R-20

COURSE STRUCTURE AND SYLLABUS

for

B. Tech
COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE)

(*Applicable for batches admitted from 2021-22*)

PRAGATI ENGINEERING COLLEGE
(AUTONOMOUS)

Approved by **AICTE**, Permanently Affiliated to **JNTUK, Kakinada**,Accredited by **NBA**, **NAAC** with ‒**A**‖ Grade

Recognized by **UGC 2(f)** and **12(b)** under UGC act, 1956

1-378, ADB Road, Surampalem,Near Peddapuram, E.G.Dist, A.P.–533 437

VISION AND MISSION OF THE INSTITUTE

VISION: To emerge as a Premier Institution for Technical Education in the Country through Academic Excellence and to be recognized as a Centre for Excellence in Research & Development, Catering to the needs of our Country.

MISSION: To realize a strong Institution by consistently maintaining State-of-art-Infrastructure and building a cohesive, World Class Team and provide need based Technical Education, Research and Development through enhanced Industry Interaction.

VISION AND MISSION OF THE DEPARTMENT

VISION: To emerge as a center of technical expertise in the field of computer science and engineering by producing globally competent professionals with technical & research capabilities, ethical values and team spirit.

MISSION:
DM1:   To produce competent software professionals.

DM2: To induce application oriented and research capabilities in students for the betterment of society.

DM3:   To inculcate ethics and human values in students to adapt to the dynamism in the field of computing technology.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Graduates are prepared to apply analysis, predictions, optimization, decision making and develop skills in order to formulate and solve complex problems with artificial intelligence.

PEO2: Graduates are prepared to take up higher studies, research & development and other creative efforts in the area of AI which drives scientific and societal advancement through technological innovation and entrepreneurship.

PEO3: Graduates are prepared to use their skills and abilities in an ethical & professional manner.

PROGRAM OUTCOMES (POs)

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

PO2: Problem Analysis: Identify, formulate, 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 public health and safety, and 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 the 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.

PROGRAM SPECIFIC OUTCOMES
(PSOs)

Engineering Students will be able to:

PSO1: Apply artificial intelligence techniques, software tools to conduct experiments, interpret data and to solve complex problems.

PSO2: Design and development of intelligent automated systems for the benefit of society by the use of AI.

PSO3: Adapt to a rapidly changing environment by learning and employing emerging software tools and technologies in the area of Artificial Intelligence.

AUTONOMOUS COLLEGES OF JNTUK
COMMON ACADEMIC REGULATIONS (R20) FOR B. TECH PROGRAMME
(Applicable for from the Academic Year 2020-21)

1. Award of B. Tech. Degree

(a) A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:
  (i) A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.
  (ii) The candidate shall register for 160 credits and secure all the 160 credits.
(b) The medium of instruction for the entire under graduate programme in Engineering & Technology will be in **English** only.

2. Programme Pattern:
  a) Total duration of the of B. Tech (Regular) Programme is four academic years
  b) Each Academic year of study is divided into **Two Semesters**.
  c) Minimum number of instruction days in each semester is 90.
  d) Grade points, based on percentage of marks awarded for each course will form the basis forcalculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
  e) The total credits for the Programme is 160.
  f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.
  g) Student is introduced to "Choice Based Credit System (CBCS)".
  h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)
  i) A student has to register for all courses in a semester.
  j) All the registered credits will be considered for the calculation of final CGPA.
  k) Each semester has - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.
  l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.
  m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.
  n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

3. Registration for Courses:
  a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.
  b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

c) The concerned college shall thoroughly verify and upload the data/courses registered by each student in the university examination center within 20 days. The Principal of the concerned college shall ensure that there no wrong registration courses by the student. The university registration portal will be closed after 20 days.

4. **(a) Award of B. Tech. Degree:** A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:
   i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.
   ii. The student shall register for 160 credits and must secure all the 160 credits.
   iii. All students shall mandatorily register for the courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure at least 40% of the marksallotted in the internal evaluation for passing the course and shall maintain 75% of attendance in the subject.
   iv. All students shall mandatorily register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.
   v. Credits are defined as per AICTE norms.

   (b) Award of B. Tech. (Honor)/B. Tech. (Minor)**:** B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for an Honors/Minor is optional.

5. **Attendance Requirements**
   a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.
   b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.
   c) Shortage of Attendance below 65% in aggregate shall not be condoned.
   d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.
   e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.
   f) A stipulated fee of Rs. 500/- in the concerned semester shall be payable towards condonation of shortage of attendance. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.
   g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.
   h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
   i) For induction programme attendance shall be maintained as per AICTE norms.
   j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

6. **Evaluation-Distribution and Weightage of marks**
   (i) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.
   (ii) To maintain the quality, external examiners and question paper setters shall be selected from reputed institutes like IISc, IITs, IIITs, IISERs, NITs and Universities.
   (iii) For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the

marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

(iv) A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

(v) Distribution and Weightage of marks:

The assessment of the student's performance in each course will be as per the details given:

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project	--	50	50
5	Project Work	60	140	200

(vi) Continuous Internal Theory Evaluation:

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (20 multiple choice questions) for 10 marks for a duration of 20 minutes (ii) one descriptive examination (3 full questions for 5 marks each) for 15 marks for a duration of 90 minutes and (iii) one assignment for marks. All the internal exams shall be conducted as per university norms from first 50% of the syllabi.

b) In the similar lines, the second online, descriptive examinations assignment shall be conducted on the rest of the 50% syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination section within one week after completion of first mid examination.

d) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

e) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

f) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

g) Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for other mid exam.

Example:
Mid-1 marks = Marks secured in (online examination-1+descriptive examination-1 +one assignment-1)
Mid-2 marks = Marks secured in (online examination-2+descriptive examination-2 +one assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

h) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

(vii) Semester End Theory Examinations Evaluation:

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.

c) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80% weightage for better of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work.

d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirementsare as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

e) The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.

f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% ofthe marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

g) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint

one mentor for each of the MOOC subjects offered. The student needs to register the course in theSWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submissionof the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

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

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. *Evaluation:* The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

7. Results Declaration:
   (i) Before results declaration, an academic council meeting shall be conducted and results shall be placed before the academic council for approval.
   (ii)With the approval of academic council, the results shall be submitted to the University to get the approval from Honorable Vice-Chancellor.
   (iii)The University may normalize the result, if required, before declaration of the result (Guidelines for normalization will be provided separately)
   (iv) A copy of approved results in a CD shall be submitted to the University examination Center.

8. Academic Audit: Academic audit in each semester will be conducted as per norms.

9. Recounting or Re-evaluation of Marks in the End Semester Examination: A student can request for recounting of revaluation of his/her answer book on payment of a prescribed fee as per university norms.

10. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

11. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

12. **Promotion Rules**

The following academic requirements have to be satisfied in addition to the attendance requirementsmentioned in item no.5 for promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

13. **Course Pattern**

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

14. Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

15. Award of Class

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

16. Minimum Instruction Days

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

17. Withholding of Results

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

18. Transitory Regulations

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

c) (i) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

19. Gap - Year

Gap Year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III yearto pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by thestudent and the committee shall decide on permitting the student for availing the Gap Year.

20. General

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

d) The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

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ACADEMIC REGULATIONS (R19) FOR B. TECH.
(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 onwards

1 Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 121 credits and secure all the 121 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech (lateral entry).

3. Promotion Rules

A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. Award of Class

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 121 Credits from II Year to IV Year
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) willhold good for B. Tech. (Lateral Entry Scheme)**

COURSE STRUCTURE

Semester- 0
3 Weeks Induction Program to be conducted at the beginning of First year

Zero Semester

Induction program (mandatory)	3 weeks duration
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch and Innovations

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, andnature.2 The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	**T**	**P**	**C**
1	HSC	20HE1T01	Professional Communicative English	3	0	0	3
2	BSC	20BM1T01	Differential Equations and Numerical Methods	3	0	0	3
3	BSC	20BC1T02	Applied Chemistry	3	0	0	3
4	ESC	20CS1T01	Programming for Problem Solving using C	3	0	0	3
5	ESC	20IT1L01	Computer Engineering Workshop	1	0	4	3
6	HSC	20HE1L01	Professional Communicative English Laboratory	0	0	3	1.5
7	BSC	20BC1L02	Applied Chemistry Laboratory	0	0	3	1.5
8	ESC	20CS1L01	Programming for Problem Solving using C Laboratory	0	0	3	1.5
9	MC	20BE1T01	Environmental Science	2	0	0	0
Total Credits							**19.5**

I Year I Semester (header for the above table)

