpreter and discuss the differences between Python and other modern languages.
2. To Describe Python dictionaries and demonstrate the use of dictionary methods.
3. Define, analyze and code the basic Python conditional and iterative control structures and explain how they can be nested and how exceptions can be used.
4. To Explain and demonstrate methods of error handling and Python exceptions.
5. To demonstrate the understanding of —magic methodsǁ through use of these in the context of a Python application.

COURSE OUTCOMES:

Up on successful completion of the course, the student is able to

1. Write and debug Python programs which make use of the fundamental control structures and method-building techniques.
2. Use data types, input, output, iterative, conditional, and functional components of the language in his or her programs.
3. Use object-oriented programming techniques to design and implement a clear, well-structured Python program.
4. Use and design classes and objects in his or her programs.
5. Outline the specific features of Python which made it more powerful programming language.

UNIT-I	INTRODUCTION TO PYTHON	Classes: 08

Overview, Basic. Python Installation, Comments in Python, Concept of Indentation in python.

UNIT-II	DATA TYPES	Classes: 08

Tuples, Lists More advanced data types (dictionary, string), Python operators, control flows, Loops, Functions.

UNIT-III	MODULES AND PACKAGES	Classes: 08

File handling in python, Module and Packages, Object oriented programming.

UNIT-IV	ADVANCED FUNCTIONS	Classes: 08

Exceptions, sorting, advanced function: map, filter, and reduce.

UNIT-V	INTRODUCTION TO STANDARD LIBRARIES	Classes: 08

Multi-Processing And Multi-Threading, Introduction To Standard Libraries(pandas,Turtle, numpy, os).

Text Books:

1. Learning Python, by Shroff Pub& Dist., O'relly publications, Publication Year: 2013.
Reference Books:
1. Python Programming for Beginners: Python Programming Languageby Joseph Joyner

HUMAN COMPUTER INTERACTION

III Year II Semester: OPEN ELECTIVE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT11	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

7. The human components functions.
8. The Computer components functions.
9. The Interaction between the human and computer components.
10. Interaction design basics
11. HCI in the software process
12. Design rules and Evaluation techniques

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Explain the human components functions regarding interaction with computer
2. Explain Computer components functions regarding interaction with human
3. Demonstrate Understanding of Interaction between the human and computer components.
4. Implement Interaction design basics
5. Use HCI in the software process

UNIT-I	INTRODUCTION	Classes: 12

Importance of user Interface – definition, importance of good design, Benefits of good design. A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT-II	DESIGN PROCESS	Classes: 15

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-III	WINDOWS	Classes: 12

New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT-IV	SOFTWARE TOOLS	Classes: 08

Specification methods, interface – Building Tools.

UNIT-V	INTERACTION DEVICES	Classes: 08

Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dreamtech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.

Reference Books:

1. Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEAL,PEARSON.
2. Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.

\

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

IV Year I Semester: OPEN ELECTIVE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT24	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

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 along with the time and space complexities
3. To learn different knowledge representation techniques
4. To understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

COURSE OUTCOMES:

1. Possess the ability to formulate an efficient problem space for a problem expressed in English.
2. Possess the ability to select a search algorithm for a problem and characterize its time and space complexities.
3. Possess the skill for representing knowledge using the appropriate technique
4. Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing
5. Apply advanced knowledge representation techniques.

UNIT-I	Introduction	Classes:10

Introduction, History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications. Problem Solving – State-Space Search and Control Strategies: Introduction, General Problem Solving, 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-II	Logic Concepts and Logic Programming & Knowledge Representation	Classes:12

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III	Expert System and Applications & Uncertainty Measure – Probability Theory	Classes:13

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools.
Uncertainty Measure – Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT-IV	Machine-Learning Paradigms & Artificial Neural Networks	Classes:13

. Machine-Learning Paradigms: Introduction. Machine Learning Systems. Supervised and Unsupervised Learning. Inductive Learning. Learning Decision Trees, Deductive Learning. Clustering, Support Vector Machines.
Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of

Artificial Neural Networks, Recurrent Networks.

UNIT-V	Advanced Knowledge Representation Techniques	Classes:12

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

TEXT BOOKS:

1. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004

REFERENCE BOOKS:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Introduction to Artificial Intelligence by Eugene Charniak, Pearson.
3. Introduction to Artificial Intelligence and expert systems Dan W.Patterson. PHI.
4. Artificial Intelligence by George Fluger rearson fifth edition.

Web References:

1. http://zsi.tech.us.edu.pl/~nowak/bien/BIEN_introduction.pdf
2. https://epub.uni-regensburg.de/13629/1/ubr06078_ocr.pdf
3. https://lecturenotes.in/subject/128/artificial-intelligence-ai

E-Textbooks:

1. https://books.google.co.in/books?id=DDNHzcN6jasC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=YmH1tXFA14MC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC Course

1. https://www.edx.org/course/artificial-intelligence-1
2. https://www.appliedaicourse.com/

SOFTWARE TESTING FUNDAMENTALS

IV Year I Semester: OPEN ELECTIVE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT25	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn
Software Testing has different goals and objectives.

1. Finding defects which may get created by the programmer while developing the software.
2. Gaining **confidence** in and providing information about the level of quality.
3. To prevent defects.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand software testing methods
2. apply various software testing techniques
3. Design and conduct a software test process for a software testing project
4. Designing solutions for various software testing problems by selecting appropriate software test model
5. Implement various practice oriented software testing projects

UNIT-I	INTRODUCTION	Classes: 08

Basics of software testing, Testing objectives, Principles of testing, Test Life Cycle, Types of testing, Software defect tracking.

UNIT-II	TESTING METHODOLOGIES	Classes: 12

White Box And Black Box Testing, Static Testing, Static Analysis Tools, Structural Testing, Unit/Code functional, testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing.

UNIT-III	INTEGRATION TESTING	Classes: 10

Integration, System, and Acceptance Testing Top down and Bottom up integration, Functional versus Non-functional testing, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing, Acceptance testing

UNIT-IV	TEST SELECTION & MINIMIZATION FOR REGRESSION TESTING	Classes: 10

Test Selection & Minimization for Regression Testing Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.

UNIT-V	TEST MANAGEMENT AND AUTOMATION TEST PLANNING	Classes: 10

Test Management and Automation Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection.

Text Books:

1. S. Desikan and G. Ramesh, “Software Testing: Principles and Practices”, Pearson Education.
2. Aditya P. Mathur, “Fundamentals of Software Testing”, Pearson Education.

Reference Books:

1. Naik and Tripathy, “Software Testing and Quality Assurance”, Wiley
2. K. K. Aggarwal and Yogesh Singh, “Software Engineering”, New Age International Publication.

INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT

IV Year II Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT26	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. Produce apps for Android platform devices
2. Gain a basic understanding of computer architecture and object-oriented programming
3. Develop a working knowledge of Apple's Xcode app development tool
4. Understand mobile design principles
5. Identify need and opportunity in app markets

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Describe those aspects of mobile programming that make it unique from programming for other platforms,
2. Critique mobile applications on their design pros and cons,
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
4. Program mobile applications for the Android operating system that use basic and advanced phone features, and
5. Deploy applications to the Android marketplace for distribution.

UNIT-I	INTRODUCTION TO ANDROID	Classes: 10

The Android Platform, Android SDK, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT-II	ANDROID APPLICATION DESIGN ESSENTIALS	Classes: 08

Android terminologies, Application Context, Activities.

UNIT-III	ANDROID USER INTERFACE DESIGN ESSENTIALS	Classes: 08

User Interface Screen elements, Designing User Interfaces with Layouts.

UNIT-IV	TESTING ANDROID APPLICATIONS	Classes: 08

Testing Android applications, Publishing Android application, Using Android preferences, managing Application resources in a hierarchy, working with different types of resources.

UNIT-V	USING COMMON ANDROID APIS	Classes: 10

Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers.

Text Books:

1. Lauren Darcey and Shane Conder, —Android Wireless Application Development‖, Pearson Education,2nd ed. (2011)

Reference Books:

1. R1. Reto Meier, —Professional Android 2 Application Development‖, Wiley India Pvt Ltd
2. R2. Mark L Murphy, —Beginning Android‖, Wiley India Pvt Ltd.
3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition.

BIG DATA

IV Year II Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT27	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics and Visualization
3. To demonstrate the usage of various Big Data tools and Data Visualization tools

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. **Compare** various file systems and **use** an appropriate file system for storing different types of data.
2. **Demonstrate** the concepts of Hadoop ecosystem for storing and processing of unstructured data.
3. **Apply** the knowledge of programming to process the stored data using Hadoop tools and generate reports.
4. **Connect** to web data sources for data gathering, **Integrate** data sources with hadoop components to process streaming data.
5. **Tabulate** and **examine** the results generated using hadoop components.

UNIT-I	INTRODUCATION TO BIG DATA	Classes: 12

Data and its importance, Big Data- Definition, V's of Big Data, Hadoop Ecosystem

HADOOP ARCHITECTURE

Hadoop Storage : HDFS, Hadoop

Processing : MapReduce Framework

Hadoop Server Roles : Name Node, Secondary Name Node and Data Node, Job Tracker, Task Tracker

HDFS-HADOOP DISTRIBUTED FILE SYSTEM

Design of HDFS, HDFS Concepts, HDFS Daemons, HDFS High Availability, Block Abstraction, FUSE-File System in User Space. HDFS Command Line Interface (CLI),Concept of File Reading and Writing in HDFS.

UNIT-II	MAPREDUCE PROGRAMMING MODEL	Classes: 12

Introduction to Map Reduce Programming model to process Big Data, key features of MapReduce, MapReduce Job skeleton, Introduction to MapReduce API, Hadoop Data Types, Develop MapReduce Job using Eclipse, build a MapReduce Job export it as a java archive(.jar file).

MAPREDUCE JOB LIFE CYCLE: How Map reduce Works? Understanding Mapper ,Combiner, Partitioner ,Shuffle & Sort and Reduce phases of MapReduce Application, Developing Map Reduce Jobs based on the requirement using given datasets like weather dataset.

MAPREDUCE API: Understanding new MapReduce API from org.apache.hadoop.mapreduce and its sub packages to develop MapReduce applications ,key difference between old MapReduce API and the new MapReduce API.

UNIT-III	INTRODUCTION TO PIG	Classes: 12

Understanding pig and pig Platform, introduction to Pig Latin Language and Execution engine, running pig in different modes, Pig Grunt Shell and its usage.

PIG LATIN LANGUAGE–DATA TYPES IN PIG
Pig Latin Basics, Key words ,Pig Data types ,Understanding Pig relation, bag, tuple and writing pig relations or statements using Grunt Shell ,expressions, Data processing operators, using Built in functions.

WRITING PIG SCRIPTS USING PIG LATIN: Writing pig scripts and saving them in text editor, running pig scripts from command line.

UNIT-IV	INTRODUCATION TO HIVE	Classes: 12

Understanding Hive Shell, Running Hive, Understanding Schema on read and Schema on write.

HIVE QL DATA TYPES, SEMANTICS: Introduction to Hive QL (Query Language), Language semantics, Hive Data Types.

HIVE DDL, DML AND HIVE SCRIPTS: Hive Statements, Understanding and working with Hive Data Definition Languages and Manipulation Language statements, Creating Hive Scripts and running them from hive terminal and commands line.

UNIT-V	SQOOP, FLUME, OOZIE	Classes: 12

SQOOP: Introduction to Sqoop tool, commands to connect databases and list databases and tables, command to import data from RDBMS into HDFS, Command to export data from HDFS into required tables of RDBMS.

FLUME: Introduction to Flume agent, understanding Flume components Source, Channel and Sink, Writing flume configuration file, running flume configuration file to ingest the data into HDFS.

OOZIE: Introduction to Oozie, Understanding work flow and how to create Work flow using Work Flow definition language in XML, running a basic Oozie workflow to run a MapReduce job.

Text Books:

1. Hadoop: The Definitive Guide, 4th Edition - O'Reilly Media
2. Big Data and Hadoop- Learn by Example, Mayank Bhushan

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

OPEN ELECTIVES
OFFERED BY
DEPARTMENT OF MECHANICAL ENGINEERING

OPEN ELECTIVE COURSE-I			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5ME71	Elements Of Mechanical Engineering	Mechanical Engineering
2.	A5ME72	Fundamentals of Engineering Materials	
OPEN ELECTIVE COURSE- II			
3.	A5ME73	Fundamentals of Mechatronics	Mechanical Engineering
4.	A5ME74	Basics Of Thermodynamics	
OPEN ELECTIVE COURSE- III			
5.	A5ME75	Basics of Robotics	Mechanical Engineering
6.	A5ME76	Fundamentals of Operations Research	
OPEN ELECTIVE COURSE- VI			
7.	A5ME77	Introduction to Material Handling	Mechanical Engineering
8.	A5ME78	Renewable Energy Sources	

ELEMENTS OF MECHANICAL ENGINEERING

V Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME71	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

This course deals with fundamental concepts of design, manufacturing and thermal engineering.

COURSE OBJECTIVES:

The course aims to enable the students learn basic concepts of mechanics, materials, thermodynamics, manufacturing and CAD/CAM.

COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability:

1. To demonstrate basic concepts of mechanics of rigid and deformable bodies.
2. To explain fundamentals of metallurgy and material science.
3. To discuss basic concepts and principles of thermodynamics.
4. To demonstrate the elements of fabrication processes and equipment.
5. To explain basic concepts of CAD/CAM.

UNIT-I MECHANICS

MECHANICS OF RIGID BODIES: Force, Force system, Classification of force systems, triangle law, parallelogram law-derivation and problems, polygon law, resolution of forces in coplanar-concurrent force system-problems; Definition of friction, laws of friction, coefficient of friction, types of friction, angle of friction, angle of repose, Definition of centroid and centre of gravity, pappus and guldinus theorems, problems on centroid of plane areas; Definition of area moment of inertia, parallel axis theorem, perpendicular axis theorem, simple problems on area moment of inertia.

MECHANICS OF DEFORMABLE BODIES: Stress, Strain, Types of stresses and strains, Poisson's ratio, stress-strain curve of mild steel, Hooke's Law, factor of safety, mechanical properties of materials, bulk modulus, shear modulus, bars of uniform and varying sections-simple problems.

UNIT-II METALLURGY & MATERIAL SCIENCE

Bonds in Solids, crystallization of metals, Classification of steels, Necessity of alloying, types of solid solutions, lever rule, phase rule, cooling curve of pure iron, Iron-Iron carbide diagram, Heat treatment-Annealing, quenching, normalizing, Hardening, tempering; Ceramic materials-classification, properties and applications.

UNIT-III	THERMO DYNAMICS

System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic view points, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry , First law of Thermodynamics – Corollaries, First law applied to a Closed System, applied to a flow system, Steady Flow Energy Equation and Limitations of the First Law, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements, Carnot cycle and its specialties.

UNIT-IV	MANUFACTRUING

Casting-Types of casting, advantage of casting and its applications, defects in castings; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances; Welding-classification, Heat affected zone in welding, welding defects-causes and remedies; Basic extrusion process and its characteristics, Forging operations and principles; Basic machining operations-drilling, milling, turning, step turning, threading, grinding and shaping; Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system.

UNIT-V	CAD/CAM

Fundamentals of CAD/CAM- Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD; Wire frame modeling: Definition, advantages, dis-advantages, wire frame entities-analytic entities and synthetic entities; Surface modeling: Definition, advantages, disadvantages, surface entities-analytic entities and synthetic entities; Solid Modeling: Definition, constructive solid geometry, advantages, modeling entities.

Text Books:

1. Singer's Engineering Mechanics by K.Vijay Kumar Reddy and J.Suresh Kumar, B.S Publications
2. Introduction to physical metallurgy by Avner, TATA McGawHill Edition.
4. Thermodynamics by P.K Nag, McGaw Hill Education.
5. Production Technology by R.K Jain, Khanna Publishers.
6. CAD/CAM Theory & Practice by Ibrahim Zeid & R.Sivasubramanian, McGaw Hill Education.

Reference Books:

1. Engineering Mechanics By R.K.Bansal, Laxmi Publications
2. Material science and metallurgy by OP Khanna, Dhanpat Ray Publications
3. Engineering Thermodynamics By Pakirappa, V.Naveen Kumar, V.Naresh, Durga Publishing House
4. Production Technology by Dr. P.C Sharma, S.CHAND
5. CAD/CAM By P.Radha Krishnan, S.Subramanyan and V.Raju, New Age International Publishers.
6. Sterngth of Materials By Dr.Sadhu Singh, Khanna Publishers.

FUNDAMENTALS OF ENGINEERING MATERIALS

V Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME72	PCC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

This course will enable students to understand basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment, various heat treatment processes, the need and application of composite materials.

COURSE OUTCOMES:

At the end of course students are able to

1. Explain basic concepts of crystal structure such as unit cells, crystal systems of metals etc.
2. Demonstrate the concept of alloying and formation of different types of phases in alloys.
3. Differentiate ferrous and non ferrous alloys.
4. Explain various heat treatment processes.
5. Classify and explain polymers, ceramics and composites.

UNIT-I CRYSTAL STRUCTURE

Unit cells, crystal systems of metals, Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, determination of grain size, effect of grain size on the properties of alloys.

UNIT-II ALLOYS & PHASE DIAGRAMS

Alloys- substitutional and interstitial solid solutions.
Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructure of ledeburite, austenite, ferrite and cementite.

UNIT-III FERROUS AND NON FERROUS ALLOYS

Alloying of steel, properties of stainless steel and tool steels, maraging steels; cast irons-grey, white, malleable and spheroidal cast irons; copper and copper alloys- brass, bronze and cupro-nickel; Aluminium and Aluminium alloys.

UNIT-IV HEAT TREATMENT OF STEEL

Annealing, tempering, normalizing and spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

UNIT-V POLYMERS, CERAMICS AND COMPOSITES

Classification, properties and applications of polymers, ceramics, composites and nano materials.

Text Books:

1. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
2. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.
3. Sidney H. Avener (2007,) *Introduction to Physical Metallurgy*, 2nd edition, Tata McGraw hill education (P) Ltd, New Delhi, India.

Reference Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. D. Kodgire (2006), Material Science and Metallurgy for engineers, 1st Edition, Everest, Pune, India.

FUNDAMENTALS OF MECHATRONICS

VI Semester: OPEN ELECTIVE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME73	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

The aim is to introduce students to the fundamental concepts and principles mechatronics. It builds upon the awareness and necessity of interdisciplinary dependency of 21st century. It aim is also to engage students to understand the introduction to mechatronics with emphasis on analog electronics, digital electronics, sensors and transducers, actuators, and microprocessors. Lectures are intended to provide the student with foundational concepts in mechatronics and practical familiarity with common elements making up mechatronic systems.

COURSE OUTCOMES:

At the end of the course students are able to

1) Demonstrate various elements underlying mechatronic systems, electronics, control systems and able differentiate their purpose in the system.
2) Analyze and select sensors, actuators, electromechanical components needed for an application.
3) To evaluate microprocessor and microcontroller interfacing to mechanical application.
4) To choose PLC to a mechanical application.
5) To design mechatronic systems for mechanical applications.

UNIT-I INTRODUCTION

Introduction to Mechatronics –-Mechatronics systems - Mechatronics design process - Mechatronics in Manufacturing –Adoptive and distributed control systems – Modelling and simulation of mechatronics systems.

UNIT-II SENSORS AND ACTUATORS

Sensors and actuators: Overview of sensors and transducers – Microsensors - Signal conditioning – Operational amplifiers – Protection – Filtering - Analog and Digital converters. Electro – pneumatics and Electro – hydraulics - Solenoids – Direct Current motors – Servomotors – Stepper motors - Micro actuators; Drives selection and application.