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	**T**	**P**	**C**
1	BSC	20BM2T02	Linear Algebra and Partial Differential Equations	3	0	0	3
2	BSC	20BP2T02	Applied Physics	3	0	0	3
3	ESC	20EC2T03	Digital Logic Design	3	0	0	3
4	ESC	20CS2T03	Python Programming	3	0	0	3
5	ESC	20IT2T01	Data Structures	3	0	0	3
6	BSC	20BP2L02	Applied Physics Laboratory	0	0	3	1.5
7	ESC	20CS2L03	Python Programming Laboratory	0	0	3	1.5
8	ESC	20IT2L02	Data Structures Laboratory	0	0	3	1.5
9	MC	20HM2T05	Constitution of India	2	0	0	0
Total Credits							**19.5**

I Year II Semester (header for the above table)

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	C
\multicolumn{8}{c}{**II Year I Semester**}							
1	BSC	20BM3T03	Transforms and Vector Calculus	3	0	0	3
2	PCC	20CS3T04	Advanced Data Structures through C	3	0	0	3
3	PCC	20AI3T01	Introduction to Artificial Intelligence	3	0	0	3
4	PCC	20IT3T02	Database Management Systems	3	0	0	3
5	PCC	20IT3T03	Mathematical Foundations of Computer Science	3	0	0	3
6	PCC	20CS3L04	Advanced Data Structures through C Laboratory	0	0	3	1.5
7	PCC	20AI3L01	Introduction to Artificial Intelligence through LISP/PROLOG Laboratory	0	0	3	1.5
8	PCC	20IT3L04	Database Management Systems Laboratory	0	0	3	1.5
9	SOC	20CS3S03	Mobile App Development through Android	0	0	4	2
10	MC	20HM3T06	Essence of Indian Traditional Knowledge	2	0	0	0
11	Project	20AI3P01	Community Service Project	0	0	0	4
Total Credits							**25.5**

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	C
II Year II Semester							
1	BSC	20BM4T05	Probability and Statistics	3	0	0	3
2	ESC	20EC4T12	Computer Organization	3	0	0	3
3	PCC	20AM4T01	Data Mining	3	0	0	3
4	ESC	20CS4T10	Java Programming	3	0	0	3
5	HSC	20HM4T01	Managerial Economics and Financial Analysis	3	0	0	3
6	PCC	20CS4L10	R Programming Laboratory	0	0	3	1.5
7	PCC	20AM4L01	Data Mining using Python Laboratory	0	0	3	1.5
8	ESC	20CS4L12	Java Programming Laboratory	0	0	3	1.5
9	SOC	20AI4S01	Applications of Python- Numpy & Pandas	0	0	4	2
Total Credits							**21.5**
Internship 2 Months (Mandatory) during summer vacation							

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	**T**	**P**	**C**
1	PC	20IT5T05	Automata Theory & Compiler Design	3	0	0	3
2	PC	20IT5T04	Operating Systems	3	0	0	3
3	PC	20AM5T02	Machine Learning	3	0	0	3
4	Open Elective		**Open Elective-I**	3	0	0	3
		20CE5T01	1.Surveying				
		20EE5T13	2.Renewable Energy Engineering				
		20ME5T29	3.Optimization Techniques				
		20HM5T03	4.Entrepreneurship				
5	PE		**Professional Elective-I**	3	0	0	3
		20CS5T05	1. Software Engineering				
		20AI5T02	2. Computer Vision				
		20DS5T09	3. Data Visualization Techniques				
		20IT5T07	4.DevOps				
6	PC	20AI5L02	Operating Systems & Compiler Design using C Laboratory	0	0	3	1.5
7	PC	20AM5L02	Machine Learning using Python Laboratory	0	0	3	1.5
8	SOC	20IT5S06	Skill Oriented Course – III Continuous Integration and Continuous Delivery using DevOps	0	0	4	2
9	MC	20HE5T02	Employability Skills-I	2	0	0	0
10	#PR	20AI5I01	Summer Internship 2 Months(Mandatory) after second year(to be evaluated during V semester	0	0	0	1.5
Total Credits							**21.5**

III Year I Semester

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	C
			III Year II Semester				

S.No	Category	Course Code	Course Title	L	T	P	C
1	PC	20CS6T08	Computer Networks	3	0	0	3
2	PC	20AM6T04	Deep Learning	3	0	0	3
3	PC	20CS6T09	Design and Analysis of Algorithms	3	0	0	3
4	PE		Professional Elective-II	3	0	0	3
		20CS6T12	1. Software Project Management				
		20AM6T05	2. Game Theory				
		20AI6T03	3. Virtual and Augmented Reality				
		20AI6T04	4. Expert Systems				
5	Open elective		Open Elective-II	3	0	0	3
		20CE6T40	1. Disaster Management				
		20EE6T19	2. Fundamentals of Electric Vehicles				
		20ME6T25	3. Introduction to Automobile Engineering				
		20EC6T26	4. Transducers and sensors				
6	PC	20CS6L09	Computer Networks using C Laboratory	0	0	3	1.5
7	PC	20AM6L03	Algorithms for Efficient Coding Laboratory using C	0	0	3	1.5
8	PC	20AM6L04	Deep Learning with Tensor flow Laboratory	0	0	3	1.5
9	SOC	20HE6S01	Soft skills and Inter Personal Communication	1	0	2	2
10	MC	20HE6T03	Employability Skills-II	2	0	0	0
Total Credits							21.5
Industrial/Research Internship(Mandatory) 2 Months during summer vacation							

S.No	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	C
IV Year I Semester							
1	PE	20AM7T06 20AI7T05 20IT7T16 20AI7T06	Professional Elective-III 1.Reinforcement Learning 2.Soft Computing 3.Block Chain Technologies 4.Speech Processing	3	0	0	3
2	PE	20CS7T12 20DS7T02 20DS7T08 20AM7T07	Professional Elective-IV 1. Cloud Computing 2. Big Data Analytics 3. NOSQL Databases 4. Video Analytics	3	0	0	3
3	PE	20AM7T08 20CS7T16 20AI7T07 20AM7T09	Professional Elective-V 1. Recommender Systems 2. Object Oriented Analysis and Design 3. AI Chatbots 4. Semantic Web	3	0	0	3
4	Open Elective	20CE7T11 20EE7T29 20EC7T40 20HM7T09	Open Elective-III 1. Highway Engineering 2. Battery Management Systems and Charging Stations 3. Industrial Electronics 4. Organizational Behavior	3	0	0	3
5	Open Elective	20CE7T18 20EE7T38 20EC7T41 20HM7T04	Open Elective-IV 1.Water Resource Engineering 2.Sustainable Energy Technologies 3. Biomedical Instrumentation 4. Marketing Management	3	0	0	3
6	HS	20HM7T11	Universal Human Values 2: Understanding Harmony	**3**	**0**	**0**	**3**
7	SOC	20AM7S05 20CS7S07	1.Machine Learning with Go (Infosys Spring Board) 2.MEAN Stack Technologies-MongoDB, Express.js, Angular JS Node.js, and AJAX	**0**	**0**	**4**	**2**
8	#PR	20AI7I02	Industrial/Research Internship 2 months (Mandatory) after third year (to be evaluated during VII semester	**0**	**0**	**4**	**3**
Total Credits							**23**

IV B. Tech –II Semester						
S.No	**Course Code**	**Course Title**	**Hours per week**			**Credits**
			L	**T**	**P**	**C**
1	20AI8P02	Major Project Work, Seminar, Internship	-	-	-	8
Total credits						8

L - Lecture   **T – Tutorial**   **P – Practical**   **C - Credit**

Professional Communicative English

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Humanities and Social Sciences	Course Code	20HE1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Emphasizes that the ultimate aim of Education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment.	K2
CO2	Enables the learners to promote peaceful co-existence and universal harmony in society and empowers them to initiate innovation.	K2
CO3	Imparts the students to manage different cultural shock due to globalization and develop multiculturalism to appreciate diverse cultures and motivate them to contribute to their nation.	K3
CO4	Arouses the thought of life to lead in the right path by recognizing the importance of work besides enhancing their LSRW skills.	K2
CO5	Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-

CO3	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-

COURSE CONTENT	
UNIT I	1. _The Greatest Resource- Education' from Professional Communicative English. Objective: Schumacher describes the education system by saying that it was mere training, something more than knowledge of facts. Outcome: Underscores that the ultimate aim of Education is to enhance wisdom. 2. 'War' from _Panorama: A Course on Reading' Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT II	1. ' A Dilemma' from Professional Communicative English Objective: The lesson centres on the pros and cons of the development of science and technology. Outcome: Enables the students to promote peaceful co-existence and universal harmony among people in society. 2. 'The Verger' from _Panorama: A Course on Reading' Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT III	1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English. Objective: Depicts of the symptoms of Cultural Shock and the aftermath consequences Outcome: Enables the students to manage different cultural shocks due to globalization. 2. 'The Scarecrow' from Panorama: A Course on Reading Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills

UNIT IV	1. _The Secret of Work' from Professional Communicative English. Objective: Portrays the ways of living life in its real sense. Outcome: Arouses the thoughtto lead life in a right path by recognizing the importance of work. 2. 'A Village Lost to the Nation' from Panorama: A Course on Reading Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills
UNIT V	1. *' The Chief Software Architect' from Professional Communicative English.* Objective: Supports the developments of technology for the betterment of human life. Outcome: Pupil gets inspired by eminent personalities who toiled for the present-day advancement of software development. 2. *'Martin Luther King and Africa' from Panorama: A Course on Reading* Objective: To develop extensive reading skill and comprehension for pleasure and profit. Outcome: Acquisition of LSRW skills

	TEXT BOOKS
1.	**DETAILED TEXTBOOK:** • **PROFESSIONAL COMMUNICATIVE ENGLISH** *Published by Maruthi Publishers.*
2.	**NON-DETAILED TEXTBOOK:** • *PANORAMA: A COURSE ON READING, Published by Oxford University Press India* The course content, along with the study material, is divided into six units.

Differential Equations and Numerical Methods

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BM1T01
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Differentiation, Integration	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Solve first order differential equations and its applications	K3
CO2	Solve the linear differential equations with constant coefficients by appropriate method	K3
CO3	Apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data.	K3
CO4	Find the approximate roots of transcendental equations by using different numerical methods	K2
CO5	Solve initial value problems by using different numerical schemes	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Differential equations of first order and first degree** Linear – Bernoulli – Exact – Reducible to exact. **Applications:** Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories.
UNIT II	**Linear differential equations of higher order** Non-homogeneous equations of higher order with constant coefficients with non-homogeneous form $e^{ax}, \sin ax, \cos ax$ polynomials in $x^n, e^{ax}V(x), x^m V(x)$ - Method of Variation of parameters.
UNIT III	**Interpolation** Introduction– Errors in polynomial interpolation – Finite differences – Forward differences– Backward differences –Central differences –properties – Differences of a polynomial-Newton's formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals: Lagrange's interpolation formula.
UNIT IV	**Solution of Algebraic and Transcendental Equations** Introduction- Bisection method – Method of false position – Iteration method – Newton-Raphson method (One variable).
UNIT V	**Solution of Ordinary Differential equations** Solution of ordinary differential equations by Taylor's series-Picard's method of successive approximations-Euler's method – Modified Euler's method - Runge-Kutta method (second and fourth order).

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
WEB RESOURCES	
1.	**UNIT I: Differential equations of first order and first degree** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://www.khanacademy.org/math/differential-equations/first-order-differential-equations
2.	**UNIT II: Linear differential equations of higher order** https://en.wikipedia.org/wiki/Differential_equation http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode https://nptel.ac.in/courses/122107037/20
3.	**UNIT III: Interpolation** https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation
4.	**UNIT IV: Solution of Algebraic and Transcendental Equations** https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations
5.	**UNIT V: Solution of Ordinary Differential Equations** https://nptel.ac.in/courses/111107063/ https://www.facweb.iitkgp.ac.in/~rajas/cgen/page/nptlcrs

Applied Chemistry
Common to ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BC1T02
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Intermediate Chemistry	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	To learn about Electrochemical cells, Batteries and Fuel cells
2	To learn about non conventional energy sources
3	To study about Nano materials, Super conductors and their preparation, applications and also about principles of green chemistry and green engineering applications
4	To know about Polymers, Plastics and Elastomers
5	To Understand the principles of different analytical instruments and their applications

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	To compare different types of batteries and explain the merits of fuel cell.	K2
CO2	List out different renewable sources of energy.	K3
CO3	To explain the Green methods of Synthesis and applications of Green technologies and also Band theory applications.	K3
CO4	Analyze the importance of Polymers in engineering applications.	K2
CO5	To Distinguish between Rotaxane and Catenane molecular machines	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3	1	2	2	2	-	2	-	-	-	2	-	1	-	1
CO 2	2	2	1	-	-	1	1	-	-	-	1	-	-	-	-
CO 3	1	1	-	1	2	-	-	-	-	-	-	1	-	1	-
CO 4	2	2	-	1	-	-	1	-	-	-	-	1	-	-	-
CO 5	1	1	1	-	-	-	1	-	-	-	2	1	1	-	-

COURSE CONTENT	
UNIT I	**ELECTROCHEMICAL ENERGY SYSTEMS** Electrode Potential, Nernst Equation, EMF of the cell, Types of Electrodes - Hydrogen and Calomel Electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, ***Concentration Cells***, Types of Ion Selective Electrodes- Glass Membrane Electro **Batteries**- Characteristics, Classification and Important Applications. Classical batteries- Dry/Lechlanche cell, Modern batteries- Zinc air, Lithium cells : Li -MnO_2 cell. **Fuel cells**- Introduction, H_2-O_2 fuel cell, Advantages of fuel cells.
UNIT II	**ENERGY SOURCES AND APPLICATIONS** Introduction- Sources of renewable energy **Solar energy** – Introduction- Photo voltaic cell/ Solar cell – Construction and Working, Applications of Solar energy. Photo Galvanic Cells, Electrochemical Sensors. **Non Conventional Energy Sources:** Hydropower, Geo Thermal Power, Tidal Power, Ocean Thermal Energy Conversion (OTEC).
UNIT III	**MATERIAL SCIENCE AND ENGINEERING** **III-A: Nanomaterials:** Introduction , Preparation of Carbon Nano Tubes(CNTs) by Arc discharge and Chemical Vapor Deposition Methods. Fullerenes : Preparation, Properties and Applications; Chemical Synthesis of Nanomaterials : Sol-gel method, Applications of Nano Materials in Wastewater treatment and Medicine. **III-B: Green Chemistry:** Introduction, Principles of Green Chemistry and Engineering Applications with a **case *study*** **Band Theory of Solids:** Introduction –Explanation of Conductors, Semiconductors and

	Insulators by Band Theory. Super conductors: Types-Preparation, Properties and Applications.
UNIT IV	**POLYMER CHEMISTRY** **Polymers**: Introduction, Functionality of monomers, Chain (Addition) Polymerization, Step(Condensation) Polymerization, Co-Ordination Polymerization, Co - Polymerization with examples and Mechanism. Conducting polymers : Mechanism of Conduction in Poly acetylene, Poly aniline and their Applications. **Plastics**: Thermoplastics and Thermo Setting resins; Preparation, Properties and Applications of Bakelite, Urea- formaldehyde Resin, Nylon – 6,6. **Elastomers**: _**Vulcanization of rubber**_, Preparation, Properties and Applications of Buna-S and Buna – N.
UNIT V	**Instrumental Methods & Molecular Machines and Switches** A) Spectroscopic Techniques: Electromagnetic Spectrum- Introduction, Absorption of radiation: Beer-Lambert's law. Principles of UV-Visible and IR Spectroscopic techniques and their Applications. B) Molecular Machines: Rotaxanes and Catenanes as artificial Molecular Machines. Molecular Switches: Introduction, Cyclodextrin based Switches.

TEXT BOOKS	
1.	P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2.	Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition .
REFERENCE BOOKS	
1.	Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2.	S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010)
3.	N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014)
WEB RESOURCES	
1.	**Electrochemical Energy systems** https://en.wikipedia.org/wiki/Electrochemical_cell
2.	**Energy Sources and Applications** _https://en.wikipedia.org/wiki/Hydropower_
3.	**Material Science and Engineering** https://en.wikipedia.org/wiki/Nanomaterials

4.	**Polymer Chemistry** https://en.wikipedia.org/wiki/Polymer_chemistry
5.	**Instrumental Methods & Molecular Machines and Switches** https://en.wikipedia.org/wiki/Spectroscopy

Programming for Problem solving using C

Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	Course Code	20CS1T01
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2	To gain knowledge of the operators, selection, control statements and repetition in C
3	To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage.
4	To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5	To assimilate about File I/O and significance of functions

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Apply the fundamentals of C Programming for Problem solving.	K3
CO2	Identify the appropriate Decision statement and Loops for a given Problem.	K2
CO3	Make use of Arrays and Strings to solve the problems in C.	K3
CO4	design and implement programs to analyze the different pointer applications	K3
CO5	Develop solutions for problems using Files and Functions.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
CO 1	3	3	3	3	1	-	-	-	-	-	-	-	1	1	-
CO 2	3	3	3	3	1	-	-	-	-	-	-	-	1	1	-
CO 3	3	3	3	2	1	-	-	-	-	-	-	-	2	1	-
CO 4	2	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO 5	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-

COURSE CONTENT	
UNIT I	**Introduction to Computers**: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers **Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers. **Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.
UNIT II	**Bitwise Operators**: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators. **Selection & Making Decisions**: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions. **Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.
UNIT III	**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.
UNIT IV	**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application. Processor Commands: Processor Commands.
UNIT V	**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions
Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS	
1.	Programming for Problem Solving, Beerhouse A. Forouzan, Richard F.Gilberg, CENGAGE.
2.	The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.
REFERENCE BOOKS	
1.	Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2.	Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3.	Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD.
WEB RESOURCES	
1.	http://nptel.ac.in/courses/106104128/
2.	http://students.iitk.ac.in/programmingclub/course/#notes
3.	http://c-faq.com/~scs/cclass/cclass.html
4.	http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