UNIT-III INTERFACING

Interfacing: Microprocessor based Controllers Architecture of microprocessor and microcontroller – System interfacing for a sensor, keyboard, display and motors - Application cases for temperature control, warning and process control systems

UNIT-IV PLCs

PLCs: Programmable Logic Controllers Architecture of Programmable Logic Controllers – Input/Output modules – programming methods – Timers and counters – Master control –

Branching – Data handling – Analog input/output – Selection of PLC and troubleshooting.	
UNIT-V	**ARTIFICIAL INTELLIGENCE**
AI: Intelligent Mechatronics and Case Studies Fuzzy logic control and Artificial Neural Networks in mechatronics – Algorithms – Computer – based instrumentation - Real-time Data Acquisition and Control – Software integration – Man Machine interface -Vision system – Mechatronics system case studies.	
Text Books:	
1. Introduction to Mechatronics and Measurement Systems, Tata McGraw Hill	
Reference Books:	
1. Designing Intelligent Machines, Michel B. Histand and David G. Alciatore, Open University London 2. Control Sensors and Actuators, ICW. Desiha, Prentice Hall	

BASICS OF THERMODYNAMICS

VI Semester: OPEN ELECTIVE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME74	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

Thermodynamics is the field of physics that deals with the relationship between heat and work in a substance during a thermodynamic process. This course covers fundamental concepts of thermodynamics such as laws of thermodynamics, purse substances, perfect gas laws, mixture of perfect gases, moiler charts and Psychrometry.

COURSE OBJECTIVES:

To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics for the analysis of thermal equipment

COURSE OUTCOMES:

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

1. Demonstrate basic concepts of thermodynamics.
2. Explain laws of thermodynamics.
3. Explain pure substances and power cycles.
4. Explain perfect gas laws and concepts of mixture of perfect gases.
5. Discuss fundamental concepts of psychrometry.

UNIT-I INTRODUCTION

Introduction: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry

UNIT-II LAWS OF THERMO DYNAMICS

First law of Thermodynamics – Corollaries – First law applied to a Closed System – applied to a flow system – Steady Flow Energy Equation. Limitations of the First Law

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Elementary Treatment of the Third Law of Thermodynamics

UNIT-III PURE SUBSTANCES & POWER CYCLES

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables.

Power Cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

UNIT-IV PERFECT GAS LAWS & MIXTURE OF PERFECT GASES

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial

pressure.

UNIT-V	PSYCHROMETRY

Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

Text Books:

1. Engineering Thermodynamics, P.K. Nag, 6th Edition, Mc Graw Hill Education.
2. Thermodynamics an engineering approach, Yunus A. Cengel & Michael A. Boles, 8th Edition, Mc Graw Hill Companies.
3. Fundamentals of Thermodynamics, Richard E. Sonntag Claus Borgnakke, 7th Edition, Wiley.

Reference Books:

1. Fundamentals of engineering thermodynamics, Radhakrishnan. E, 2nd Edition, Prentice hall of India Pvt Ltd., 2006.
2. Thermodynamics, Arora.C.P, Tata Mc Graw Hill, New Delhi.
3. Applied Thermodynamics, Onkar Singh, 3rd Edition, New Age, India

BASICS OF ROBOTICS

VII Semester: OPEN ELECTIVE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME75	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

Today robot finds applications in industries, medical and other fields. For example, in eye surgery (replacement of retina), where a cylindrical portion needs to be replaced, the operation is best done by robots. Mobile robots like walking machines, hopping machines are examples of robots, Nuclear and power plants uses fish like robots which move inside pipes for purpose of inspection. This course focuses on b various types of industrial robots, their kinematic and kinetic aspects, different types of grippers, mechanics of grippers, trajectory planning etc.

COURSE OUTCOMES:

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

1. Demonstrate different types of robots, specifications of robots and different end effectors used in robots.
2. Explain various types of end effectors
3. Evaluate rotation matrices, forward kinematics of RR, RP and 3R Manipulators.
4. Explain inverse kinematics of RR manipulator, RP manipulator and trajectory planning techniques.
5. Explain feedback components used in robots and industrial applications.

UNIT-I INTRODUCTION

Introduction: Automation and Robotics, Asimov's laws, Robot Architecture, Components, , Anatomy of robot, Factors to be considered in the selection of robot, present and future applications, Specifications- Degree of freedom, Pay load, Parts per hour, Accuracy, Repeatability, Speed, Work space, Work volume, Work envelope, classification of robots based on configuration and control systems

UNIT-II END EFFECTORS & ACTUATORS

End effectors: Mechanical and Non-mechanical grippers, requirements for the design of grippers, considerations for the selection of grippers, Types of actuation mechanisms.

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators

UNIT-III MOTION ANALYSIS & DIRECT KINEMATICS

Motion Analysis: Basic Rotation Matrices, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: D-H notation, D-H method of Assignment of frames, D-H Transformation Matrix, joint coordinates and world coordinates, Forward kinematics of 2R, RP and 3R manipulators

UNIT-IV INVERSE KINEMATICS & TRAJECTORY PLANNING

Inverse kinematics : Inverse kinematics of 2R and RP manipulators.

Trajectory Planning: Definition of Trajectory planning, Path, Trajectory, Knot points, Steps involved in trajectory planning, Trajectory planning techniques-Joint space and Cartesian space techniques, Cubic polynomial trajectory

UNIT-V	FEEDBACK COMPONENTS & APPLICATIONS

Feedback Components: Position sensors – potentiometers, resolvers, optical encoders, Velocity sensor, Contact Sensors-Touch sensors, Tactile and Range sensors, Force and Torque sensors, Proximity sensor, Inductive sensor.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Industrial Robotics by Groover M P, Pearson Edu.
2. Robotics by Fu K S, McGraw Hill.
3. Theory of Applied Robotics (kinematics,Dynamics and Control-Jazar,Springer.

Reference Books:

1. Robotics and Control by Mittal R K & Nagrath I J, TMH.
2. Robot Dynamics and Controls by Spony and Vidyasagar, John Wiley
3. Robot Analysis and control by Asada and Slotine, Wiley Inter-Science
4. Introduction to Robotics by John J Craig, Pearson Education

FUNDAMENTALS OF OPERATIONS RESEARCH

VII Semester: OPEN ELECTIVE - III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME76	OEC	3	-	-	3	30	70	100

COURSE DESCRIPTION:

Operations research (OR) is an analytical method of problem-solving and decision-making that is useful in the management of organizations. In operations research, problems are broken down into basic components and then solved in defined steps by mathematical analysis. This course gives insight of Linear Programming, Transportation, assignment problems, sequencing etc.