Computer Engineering Workshop

Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	Course Code	20IT1L01
Course Type	Laboratory	L-T-P-C	1-0-4-3
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	PC Hardware: Identification of basic peripherals, Assembling a PC, Installation of system software like MS Windows, device drivers, etc. Troubleshooting of PC Hardware and Software issues.
2	Internet & World Wide Web: Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums. Awareness of cyber hygiene (protecting the personal computer from getting infected with the viruses), worms and other cyber attacks.
3	Productivity Tools: Understanding and practical approach of professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite office tools.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	BTL
CO1	Identify, assemble and update the components of a computer	K2
CO2	Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems	K3
CO3	Make use of tools for converting pdf to word and vice versa	K2
CO4	Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTex	K3

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5-Evaluating, k6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO3	2	2	2	1	2	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	-	1	2	2

COURSE CONTENT	
Task 1	Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.
Task 2	Practicing disassembling and assembling components of a PC
Task 3	Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual boating with Windows and Linux
Task 4	Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders.
Task 5	Demonstration of Hardware and Software Troubleshooting
Task 6	Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC, Bluetooth Technology, Wireless Technology, Modem, DSL, and Dialup Connection.
Task 7	Surfing the Web using Web Browsers, Awareness of various threats on the Internet and its solutions, Search engines and usage of various search engines, Need of anti-virus, Installation of anti-virus, configuring personal firewall and windows update. (Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers)
Productivity Tools	
Task 8	Basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3 and its properties. Preparation of a simple website/ homepage, Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list. Features to be covered:- Layouts, Inserting text objects, Editing text objects, Inserting Tables, Working with menu objects, Inserting pages, Hyper linking, Renaming, deleting, modifying pages,

	etc.,
Task 9	Demonstration and Practice of various features of Microsoft Word Assignment: 1. Create a project certificate. 2. Creating a news letter Features to be covered:-Formatting Fonts, Paragraphs, Text effects, Spacing, Borders and Colors, Header and Footer, Date and Time option, tables, Images, Bullets and Numbering, Table of Content, Newspaper columns, Drawing toolbar and Word Art and Mail Merge in word etc.,
Task 10	Demonstration and Practice of various features Microsoft Excel Assignment: 1. Creating a scheduler 2. Calculating GPA 3. Calculating Total, average of marks in various subjects and ranks of students based on marks Features to be covered:- Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel, Charts, Renaming and Inserting worksheets, etc.,
Task 11	Demonstration and Practice of various features Microsoft Power Point Features to be covered:- Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks Tables and Charts, Master Layouts, Types of views, Inserting – Background, textures, Design Templates, etc.,
Task 12	Demonstration and Practice of various features LaTeX – document preparation, presentation (Features covered in Task 9 and Task 11 need to be explored in LaTex)
Task 13	Tools for converting word to pdf and pdf to word
Task 14	Internet of Things (IoT): IoT fundamentals, applications, protocols, communication models, architecture, IoT devices

Note: Faculty to consolidate the workshop manuals using the textbook and references

REFERENCE BOOKS	
1	Computer Fundamentals, Anita Goel, Pearson India Education, 2017
2	PC Hardware Trouble Shooting Made Easy, TMH
3	Introduction to Information Technology, ITL Education Solutions Limited, 2nd Edition, Perason, 2020
4	Upgrading and Repairing PCs, 18th Edition, Scott Mueller, QUE, Pearson, 2008
5	LaTeX Companion – Leslie Lamport, PHI/Pearson
6	Introducing HTML5, Bruce Lawson, Remy Sharp, 2nd Edition, Pearson, 2012
7	Teach yourself HTML in 24 hours, By Techmedia
8	HTML 5 and CSS 3.0 to the Real World by Alexis Goldstein, Sitepoint publication

9	Internet of Things, Technologies, Applications, Challenges and Solutions, B K Tripathy, J Anuradha, CRC Press
10	Comdex Information Technology Course Tool Kit, Vikas Gupta, Wiley Dreamtech
11	IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme, CISCO Press, Pearson Education
12	Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu, S. Chand Publishers

Professional Communicative English Laboratory

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Humanities and Social Sciences	Course Code	20HE1L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Understand different speech sounds and maintain proper pronunciation and rhythm in day to day conversations.	K2
CO2	Interpret and respond appropriately in various day to day contexts and improves technics in group discussions.	K5
CO3	Develop the required communication skills to deliver effective presentations and interviews with clarity and impact.	K6

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

COURSE CONTENT	
UNIT I	Introduction, Consonant Sounds, Vowel Sounds
UNIT II	Rhythm and Pronunciation , Weak/strong and contrasted forms, Practice of Rhythm
UNIT III	Dialogues
UNIT IV	Group Discussions
UNIT V	Presentations & Public Speaking
UNIT VI	Interviews

PRESCRIBED LAB MANUAL FOR SEMESTER I:
‗**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication
Skills‗Published by Maruthi Publications.

OBJECTIVES: To enable the students to learn demonstratively the communication
skills oflistening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the
studentsbecome successful in the competitive world.

The course content, along with the study material, is divided into six units.

Applied Chemistry Laboratory

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BC1L02
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites	Basic Chemistry	Internal Assessment Semester End Examination Total Marks	15 35 50

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of polymers and nano particles	K3
CO2	Determine the concentration of different metal ions present in water by complexometric titrations.	K2
CO3	Evaluate the accurate value of P^H and conductivity of given solutions and to estimate the viscosity and surface tension of given solutions.	K5

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
Any 10 of the following listed 13 experiments	
Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis	
1.	Estimation of HCI using standard Na_2CO_3 solutions
2.	Determination of alkalinity of a sample containing Na_2CO_3 and NaOH
3.	Estimation of $KmnO_4$ using standard Oxalic acid solution
4.	Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
5.	Determination of Temporary and permanent Hardness of water using standard EDTA solution
6.	Determination of % moisture content in a coal sample
7.	Determination of Mg^{2+} present in an antacid
8.	Estimation of HCl using standard NaOH Solution by Conductometric titration
9.	Estimation of Vitamin – C
10.	Preparation of Phenol – Formaldehyde Resin
11.	Determination of viscosity of a liquid
12.	Determination of surface tension of a liquid
13.	Preparation of Nano particles.(Cu/Zn)

TEXT BOOKS	
1.	Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000)
2.	N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007)
REFERENCE BOOKS	
1.	Vogel's Textbook of Quantitative chemical analysis, J. Mendham et.al.
2.	College designed manual
WEB RESOURCES	

1.	www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness
2.	https://pubs.acs.org/doi/abs/10.1021/i560133a023
3	https://pdfs.semanticscholar.org/33d4/3b264bad212a14d660667298f12944ea11d5

Programming for Problem solving using C Laboratory

Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Science	Course Code	20CS1L01
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites		Internal Assessment Semester End Examination Total Marks	15 35 50

COURSE OBJECTIVES	
1	Apply the principles of C language in problem solving.
2	To design flowcharts, algorithms and knowing how to debug programs.
3	To design & develop of C programs using arrays, strings pointers & functions.
4	To review the file operations, preprocessor commands.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Knowledge on various concepts of a C language.	K3
CO2	Draw flowcharts and write algorithms.	K3
CO3	Design and development of C problem solving skills.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO2	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	2	-

COURSE CONTENT	
1.	**Exercise 1:** 1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters. 2. Write a C program to compute the perimeter and area of a rectangle with a

	height of 7 inches and width of 5 inches. 3. Write a C program to display multiple variables.
2.	**Exercise 2:** 1. Write a C program to calculate the distance between the two points. 2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".
3.	**Exercise 3:** 1. Write a C program to convert a string to a long integer. 2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape. 3. Write a C program to calculate the factorial of a given number.
4.	**Exercise 4:** 1. Write a program in C to display the n terms of even natural number and their sum. 2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms. 3. Write a C program to check whether a given number is an Armstrong number or not.
5.	**Exercise 5:** 1. Write a program in C to print all unique elements in an array. 2. Write a program in C to separate odd and even integers in separate arrays. 3. Write a program in C to sort elements of array in ascending order.
6.	**Exercise 6:** 1. Write a program in C for multiplication of two square Matrices. 2. Write a program in C to find transpose of a given matrix.
7.	**Exercise 7:** 1. Write a program in C to search an element in a row wise and column wise sorted matrix. 2. Write a program in C to print individual characters of string in reverse order.
8.	**Exercise 8:** 1. Write a program in C to compare two strings without using string library functions. 2. Write a program in C to copy one string to another string.
9.	**Exercise 9:** 1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation 2. Write a program in C to demonstrate how to handle the pointers in the program.
10.	**Exercise 10:** 1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator. 2.Write a program in C to add two numbers using pointers
11.	**Exercise 11:** 1. Write a program in C to add numbers using call by reference. 2. Write a program in C to find the largest element using Dynamic Memory

		Allocation.
12.		**Exercise 12:** 1. Write a program in C to swap elements using call by reference. 2. Write a program in C to count the number of vowels and consonants in a string using a pointer.
13.		**Exercise 13:** 1. Write a program in C to show how a function returning pointer. 2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.
14.		**Exercise 14:** 1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs 2. Write a program in C to convert decimal number to binary number using the function.
15.		**Exercise 15:** 1. Write a program in C to check whether a number is a prime number or not using the function. 2. Write a program in C to get the largest element of an array using the function.
16.		**Exercise 16:** 1. Write a program in C to append multiple lines at the end of a text file. 2. Write a program in C to copy a file in another name. 3. Write a program in C to remove a file from the disk.