COURSE OBJECTIVES:

The objectives of this course are to learn quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

COURSE OUTCOMES:

At the end of course students will be able to

1. Describe types of models and solve linear programming problem.
2. Solve transportation and assignment problems.
3. Analyze sequencing and replacement models and apply them for optimization.
4. Apply gaming theory for optimal decision making.
5. Analyze inventory models to optimize the cost

UNIT-I INTRODUCTION & ALLOCATION

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT-II TRANSPORTATION & ASSIGNMENT PROBLEMS

TRANSPORTATION PROBLEM: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

ASSIGNMENT PROBLEM: Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT-III SEQUENCING & REPLACEMENT

SEQUENCING: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines

REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely.

UNIT-IV	THEORY OF GAMES

THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

UNIT-V	INVENTORY

INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

Text Books:

1. Operation Research by J.K.Sharma, MacMilan.
2. Operations Researchby ACS Kumar, Yesdee

Reference Books:

1. Operations Research: Methods and Problems by Maurice Saseini, Arhur Yaspan and Lawrence Friedman
2. Operations Research by A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi, Pearson Education.
3. Operations Research by Wagner, PHI Publications.
4. Introduction to O.Rby Hillier & Libermann,TMH.

INTRODUCTION TO MATERIAL HANDLING

VIII Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME77	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. As a process, material handling incorporates a wide range of manual, semi-automated and automated equipments and systems that support logistics and make the supply chain work. This course will give an insight material handling equipment such as transport systems and storage systems, various inventory models and forecasting techniques.

COURSE OBJECTIVES:

The aim of this course is to enable the students to learn basic concepts of material handling, consideration in material handling system, materials transport and storage system, various inventory models and forecasting techniques.

COURSE OUTCOMES:

At the end of the course students are able to

1. Demonstrate basic concepts and principles of material handling.
2. Discuss about various material transport systems.
3. Explain conventional and automated storage systems.
4. Explain various inventory models.
5. Demonstrate different forecasting techniques.

UNIT-I	INTRODUCTION

Introduction: Overview of material handling equipment, considerations in material handling system design, The 10 principles of material handling.

UNIT-II	MATERIAL TRANSPORT SYSTEMS

Material Transport Systems: Industrial trucks, Automated guided vehicle systems, Monorails and other rail guided vehicles, conveyor systems, cranes and hoists, Analysis of material transport systems.

UNIT-III	STORAGE SYSTEMS

Storage Systems: Storage system performance, storage location strategies, conventional storage methods and equipment, automated storage systems and analysis of automated storage systems.

UNIT-IV	INVENTORY

Inventory: Introduction, Inventory management, Static Inventory models, ABC Analysis, VED analysis, Just in Time, Aggregate inventory analysis, Inventory models with quantity discounts.

UNIT-V	FORECASTING

Forecasting: Forecasting techniques, Make or Buy decision, Acceptance sampling, Materials requirement planning, objectives of master schedule.

Text Books:

1. Mikell P. Groover, Automation Production Systems and Computer Integrated Manufacturing, Pearson International Edition.
2. A.K Singh, Materials Management, Laxmi Publications (P) Ltd.

Reference Books:

1. Dr.K.C Arora, Vikas V.Shinde, Aspects of Material Handling, Laxmi Publications (P) Ltd.
2. Charles Reese, Material Handling Systems, Taylor & Francis Network

RENEWABLE ENERGY SOURCES

VIII Semester: OPEN ELECTIVE - IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME78	OEC	3	0	0	3	30	70	100

COURSE OVERVIEW:

The energy has become an important and one of the basic infrastructures for the economic development of the country. It is imperative for the sustained growth of the economy. This course envisages the new and renewable source of energy, available in nature and to expose the students on sources of energy crisis and the alternates available, also stress up on the application of non-conventional energy technologies.

COURSE OBJECTIVES:

To impart the knowledge of basics of different non conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.

COURSE OUTCOMES:

At the end of the course students are able to

1. Demonstrate various energy sources and their availability.
2. Explain concepts and applications of solar radiation
3. Discuss eloboratively the principles of wind energy conversion
4. Explain Biomass conversion techniques and Geothermal Sources and resources
5. Explain about tidal energy and Ocean Thermal Energy.

UNIT- I ENERGY SOURCES & THEIR AVAILABILITY

Energy Sources & their Availability - Importance of Non Conventional Energy Resources - Classification of NCES - Solar, Wind, Geothermal, Bio-mass, Nuclear Energy & Fuel Cells, Ocean Energy Sources, Comparison of these Energy Sources, Prospects of Renewable Energy Sources - Criteria for Assessing the Potential of NCES, Statistics on Conventional Energy Sources and supply in Developing Countries

UNIT- II INTRODUCTION TO SOLAR RADIATION & APPLICATIONS OF SOLAR ENERGY

Introduction to Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Solar Energy Storage – Collectors: Flat plate and Concentrating collectors, collector efficiency, Focusing and non-focusing type

Applications of Solar Energy - solar water heater- Solar Cooker-Box type- Solar dryer - solar greenhouse—Summer and winter greenhouse-solar electric power generation- Solar Photo- Voltaic, Solar Cell Principle, Conversion efficiency and power output, Basic Photo Voltaic System for Power Generation.

UNIT- III	PRINCIPLE OF WIND ENERGY CONVERSION

Principle of Wind Energy Conversion - Basic components of Wind Energy Conversion Systems : Wind data and energy estimation, Site Selection Considerations - Wind mill Components, Various Types and their Constructional Features - Effect of Density, Frequency Variances, Angle of attack, and Wind Speed - Design Considerations of Horizontal and Vertical Axis Wind Machines - Analysis of Aerodynamic Forces Acting on Wind Mill Blades and Estimation of Power Output.

UNIT- IV	BIOMASS CONVERSION TECHNIQUES , GEOTHERMAL SOURCES AND RESOURCES

Biomass conversion techniques - Biogas Generation - Factors affecting biogas Generation-Types of biogas plants - Advantages and disadvantages of biogas plants - site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas - urban waste to energy conversion.

Geothermal Sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India - exhaust types of conventional steam turbines.

UNIT- V	TIDAL ENERGY & OCEAN THERMAL ENERGY CONVERSION

Tidal Energy - Principle of working, performance and limitations. Wave Energy - Principle of working, performance and limitations.

Ocean Thermal Energy Conversion - Availability, theory and working principle, performance and limitations. OTEC power plants, Operational of small cycle experimental facility, Economics of OTEC, Environmental impacts of OTEC.