Environmental Science

Common to CE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Mandatory Course	Course Code	20BE1T01
Course Type	Theory	L-T-P-C	2-0-0-0
Prerequisites	Basic Knowledge in Environment and protection.	Internal Assessment Semester End Examination Total Marks	0 0 0

COURSE OBJECTIVES	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.	K2
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities	K2
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century	K2
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems	K2
CO5	Influence their society in proper utilization of goods and services.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	1	-	1	-	-	1	2	-	-	-	1	-	-	-	-
CO 2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	1	1	3	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	3	1	-	-	-	-	-	-	-

Table heading (above table): **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

COURSE CONTENT	
UNIT I	**Multidisciplinary nature of Environmental Studies** Definition, Scope and Importance-International Efforts & Indian Environmentalists **Natural Resources** Forest resources : deforestation – Mining, dams and other effects on forest and tribal people. Water resources :Use and over utilization of surface and groundwater. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems. Energy resources: renewable and nonrenewable energy sources. Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.
UNIT II	**Ecosystems, Biodiversity and its conservation** Definition of Ecosystem and its structure, Functions Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity, Endangered and endemic species of India.
UNIT III	**Environmental Pollution and Solid Waste Management** Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution. Solid Waste Management: Sources, effects and control measures of urban and industrial waste, e-waste management
UNIT IV	**Social Issues and the Environment** Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act-Issues involved in enforcement of environmental legislation, Rain water harvesting,

	Global Environmental challenges-case studies
UNIT V	**Human population and the Environment** Population growth, Women and child welfare, Role of Information technology in environment and human health. Impact Assessment and its significances, stages of EIA Field work: A mini project related to Environmental issues / to visit a local polluted site (Submission of project by every student)

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4.	Environmental Studies by PiyushMalaviya, Pratibha Singh, Anoopsingh: Acme Learning, New Delhi.
5.	An Introduction to Environmental Pollution by Dr.B.k.Sharma AND Dr.(Miss)H.kaur,Goel publishing House ,a unit of Krishna Prakasham Media (p) LH,Meerut –India
WEB RESOURCES	
1.	**UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES** http://www.defra.gov.uk/environment/climatechange https://www.climatesolutions.org https://en.wikibooks.org/wiki/Ecology/Ecosystems
2.	**UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION** http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	**UNIT-3: ENVIRONMENTAL POLLUTION** https://www.omicsonline.org/environment-pollution-climate-change.php and https://www.britannica.com/technology/solid-waste-management

4.	**UNIT-4: SOCIAL ISSUES AND THE ENVIRONMENT** http://www.publichealthnotes.com/solid-waste-management/
5.	**UNIT-5: HUMANPOPULATION AND THE** **NVIRONMENT**http://www.ecoindia.com/education/water-conservation.html https://thewaterproject.org/water_conservation\ https://legalcareerpath.com/what-is-environmental-law/

Linear Algebra and Partial Differential Equations
Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BM2T02
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Basics of Matrices, Differentiation, Integration	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix.	K3
CO2	Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	K2
CO3	Find areas and volumes using double and triple integrals	K2
CO4	Find partial derivatives of multivariable functions and apply them to find extreme values of a function.	K3
CO5	Apply a range of techniques to find solutions of standard PDEs	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

COURSE CONTENT	
UNIT I	**Solving system of linear equations, Eigen Values and Eigen vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method, Gauss Jacobi and Gauss Seidel for solving system of equations – Eigenvalues and Eigen vectors and their properties.
UNIT II	**Cayley-Hamilton Theorem and Quadratic forms** Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Quadratic forms-Reduction to canonical form by congruent transformations- nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation.
UNIT III	**Multiple integrals** Multiple integrals: Double and triple integrals – Change of variables -Polar coordinates - Cylindrical coordinates– Change of order of integration. **Applications:** Finding Areas and Volumes.
UNIT IV	**Partial differentiation** Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor's and Maclaurin's series expansion of functions of two variables – Jacobian – Functional dependence. **Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT V	**Partial Differential Equations and Applications** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. **Applications:** One dimensional wave and heat equations.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**T. Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications
WEB RESOURCES	
1.	**UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors** https://en.wikipedia.org/wiki/System_of_linear_equations https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
2.	**UNIT II: Cayley-Hamilton Theorem and Quadratic forms** https://www.math.hmc.edu/calculus/tutorials/eigenstuff/ https://en.wikipedia.org/wiki/Quadratic_form
3.	**UNIT III: Multiple Integrals** https://en.wikipedia.org/wiki/Multiple_integral http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
4.	**UNIT IV: Partial Differentiation** https://en.wikipedia.org/wiki/Partial_derivative https://www.whitman.edu/mathematics/calculus_online/section14.03.html
5.	**UNIT V:Partial Differential Equations and Applications** https://en.wikipedia.org/wiki/Partial_differential_equation

Applied Physics

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BP2T02
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Intermediate Physics	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2	Impart the knowledge of Lasers, Optical Fibers and their implications in optical communications.
3	To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in emerging micro devices.
4	To explain the concepts of Quantum Mechanics and free electron theories for study of metals and semiconductors.
5	Understand the formation of bands in Semiconductors and their working mechanism for their utility in Engineering applications

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the optical applications using the concepts of Interference and diffraction.	K4
CO2	Apply the basics of Laser Mechanism and fiber optics for the communications systems.	K3
CO3	Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response.	K3
CO4	Understand the concepts of quantum mechanics for calculation of free quantum particle energies and phenomenon of electrical & thermal conductivities to sub microscopic particles.	K2
CO5	Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	2	-	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	2	-	-	-

COURSE CONTENT	
UNIT I	**WAVEOPTICS** **INTERFERENCE** Introduction-Principle of Superposition – Coherent Sources – Interference in parallel thin film(reflection geometry)- Newton's rings, Determination of Wavelength and Refractive Index & Applications. **DIFFRACTION** Introduction-Types of diffraction-Fraunhoffer diffraction due to single slit, Double slit, N Slits (Qualitative)-Rayleigh criterion of resolution and Resolving power of grating (Qualitative).
UNIT II	**LASERS** Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Schemes - Ruby laser – Helium Neon laser – Applications **FIBER OPTICS:** Introduction- Structure & Principle of Optical Fiber-Numerical Aperture and Acceptance Angle-classification of Optical fibers based on Refractive Index Profile and Modes- Block Diagram of optical fiber communication system- Advantages of Optical fibers- Applications.
UNIT III	**MAGNETICS PROPERTIES** Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials Dia,Para,Ferro,Antiiferro and Ferri Magnetic materials-Weiss Domain Theory(Qualitative Treatment)-Hysteresis-B-H Curve-soft and hard magnetic materials & applications **DIELECTRICS** Introduction - Dielectric polarization– Dielectric Polarizability, Susceptibility and Dielectric

	constant-types of polarizations- Electronic Ionic and Orientation polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics.
UNIT IV	**QUANTUM MECHANICS** Introduction – Matter waves – de Broglie's hypothesis–Interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box **FREE ELECTRON THEORY** Classical Free Electron Theory(Qualitative with discussions of merit and demerits)-Quantum Free Electron Theory-Equation of conductivity based on quantum free electron theory-Fermi Dirac Distribution-Density of States-Fermi Energy
UNIT V	**BANDTHEORYOFSOLIDS** Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron-Classification of Crystalline Solids-Concept of hole **SEMICONDUCTOR PHYSICS** Introduction–Intrinsic Semi conductors - density of charge carriers- Electrical conductivity – Fermi level – extrinsic semiconductors - p-type & n-type - Density of charge carriers-Drift and Diffusion currents-Einstein's Equation -Hall effect - Applications of Hall effect

TEXT BOOKS	
1.	Engineering Physics by M.N.Avadhanalu,P.G.Kshirsagar & T V S Arun Murty,S Chand Pubication,11th Edition 2019
2.	̶Engineering Physics‖ by M.R.Srinivasan, New Age international publishers
3.	Engineering Physics by P.K Palanisamy,Sci Tech Publication
REFERENCE BOOKS	
1.	Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition
2.	Solid State Physics ,AJ Dekker, I Edition,Macmillan Publishers India Private Limited
3.	̶Solid State Physics‖ by SO Pilai., - New age International Publishers
4.	Engineering Physics by DK Bhattacharya and Poonam Tandon,Oxford Press(2018)
WEB RESOURCES	
1.	https://nptel.ac.in/courses/122/107/122107035/# https://nptel.ac.in/courses/122/107/122107035/#
2.	https://pragatiengg.org/pluginfile.php/29143/mod_folder/content/0/UNIT%20IV%20LAS

	ERS%20.pptx?forcedownload=1
	https://nptel.ac.in/courses/104/104/104104085/
	https://nptel.ac.in/courses/115/107/115107095/
3.	https://nptel.ac.in/courses/113/104/113104090/
	https://youtu.be/DDLljK1ODeg
4.	https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html
	https://nptel.ac.in/courses/115/101/115101107/
	https://nptel.ac.in/courses/115/105/115105122/
5.	https://www.electronics-tutorials.ws/diode/diode_1.html
	https://nptel.ac.in/courses/115/105/115105099/
	https://nptel.ac.in/courses/108/108/108108122/

Digital Logic Design
Common to CSE (AI&ML), CSE(AI), CSE(DS)

Course Category	Engineering Sciences	Course Code	20EC2T03
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, theory of Boolean algebra and map method for minimization of switching functions.
2	To introduce the basic tools for design of combinational and sequential digital logic.
3	To learn simple digital circuits in preparation for computer engineering.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.	K1
CO2	Understand the different switching algebra theorems and apply them for logic functions and Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.	K2
CO3	Design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays.	K4
CO4	Design various sequential circuits starting from flip-flop and conversion of flipflops.	K4
CO5	Design registers, shift registers, synchronous counters and ring counters.	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 2	2	2	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 3	1	2	2	-	-	-	-	-	-	1	-	-	-	2	-
CO 4	2	1	2	-	-	-	-	-	-	1	-	-	1	-	-
CO 5	2	2	3	-	-	-	-	-	-	1	-	-	-	1	-

COURSE CONTENT	
UNIT I	Digital Systems and Binary NumbersDigital Systems, Binary Numbers, Octal and Hexadecimal Numbers, Complements of Numbers,Signed Binary Numbers, Arithmetic addition and subtraction, 4-bit codes: BCD, EXCESS 3,alphanumeric codes, 9's complement, 2421, etc.
UNIT II	Concept of Boolean algebra: Basic Theorems and Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Minterms and Maxterms. Gate level Minimization Map Method, Three-Variable K-Map, Four Variable K-Maps. Products of Sum Simplification, Sum of Products Simplification, Don't – Care Conditions, NAND and NOR Implementation, Exclusive OR Function.
UNIT III	Combinational Logic: Introduction, Analysis Procedure, Binary Adder–Subtractor, Binary Multiplier, Decoders,Encoders, Multiplexers, Demultiplexers, Priority Encoder, Code Converters, MagnitudeComparator, HDL Models of Combinational Circuits. Realization of Switching Functions Using PROM, PAL and PLA.
UNIT IV	Synchronous Sequential Logic Introduction to Sequential Circuits, Storage Elements: Latches, Flip-Flops, RS- Latch Using NAND and NOR Gates, Truth Tables. RS, JK, T and D Flip Flops, Truth and Excitation Tables, Conversion of Flip Flops.
UNIT V	Registers and Counters Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter.

TEXT BOOKS	
1.	Digital Design, 5/e, M.Morris Mano, Michael D Ciletti, PEA.
2.	Fundamentals of Logic Design, 5/e, Roth, Cengage
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M.Morris Mano, PEA.
2.	Digital Logic Design, Leach, Malvino, Saha, TMH.
3.	Modern Digital Electronics, R.P. Jain, TMH.

Python Programming
Common to CSE, CSE (AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	Course Code	20CS2T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about Python programming language syntax, semantics, and the runtime environment.
2	To be familiarized with universal computer programming concepts like data types, containers.
3	To be familiarized with general computer programming concepts like conditional execution, loops & functions.
4	To be familiarized with general coding techniques and object-oriented programming

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Develop essential programming skills in computer programming concepts like data types, containers.	K3
CO2	Apply the basics of programming in the Python language.	K3
CO3	Solve coding tasks related conditional execution, loops.	K3
CO4	Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming.	K3
CO5	Make use of Exceptions and GUI interfaces for developing applications	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
CO1	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2

COURSE CONTENT	
UNIT I	Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.
UNIT II	Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement, Conditional Iteration The While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.
UNIT III	List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function. Modules: Modules, Standard Modules, Packages.
UNIT IV	File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support

	Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism.
UNIT V	Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming**:** Introduction to Programming Concepts with Scratch.

TEXT BOOKS	
1.	Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2.	Python Programming: A Modern Approach, VamsiKurama, Pearson.
REFERENCE BOOKS	
1.	Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2.	Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
WEB RESOURCES	
1.	https://www.tutorialspoint.com/python3/python_tutorial.pdf

Data Structures

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Engineering Sciences	Course Code	20IT2T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce the fundamental concept of data structures and abstract data types
2	Emphasize the importance of data structures in developing and implementing efficient algorithms
3	Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Summarize the properties, interfaces, and behaviors of basic abstract data types	K2
CO2	Discuss the computational efficiency of the principal algorithms for sorting & searching	K2
CO3	Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs	K3
CO4	Demonstrate different methods for traversing trees	K2
CO5	Implement algorithms on Graphs	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO 2	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 3	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO 4	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO 5	3	3	1	1	1	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT I	**Data Structures** - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. Searching - Linear search, Binary search, Fibonacci search. **Sorting**- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms.
UNIT II	**Linked List:** Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion.
UNIT III	**Queues:** Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues-Circular Queues, Deques, Priority Queues, Multiple Queues. **Stacks:** Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions.
UNIT IV	**Trees:** Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion and Rotations.
UNIT V	**Graphs:** Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm.

TEXT BOOKS	
1.	Data Structures Using C. 2nd Edition.Reema Thareja, Oxford.
2.	Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.
REFERENCE BOOKS	
1.	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press.
2.	Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.
3.	Data Structures with C, Seymour Lipschutz TMH
WEB RESOURCES	
1.	http://algs4.cs.princeton.edu/home/
2.	https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf

Applied Physics Laboratory

Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Basic Sciences	Course Code	20BP2L02
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites	Intermediate Physics	Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	The student will have exposure to experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental results and correlate with the theoretical principles.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	K2
CO2	Determine the Magnetic and Dielectric constants of materials.	K3
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT **(Any 10 of the following listed 15 experiments):** **8 Regular mode and any two experiments in Virtual mode(Virtual Lab)**	
1.	Determination of wavelength of laser Light using diffraction grating.
2.	Determination of wavelength of a light using Diffraction Grating-Normal incidence.
3.	Newton's rings – Determination of Radius of Curvature of Plano - Convex Lens.
4.	Determination of thickness of a spacer using wedge film and parallel interference fringes.
5.	Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
6.	Energy Band gap of a Semiconductor p - n junction.
7.	Characteristics of Thermistor – Temperature Coefficients
8.	Determination of dielectric constant by charging and discharging method
9.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10.	Determination of Dispersive power of diffraction grating.
11.	To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode
12.	Determination of Hall Voltage and Hall coefficients of a given semiconductor using Hall effect.
13.	Determination of Acceleration due to gravity and Radius of gyration Using Compound Pendulum.

14.	Determination of Numerical Aperture and acceptance angle of an Optical Fiber
15.	Estimation of Planck's Constant using Photoelectric Effect.

TEXT BOOKS

1.	College customized manual

WEB RESOURCES

1.	www.vlab.co.in (virtual lab link)

Python Programming Laboratory

Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Engineering Sciences	Course Code	20CS2L03
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment**	15
		Semester End Examination	35
		Total Marks	50

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

	COURSE OUTCOMES	BTL
	Upon successful completion of the course, the student will be able to:	
CO1	Write, Test and Debug Python Programs and Use Conditionals and Loops for Python Programs	K4
CO2	Use functions and represent Compound data using Lists, Tuples and Dictionaries	K3
CO3	Use various applications using python	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2
CO3	3	2	1	1	1	-	-	-	-	-	-	2	3	3	2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

COURSE CONTENT

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.

2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and averageof the three numbers and print out the values of total and average.

3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.

4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.

5) Use a *for*loop to print a triangle like the one below. Allow the user to specify howhigh the triangle should be.
   ```
   *
   **
   ***
   ****
   ```

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.

7) Write a program that asks the user for two numbers and prints *Close* if the numbersare within .001 of each other and Not close otherwise.

8) Write a program that asks the user to enter a word and prints out whether that wordcontains any vowels.

9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde*and*ABCDE* the program should print out *AaBbCcDdEe*.

10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.

11) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and

then inserts multiplication symbols where appropriate.

12) Write a program that generates a list of 20 random numbers between 1 and 100.
    (a) Print the list.
    (b) Print the average of the elements in the list.
    (c) Print the largest and smallest values in the list.
    (d) Print the second largest and second smallest entries in the list
    (e) Print how many even numbers are in the list.