Text Books:

1. G. D. Rai, “Non-Conventional Energy Sources”,4th Edition, Khanna Publishers, 2000

2. B H Khan, “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011

Reference Books:

1. S.Hasan Saeed and D.K.Sharma , “Non-Conventional Energy Resources”,3rd Edition,S.K.Kataria & Sons, 2012
2. Renewable energy sources and conversion technology by N.K. Bansal, M. Kleemann, M. Heliss, Tata McGraw Hill 1990.
3. S. P. Sukhatme”, “Solar Energy Principles and Application”, TMH, 2009

OPEN ELECTIVES
OFFERED BY
DEPARTMENT OF HSM

OPEN ELECTIVE COURSE-I			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1	A5HS06	Business Economics and Financial Analysis	HSM
2	A5HS07	Basics of Entrepreneurship	HSM
OPEN ELECTIVE COURSE-II			
3	A5HS09	Advanced Entrepreneurship	HSM
OPEN ELECTIVE COURSE-III			
4	A5HS10	Indian Ethos & Business Ethics	HSM
OPEN ELECTIVE COURSE-IV			
5	A5HS15	Management Science	HSM
6	A5HS16	Intellectual Property Rights	HSM

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

V Semester: OPEN ELECTIVE-I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS06	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To enable the student to understand and appreciate, with a particular insight, the importance of certain basic issues governing the business operations namely; demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting and financial accounting and financial analysis.

COURSE OUTCOMES:

At the end of the course, the student will

1. Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
2. Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Develop an understanding of Analyse how capital budgeting decisions are carried out.
4. Understanding the framework for both manual and computerised accounting process
5. Know how to analyse and interpret the financial statements through ratio analysis.

UNIT-I	INTRODUCTION & DEMAND ANALYSIS	Classes: 12

Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT-II	PRODUCTION & COST ANALYSIS	Classes: 12

Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-DouglasProduction function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT-III	MARKETS & NEW ECONOMIC ENVIRONMENT	Classes: 12

Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT-IV	CAPITAL BUDGETING	Classes: 12

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of return (ARR) and Net Present Value Method (simple problems).

UNIT-V	INTRODUCTION TO FINANCIAL ACCOUNTING & FINANCIAL ANALYSIS	Classes: 12

Accounting concepts and Conventions - Introduction IFRS - Double - Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trasing Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

Text Books:

1. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi, 2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey &Chrystel, Economics, Oxford University Press, 2012.
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting - A Managerial Perspective, Pearson, 2012.
6. S.N. Maheswari& S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha: MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar &Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J.V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

BASIC OF ENTREPRENEURHIP

V Semester: OPEN ELECTIVE-I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A4HS07	Foundation	3	0	0	3	30	70	100
Contact Classes: 50	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 50		

COURSE OBJECTIVES:

The course should enable the students to:

The curriculum helps students

1. Understand and **discover** entrepreneurship
2. Build a strong foundation for students to **start**, **build**, and **grow** a viable and sustainable venture
3. Develop an entrepreneurial outlook and **mindset**, critical **skills** and **knowledge**
4. Mitigate three types of **risks:** Customer, Business Model, and Product/Technical

COURSE OUTCOMES:

1. Entrepreneurship and Innovation minors will be able to sell themselves and their ideas. Students master oral and visual presentation skills and establish a foundation of confidence in the skills necessary to cause others to act.
2. The ability to imagine, recognize, and seize opportunities for innovation and new venture creation in the arts and culture sector
3. The know-how to bring capital to ideas in both commercial and nonprofit domains.

UNIT-I	DISCOVER YOURSELF AND IDENTIFY PROBLEMS WORTH SOLVING	Classes: 10

Discover Yourself: Find your flow, Effectuation, Case Study: Tristan Walker: The extroverted introvert, Identify your entrepreneurial style,

Identify Problems Worth Solving: What is a business opportunity and how to identify it, Find problems around you that are worth solving, Methods for finding and understanding problems - (Observation, Questioning, DT, Jobs to be done (JTBD), How to run problem interviews to understand the customer's worldview, Introduction to Design Thinking – Process and Examples,

Generate ideas that are potential solutions to the problem identified – DISRUPT, Class Presentation: Present the problem you "love"

UNIT-II	CUSTOMER, BUSINESS MODEL, VALIDATION	Classes: 10

CUSTOMER :Identify Your Customer Segments and Early Adopters - The difference between a consumer and a customer (decision maker), Market Types, Segmentation and Targeting, Defining the personas; Understanding Early Adopters and Customer Adoption Patterns, Identify the innovators and early adopters for your startup; Craft Your Value Proposition - Come up with creative solutions for the identified problems, Deep dive into Gains, Pains and "Jobs-To- Be-Done" (using Value Proposition Canvas, or VPC), Identify the UVP of your solution using the Value Proposition section of the VPC, Outcome-Driven Innovation, Class Presentation: Communicating the Value Proposition- 1 min Customer Pitch .

BUSINESS MODEL: Get Started with Lean Canvas.

VALIDATION: Develop the Solution, Sizing the Opportunity, Building an MVP.

UNIT-III	MONEY AND TEAM	Classes: 12

MONEY: Revenue Streams - Basics of how companies make money, Understand income, costs, gross and net margins, Identify primary and secondary revenue, streams ; Pricing and Costs - Value, price, and costs; Different pricing, Understand product costs and operations costs; Basics of

unit costing strategies; Financing Your New Venture - How to finance business ideas, Various sources of funds available to an entrepreneur and pros and cons of each, What investors expect from you, Practice Pitching to Investors and Corporates.
TEAM: Team Building - Shared Leadership, Role of a good team in a venture's success; What to look for in a team; How do you ensure there is a good fit? Defining clear roles and responsibilities, How to pitch to candidates to join your startup, Explore collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board, Slack.

UNIT-IV	MARKETING & SALES	Classes: 10

MARKETING & SALES: Positioning - Understand the difference between product and brand and the linkbetween them, Define the positioning statement for your product/service and how it should translate into what your customers should see about that brand in the market place.
Channels &Strategy :• Building Digital Presenceand leveraging Social media,Creating your company profile page,Measuring the effectiveness ofselectedchannels,Budgeting and planning.

UNIT-V	PLANNING & TRACKING	Classes: 08

Sales Planning : Understanding why customers buy and how buying decisions are made; Listening,Sales planning, setting targets,Unique Sales Proposition (USP); Art ofthe sales pitch (focus on customers needs, not on product features,Follow-up and closing a sale; Asking for the sale
Planning &Tracking : Importance of project management to launch and track progress, Understanding timemanagement,workflow, and delegation oftasks.
Business Regulation : Basics of business regulations ofstarting and operating a business; Importance of being compliant and keeping proper documentation,How to find help to getstarted.