13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.

14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, thelongest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.

15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].

16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements,it is much shorter with lists and it is also easier to add new conversions if you use lists.

17) Write a function called *sum_digits*that is given an integer num and returns the sum of the digits of num.

18) Write a function called *first_diff*that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.

19) Write a function called *number_of_factors*that takes an integer and returns howmany factors the number has.

20) Write a function called *is_sorted*that is given a list and returns True if the list issorted and False otherwise.

21) Write a function called root that is given a number x and an integer n and returns$x^{1/n}$. In the function definition, set the default value of n to 2.

22) Write a function called primes that is given a number n and returns a list of the firstn primes. Let the default value of n be 100.

23) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
    (a) Do this using the sort method. (b) Do this without using the sort method.

24)   Write a program that asks the user for a word and finds all the smaller

words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.

25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.

26) Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

27) Write a class called Product. The class should have fields called name, amount,and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price*that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase*that receives the number of items to be bought and decreases amount by that much.

28) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes*that returns a string of minutes and secondsformatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours*that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.

30) Write a Python class to implement pow(x, n).

31) Write a Python class to reverse a string word by word.

32) Write a program that opens a file dialog that allows you to select a text file. Theprogram then displays the contents of the file in a textbox.

33) Write a program to demonstrate Try/except/else.

34) Write a program to demonstrate try/finally and with/as.

Data Structures Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Engineering Sciences	**Course Code**	20IT2L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Programming for Problem Solving using C	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Demonstrate the different data structures implementation.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Use basic data structures such as arrays and linked list.	K3
CO2	Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.	K2
CO3	Use various searching and sorting algorithms.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO2	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO3	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

COURSE CONTENT	
Exercise -1 (Searching)	a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list. b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list.
Exercise -2 (Sorting-I)	a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order b) Write C program that implement Quick sort, to sort a given list of integers in ascending order c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order
Exercise -3 (Sorting-II)	a) Write C program that implement radix sort, to sort a given list of integers in ascending order b) Write C program that implement merge sort, to sort a given list of integers in ascending order
Exercise -4 (Singly Linked List)	a) Write a C program that uses functions to create a singly linked list b) Write a C program that uses functions to perform insertion operation on a singly linked list c) Write a C program that uses functions to perform deletion operation on a singly linked list d) Write a C program to reverse elements of a single linked list.
Exercise -5 (Queue)	a) Write C program that implement Queue (its operations) using arrays. b) Write C program that implement Queue (its operations) using linked lists
Exercise -6 (Stack)	a) Write C program that implement stack (its operations) using arrays b) Write C program that implement stack (its operations) using Linked list c) Write a C program that uses Stack operations to evaluate postfix expression
Exercise -7 (Binary Tree)	Write a recursive C program for traversing a binary tree in preorder, inorder and postorder.
Exercise -8 (Binary Search Tree)	a) Write a C program to Create a BST b) Write a C program to insert a node into a BST. c) Write a C program to delete a node from a BST.

Constitution of India

Common to CE, EEE, MECH, ECE, CSE, CSE (DS), CSE (AI&ML), CSE(AI), IT

Course Category	Mandatory Course	Course Code	20HM2T05
Course Type	Theory	L-T-P-C	2-0-0-0
Prerequisites		Internal Assessment	0
		Semester End Examination	0
		Total Marks	0

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Understand the evolution of Constitution of India	K2
CO2	Make use of one's Fundamental rights.	K3
CO3	Understand the functioning of the Union Government	K2
CO4	Understand the functioning of the State and local self Government.	K2
CO5	Understand the value of Indian Constitution in functioning of the country.	K2

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	-	-	-	-	-	3	-	3	-	1	-	2	-	-	-
CO 2	-	-	-	-	-	1	-	2	1	1	-	1	-	-	-
CO 3	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO 4	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-
CO 5	-	-	-	-	-	1	1	1	1	1	-	2	-	-	-

COURSE CONTENT	
UNIT I	**Introduction to Indian constitution:** Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.
UNIT II	**Fundamental Rights:** Individual and Collective Rights – Limitations of the fundamental Rights – Fundamental Rights Vs Duties
UNIT III	**Union Government:** Union Legislature – Lok Sabha and Rajya Sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).
UNIT IV	**State Government:**State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions) **Local Self Government:** Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)
UNIT V	The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

REFERENCE BOOKS	
1.	‗Indian Polity' by Laxmikanth
2.	‗Indian Administration' by Subhash Kashyap
3.	‗Indian Constitution' by D.D. Basu
4.	‗Indian Administration' by Avasti and Avasti
WEB RESOURCES	
1.	https://www.clearias.com/historical-background-of-indian-constitution/
2.	https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html
3.	https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

Transforms and Vector Calculus

Common to CE, ME, ECE, CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Basic Sciences	Course Code	20BM3T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Examine the properties of Laplace transformation	K3
CO2	Solve ordinary differential equations by using Laplace transformation technique	K2
CO3	Expand a periodic function as a Fourier series and find Fourier transform of a given function.	K3
CO4	Understand vector differential properties of scalar and vector point functions and their applications	K2
CO5	Apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function.
UNIT II	**Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.
UNIT III	**Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms.
UNIT IV	**Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities.
UNIT V	**Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India

	REFERENCE BOOKS
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline.
7.	**Shanti Narayan**, Integral Calculus – Vol. 1 & II
	WEB RESOURCES
1.	**UNIT I: Laplace transforms** https://en.wikipedia.org/wiki/Laplace_transform https://web.stanford.edu/~boyd/ee102/laplace.pdf
2.	**UNIT II: Inverse Laplace transforms** https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php
3.	**Unit – III: Fourier Analysis** https://www.mathsisfun.com/calculus/fourier-series.html https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html
4.	**UNIT IV: Vector Differentiation** https://en.wikipedia.org/wiki/Vector_calculus
5.	**UNIT V: Vector Integration** https://en.wikipedia.org/wiki/Divergence_theorem http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx

Advanced Data Structures through C
Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

Course Category	Professional Core	Course Code	20CS3T04
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Data Structures	Internal Assessment Semester End Examination Total Marks	30 70 100

	COURSE OBJECTIVES
1	Comprehensive understanding of dictionaries, hashing mechanism which supports faster data retrieval and skip lists
2	Illustration of Balanced trees and their operations.
3	Comprehension of heaps, queues and their operations Priority Queues.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Develop symbol table using hashing techniques	K3
CO2	Implement priority queues using Binary heap and Binomial Queue and their applications	K3
CO3	Analyze algorithms for Height balanced trees such as AVL trees, red-black trees.	K3
CO4	Analyze algorithms for Height balanced trees B-trees and B+ trees	K3
CO5	Develop algorithms for digital search trees, binary tries and patricia	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Contribution of Course Outcomes towards achievement of Program **Outcomes (1 – Low, 2 - Medium, 3 – High)**															
CO1	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	2	2

COURSE CONTENT	
UNIT I	**HASHING:** Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic, Hashing.
UNIT II	**PRIORITY QUEUES (HEAPS):** Model, Simple Implementation, Binary Heap-Structure Property-Heap-Order Property-Basic Heap Operations- Other Heap Operation, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation Implementation of Binomial Queues
UNIT III	**EFFICIENT BINARY SEARCH TREES:** Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Definition- Representation of a RedBlack Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a RedBlack Tree- Joining Red-Black Trees, Splitting a Red-Black tree
UNIT IV	**MULTIWAY SEARCH TREES:** M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree.
UNIT V	**DIGITAL SEARCH STRUCTURES:** Digital Search Trees, Definition- Search, Insert and Delete- Binary tries and Patricia, Binary Tries, Compressed Binary Tries- Patricia, Multiway Tries- Definitions- Searching a Trie-Sampling Strategies- Insertion into a Trie- Deletion from a Trie- Keys with Different Length-Height of a TrieSpace Required.