Text Books:

1. S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International, 2007.
2. Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016.
3. D F Kuratko and T V Rao —Entrepreneurship-A South-Asian Perspective —Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)

Reference Books:

1. Vasant Desai —Small Scale industries and entrepreneurshipll Himalaya publishing 2012.
2. Rajeev Roy —Entrepreneurshipll 2e, Oxford, 2012.
3. B.JanakiramandM.Rizwanall Entrepreneurship Development: Text &Cases,Excel Books,2011.
4. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
5. Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

Web References:

1. http://freevideolectures.com/Course/3641/Entrepreneurship-Through-the-Lens-of-Venture- Capital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd

ADVANCED ENTREPRENEURHIP

VI Semester: OPEN ELECTIVE-II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A4HS13	Foundation	3	0	0	3	30	70	100
Contact Classes: 50	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 50		

COURSE OBJECTIVES:

The course should enable the students to:

The curriculum helps students

1. Understand and **discover** entrepreneurship
2. Build a strong foundation for students to **start**, **build**, and **grow** a viable and sustainable venture
3. Develop an entrepreneurial outlook and **mindset**, critical **skills** and **knowledge**
4. Mitigate three types of **risks:** Customer, Business Model, and Product/Technical

COURSE OUTCOMES:

1. The knowledge and mastery of organizational and management techniques in the arts, including leadership, organizational design, human resources, legal issues, and finance
2. The knowledge of the legal and ethical environment impacting business organizations and exhibit an understanding and appreciation of the ethical implications of decisions.
3. An ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.

UNIT-I	ORIENTATION TO GROWTH	Classes: 10

ORIENTATION TO GROWTH : Getting Ready for Growth-Why growth stage is different compared to startup phase, Why Product-Market fit is not enough, Case study, To assess readiness for growth,To chart a growth path.

UNIT-II	CUSTOMER, BUSINESS MODEL, VALIDATION	Classes: 10

CUSTOMERS : Expanding Customer Base-Revisit your business model and develop fewvariants (more business modeltypes),Identify additional customersegmentsthatyoursolution can address,Evaluate business modelsforthe new customer segments,Relook at the Problem Statement (can you expand the scope and scalability of your business by repositioning your problem statement?), Explore additional ways to monetize.

BUSINESS MODEL: Get Started with Lean Canvas.

VALIDATION: Develop the Solution, Sizing the Opportunity, Building an MVP.

UNIT-III	TRACTION AND TEAM	Classes: 12

TRACTION : Scaling - How to gain traction beyond earlycustomers,Defining traction (in quantifiable terms) and identifying themost important metricstomeasuretraction,Calculate cost of new customeracquisition,Estimate your customer lifetime value(LTV),Identifying waste in your operations and focusing your team on what is important fortraction.

Channels and Strategy - The Bullseye framework,Identify Channels using Bulls EyeFramework,Measuring the effectiveness ofselectedchannels,Budgeting and planning.

UNIT-IV	MONEY & SALES	Classes: 10

MONEY : Growing Revenues - Stabilizing key revenue streams,Developingadditionalrevenue streams(licensing,franchising),Exploring new channels and partnerships,Sales Planning - Understanding why customers buy and how buying decisions are made; Listeningskills,Sales planning, setting targets,Unique Sales Proposition (USP); Art of the sales pitch (focus on customers needs, not on product features,Follow-up and closing a sale; Asking for the sale.

Strengthening Sales - Follow-up and closing a sale; Asking for the sale, Building a professional salesteam,Sales compensation and incentives,Sales planning, setting targets.

Improving Margins - Testing price elasticity,Optimizing costs and operational expenses, Advanced concepts of unit costing.FinancialModeling - Financial modeling of your venture'sgrowth,Analyzing competitor and peer'sfinancial models.

UNIT-V	SUPPORT	Classes: 08

SUPPORT: Legal - Overview of legal issues and their impact on entrepreneurs, Importance of getting professional help (legal and accounting),Importance of being compliant and keeping proper documentation, Patents and Intellectual property, Trademarks.
Mentors, Advisors, and Experts - The importance of a Mentor and how to find one, Role of business advisors and experts for specific targets in your growth plan

Text Books:

1. Bygrave, W., &Zacharakis, A. (2017) Entrepreneurship, 4th Edition (3rd Edition is ok too) Wiley.
2. Carree, M. A., Thurik, A. R. "The impact of entrepreneurship on economic growth" In: Audretsch, D. B., Acs, Z. J. (eds). Handbook of Entrepreneurship Research. Berlin: Springer Verlag, 2010.

Reference Books:

1. Eric, Reis (2017) The Startup Way: How Entrepreneurial Management Transforms Culture and Drives Growth
2. Thurik, A. R., Audretsch, D. B., Stam, E. "The rise of the entrepreneurial economy and the future of dynamic capitalism" Technovation
3. Audretsch, D. B., Grilo, I., Thurik, A. R. (eds). The Handbook of Research on Entrepreneurship Policy. Cheltenham, UK: Edward Elgar, 2007.

Web References:

1. https://www.ediindia.org/EDIILibrary.aspx
2. https://www.entrepreneurshipsecret.com/sources-of-information-for-entrepreneurship-development-contd

INDIAN ETHOS AND BUSINESS ETHICS

VII Semester: OPEN ELECTIVE-III

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A4HS14	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the importance of ethics in business
2. To acquire knowledge and capability to develop ethical practices for effective management
3. To understand the Business Ethics and to provide best practices of business ethics.
4. To learn the values and implement in their careers to become a good managers.
5. To develop various ethical Responsibilities and practice in their professional life
6. To imbibe the ethical issues and to adhere to the ethical codes.

COURSE OUTCOMES:

1. Understand the dynamics of morality
2. Identify the constant in morality
3. Recognize the variable values in morality
4. Students will be able to understand the business ethics.
5. The student will be able to analyze various ethical codes in corporate governance
6. Student will be able to analyze the Employees conditions and Business Ethics

UNIT-I	INTRODUCTION TO INDIAN ETHOS	Classes: 12

History & Relevance, Principles Practiced by Indian Companies, Role of Indian Ethos in Managerial Practices, Management Lessons from Vedas, Mahabharata, Bible and Quran.

UNIT-II	UNDERSTANDING VALUES IN BUSINESS	Classes: 12

Kautilya'sArthashastra, Indian Heritage in Business, Management-Production and Consumption. Ethics v/s Ethos , Indian v/s Western Management, Work Ethos and Values for Indian Managers-Relevance of Value Based Management in Global Change- Impact of Values on Stakeholders, Trans-Cultural Human Values, Secular v/s Spiritual Values , Value System in Work Culture, Stress Management-Meditation for mental health, Yoga.

UNIT-III	CONTEMPORARY APPROACHES TO INDIAN ETHOS	Classes: 12

Contemporary Approaches to Leadership- Joint Hindu Family Business–Leadership Qualities of Karta, Indian Systems of Learning-Gurukul System of Learning, Advantages- Disadvantages of Karma, importance of Karma to Managers-Nishkama Karma-Laws of Karma, Law of Creation- Law of Humility- Law of Growth- Law of Responsibility- Law of Connection-Corporate Karma Leadership.

UNIT-IV	UNDERSTANDING THE BUSINESS ETHICS	Classes: 12

Understanding the need for ethics, Ethical values, myths and ambiguity, ethical codes, Ethical Principles in Business; Theories of Ethics, Absolutism verses Relativism, Teleological approach, the Deontological approach, Kohlberg's six stages of moral development (CMD).

UNIT-V	ETHICAL CULTURE IN ORGANIZATION	Classes: 12

Ethical Culture in Organization, Developing codes of Ethics and conduct, Ethical and value based leadership. Role of scriptures in understanding ethics, Indian wisdom & Indian approaches towards business ethics.

TEXT BOOKS:

1.M.G. Velasquez, Business Ethics, Prentice Hall India Limited, New Delhi,
2. R.C. Sekhar, Ethical Choices in Business, Response Books, New Delhi, 2007

REFERENCE BOOKS:

1. 1. Chakraborty S.K., —Management Transformation by Valuesǁ, New Delhi, Sage Publication, 1990.
2. 2. Chakraborty, S.K., Ethics in Management-Vedantic Approach, New Delhi, Oxford India Ltd. 1995.
3. 3. Fernando A.C., Business Ethics:

Web References:

1. http://lsib.co.uk/lms/wp-content/uploads/2015/02/Indian-Ethos-and-Management.pdf
2. www.vikaspublishing.com/books/business-economics/management/ethics

MANAGEMENT SCIENCE

VIII Semester: OPEN ELECTIVE-IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS11	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Familiarize & obtain Knowledge with the process of management and to provide basic insights into management practices.
2. Understand the structure & Designing of an Organization.
3. Knowledge on the aspects of Production.
4. Analyse the market and the strategies involved in Marketing.
5. Knowledge on concepts related to Human Resources.
6. Understand the techniques used in Project Management.
7. Familiarize with strategies used for analysis of an Organization.
8. Understand the Contemporary Management Issues.
9. Familiarize with the management skills which can be applied in the Organizational context to achieve Organizational goals.

COURSE OUTCOMES:

1. Knowledge on management theories and practices.
2. Understanding designing organizational structure.
3. Understanding on the methods & charts used in operations management.
4. Ability to understand the market and its environment.
5. Understand the processes, functions etc in Human Resources Management.
6. Ability to solve problems in managing the Project.
7. Knowledge on Strategic alternatives.
8. Familiar with the practices implemented in management.
9. Understand the social responsibilities of Management.
10. Understand the basic concepts of Management.

UNIT-I	INTRODUCTION TO MANAGEMENT AND ORGANIZATION	Classes: 12

Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management-Taylor's Scientific Management Theory- Fayal's Principles of Management- Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory Y - Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management, Designing Organizational Structures: Basic concepts related to Organization - Departmentation and Decentralization, Types and Evaluation of mechanisticand organic structures of organization and suitability.

UNIT-II	OPERATIONS AND MARKETING MANAGEMENT	Classes: 12

Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study - Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering(BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality, Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

UNIT-III	HUMAN RESOURCES MANAGEMENT(HRM)	Classes: 12

Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating - Capability Maturity Model (CMM) Levels - Performance Management System.

UNIT-IV	PROJECT MANAGEMENT (PERT/ CPM)	Classes: 12
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems)		
UNIT-V	**STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES**	**Classes: 12**
Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.		

TEXT BOOKS:

1.A.R.Aryasri : Management Science, TMH, (Latest edition)
2.Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.

REFERENCE BOOKS:

1. Kotler Philip and Keller Kevin Lane: Marketing Management, Pearson, 2012.
2. Koontz and Weihrich: Essentials of Management, McGraw Hill, 2012.
3. Thomas N. Duening and John M. Ivancevich Management - Principles and Guidelines, Biztantra, 2012.
4. Kanishka Bedi, Production and Operations Management, Oxford Uiversity Press, 2012.
5. Samuel C. Certo: Modern Management, 2012.
6. Schermerhorn, Capling, Poole and Wiesner: Management, Wiley, 2012.
7. Parnell: Strategic Management, Cengage, 2012.
8. Lawrence R Jauch, R. Gupta and William F. Glueck: Business Policy and Strategic Management Science, McGraw Hill, 2012.

Web References:

1. https://www.smartzworld.com/notes/management-science-pdf-notes-ms-notes-pdf
2. https://www.alljntuworld.in/download/management-science-notes/

INTELLECTUAL PROPERTY RIGHTS

VIII Semester: OPEN ELECTIVE-IV

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5HS12	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3. To disseminate knowledge on copyrights and its related rights and registration aspects
4. To aware about current trends in IPR and Govt. steps in fostering IPR
5. To familiarize them with the kind of rights, remedies and licensing regime associated with each kind of intellectual property so that students can have a basic understanding of Intellectual Property laws.

COURSE OUTCOMES:

1 .Skill to understand the concept of intellectual property rights.
2. Develops procedural knowledge to Legal System and solving the problem relating to intellectual property rights.
3. Skill to pursue the professional programs in Company Secretaryship, Law, Business(MBA), International Affairs, Public Administration and Other fields.
4. Employability as the Compliance Officer, Public Relation Officer and Liaison Officer.
5. Establishment of Legal Consultancy and service provider.

UNIT-I	INTRODUCTION	Classes: 12

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT-II	TRADE MARKS	Classes: 12

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT-III	LAW OF COPY RIGHTS AND PATENTS	Classes: 12

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT-IV	TRADE SECRETS AND UNFAIR COMPETITION	Classes: 12

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, False advertising.

UNIT-V	NEW DEVELOPMENT OF INTELLECTUAL PROPERTY	Classes: 12

new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddhaganguli, Tata Mc Graw Hill Publishing Company Ltd.

REFERENCE BOOKS:

1. Deborah. E. Bouchoux (2009), Intellectual property, Cengage learning, India.
2. Deborah. E. Bouchoux (2001), Protecting your companies intellectual property, AMACOM, USA.
3. Prabuddaganguli (2003), Intellectual property right, Tata McGraw Hill Publishing company ltd., India.
4. Robert Hisrich, Michael P. PEter, Dean A. Shepherd (201), Entrepreneurship, Tata McGraw Hill., India.

Web References:

1. Subramanian, N., &Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf
3. Journal of Intellectual Property Rights (JIPR): NISCAIR