TEXT BOOKS	
1.	Fundamentals of DATA STRUCTURES in C: 2nd ed. Horowitz , Sahani, Anderson-freed,

	Universities Press
2.	Data structures and Algorithm Analysis in C, 2nd ed. Mark Allen Weiss, Pearson

REFERENCE BOOKS	
1.	Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
2.	File Structures :An Object oriented approach with C++, 3rd ed, Michel J Folk, Greg Riccardi, Bill Zoellick
3.	Data Structures and Algorithms : Concepts, Techniques and Applications, GAV Pai, Tata McGraw Hill Corporation, ISBN: 9780070667266, 9780070667266, 2008

WEB RESOURCES	
1.	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
2.	http://utubersity.com/?page_id=878
3.	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
4.	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
5.	http://lcm.csa.iisc.ernet.in/dsa/dsa.html
6.	http://utubersity.com/?page_id=878
7.	http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
8.	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Introduction to Artificial Intelligence
Common to CSE(AI&ML) and CSE(AI)

Course Category	Professional Core	Course Code	20CS3T05
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Data Structures	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To provide a strong foundation of fundamental concepts in Artificial Intelligence.
2	To provide a basic exposition to the goals and methods of Artificial Intelligence.
3	To apply the techniques in applications which involve perception, reasoning and learning.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the history and foundations of Artificial Intelligence	K1
CO2	Apply the basic principles of AI in problem solving	K3
CO3	Choose the appropriate representation of Knowledge	K4
CO4	Solve the problems with uncertainty using probability	K4
CO5	Examine the Scope of AI and its societal implications	K5

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO2	1	2	3	3	3	-	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	1	2	3	3	3	-	-	-	-	-	-	-	2	3	-
CO5	1	2	3	3	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT I	**Introduction:** What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.
UNIT II	**Problem Solving:** Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.
UNIT III	**Knowledge Representation:** Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.
UNIT IV	**Uncertain Knowledge and Reasoning:** Acting under Uncertainty**,** Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks.
UNIT V	**AI present and Future:** Weak AI: Can Machines Act Intelligently?, Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence, Agent Components, Agent Architectures, Are We Going in the Right Direction?, What If AI Does Succeed?.

TEXT BOOKS	
1.	Stuart Russell and Peter Norvig, ‒Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Pearson, 2010
2.	Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill, 2010
REFERENCE BOOKS	

1.	SarojKaushik, ‑Artificial Intelligence‖, Cengage Learning India, 2011
2.	David Poole and Alan Mackworth, ‑Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010.
3.	Trivedi, M.C., ‑A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106105077
2.	https://nptel.ac.in/courses/106106126
3.	https://aima.cs.berkeley.edu
4.	https://ai.berkeley,edu/project_overview.html

Database Management Systems
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core		Course Code	20IT3T02
Course Type	Theory		**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

1	To introduce about database management systems
2	To give a good formal foundation on the relational model of data and usage of RelationalAlgebra
3	To introduce the concepts of basic SQL as a universal Database language
4	To demonstrate the principles behind systematic database design approaches by coveringconceptual design, logical design through normalization
5	To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1 Describe a relational database and object-oriented database	K2
CO2 Create, maintain, and manipulate a relational database using SQL	K3
CO3 Describe ER model for database design	K1
CO4 Design a database with understanding on Normalization.	K2
CO5 Understand the storage, recovery and accessing mechanisms	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

Contribution of Course Outcomes towards achievement of Program :
Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	3	3	-	-	-	-	-	1	-	-	1	1	1	2
CO3	3	3	3	2	-	-	-	-	1	-	2	1	1	1	1
CO4	3	3	3	-	-	-	-	-	1	-	3	1	1	1	2
CO5	3	2	1	-	-	-	-	-	1	-	-	1	1	1	2

COURSE CONTENT	
UNIT I	Introduction: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment. Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.
UNIT II	Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).
UNIT III	SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational setoperations. Indexing Techniques: B+ Trees: Search, Insert, Delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning
UNIT IV	Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth

	normal form(4NF), Fifth Normal Form (5NF).
UNIT V	Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

TEXTBOOKS	
1.	Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
2.	Database System Concepts,5/e, Silberschatz, Korth, TMH

REFERENCE BOOKS	
1.	Introduction to Database Systems, 8/e C J Date, PEA.
2.	Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA
3.	Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://www.geeksforgeeks.org/introduction-to-nosql/

Mathematical Foundations For Computer Science
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core		Course Code	20IT3T03
Course Type	Theory		**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

1	To introduce the students to the topics and techniques of discrete methods and combinatorialreasoning
2	To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close tiesbetween this discipline and the area of computer science

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1	Demonstrate skills in solving mathematical problems	K2
CO2	Comprehend mathematical principles and logic	K2
CO3	Practice problems related to fundamental theorems	K2
CO4	Solve recurrence relations of various types	K2
CO5	Represent graphs as mathematical structure and apply graph theory in solving computer science problems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program :														
Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	1	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	1	1	1

COURSE CONTENT	
UNIT I	Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.
UNIT II	Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism.
UNIT III	Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems
UNIT IV	Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations
UNIT V	Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees
TEXTBOOKS	
1.	Discrete Mathematical Structures with Applications to Computer Science, J. P.

	Tremblay and P.Manohar, Tata McGraw Hill.
2.	Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3.	Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.
REFERENCE BOOKS	
1.	Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
2.	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
3.	Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011.
4.	Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/106/106106094/

Advanced Data Structures through C Laboratory

Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	**Course Code**	20CS3L04
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Data Structures Laboratory	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To make the student implement efficient data structures for maintenance of data
2	To make the student implement rigid data structures for faster lookup
3	To make the student develop balanced trees and their various operations.

COURSE OUTCOMES		**BTL**
Upon successful completion of the course, the student will be able to:		
CO1	Implement programs for efficiently retrieving records with Hash tables and Heaps.	K3
CO2	Develop programs for, efficient data storage and text processing applications.	K3
CO3	Develop programs for implementing balanced trees and their Operations.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	-

COURSE CONTENT	
1	Implement functions of Dictionary usingHashing (division method, Multiplication method, Universal hashing)
2	Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client_s telephone number
3	Implement various operations on Priority Queue
4	Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure.
5	Implement insertion operation on AVL trees.
6	Implement deletion operation on AVL trees.
7	Implement insertion operation on Red Black trees.
8	Implement deletion operation on Red Black trees.
9	Implement various operations on M-way search tree.
10	Implement various operations on B Trees
11	Implement various operations on B+ Trees
12	Implement Search Operation with Trie
13	Given an array of integers, with Trie structure find out two elements whose XOR is maximum.

TEXT BOOKS	
1.	Introduction to Algorithms," T.H. Cormen, C.E. Leiserson ,R.L. Rivest, and C. Stein, Third Edition.
2.	Data Structures with C (Schaum's Outline Series) by Seymour Lipschutz, July 2017.
REFERENCE BOOKS	
1.	Data Structures & Algorithm Analysis in C,SecondEdition,Mark Allen Weiss,PearsonEducation,India,January 2002 Edition.
2.	Algorithm Design and Applications, Michael T Goodrich, Roberto Tamassia, John Wiley,2002.
3.	Data Structures and Algorithms in C,Adam Drozdek,2004 Edition.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/102/106102064/
2.	https://www.tutorialspoint.com/advanced_data_structures/index.asp
3.	https://www.geeksforgeeks.org/advanced-data-structures/#SelfbalancingBSTs
4.	https://www.geeksforgeeks.org/trie-insert-and-search/
5.	https://www.cs.yale.edu/homes/aspnes/pinewiki/C(2f)HashTables.html?highlight=%28CategoryAlgorithmNotes%29

Introduction to Artificial Intelligence through LISP/PROLOG Laboratory
Common to CSE(AI&ML) and CSE(AI)

Course Category		Course Code	20CS3L05
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	To provide a strong foundation of fundamental concepts in Artificial Intelligence.
2	To provide a basic exposition to the goals and methods of Artificial Intelligence.
3	To apply the techniques in applications which involve perception, reasoning and learning.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Apply the basic principles of AI in problem solving using LISP/PROLOG	K3
CO2	Implement different algorithms using LISP/PROLOG	K3
CO3	Develop an Expert System using JESS/PROLOG	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	3	1	1	0	0	0	0	0	0	0	1	1	0
CO2	3	3	3	1	1	0	0	0	0	0	0	0	1	2	0
CO3	3	3	3	1	1	0	0	0	0	0	0	0	1	2	0

COURSE CONTENT	
1	Implementation of DFS for water jug problem using LISP/PROLOG
2	Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java
3	Implementation of TSP using heuristic approach using Java/LISP/ PROLOG
4	Implementation of Simulated Annealing Algorithm using LISP/PROLOG
5	Implementation of Hill-climbing to solve 8- Puzzle Problem
6	Implementation of Monkey Banana Problem using LISP/PROLOG
7	Implementation of A* Algorithm using LISP/PROLOG
8	Implementation of Hill Climbing Algorithm using LISP/PROLOG
9	Implementation Expert System with forward chaining using JESS/CLIPS
10	Implementation Expert System with backward chaining using RVD/PROLOG

TEXT BOOKS	
1.	Stuart Russell and Peter Norvig, ‒Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Pearson.
2.	Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill
REFERENCE BOOKS	
1.	SarojKaushik, ‒Artificial Intelligence‖, Cengage Learning India, 2011
2.	David Poole and Alan Mackworth, ‒Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010.
3.	Trivedi, M.C., ‒A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.
WEB RESOURCES	
1.	Prolog program of water jug problem - Prolog Tutorial	Codepoc.io
2.	Implementation of BFS for tic-tac-toe problem using LISP /PROLOG/Java (Python) - Goeduhub Technologies
3.	Implementation of Monkey Banana Problem using LISP/PROLOG Implementation of A*

	Algorithm using LISP/PROLOG - Google Search
4.	Hill Climbing Algorithm	Hill Climbing in Artificial Intelligence	Data Science Tutorial	Edureka - YouTube
5.	Forward and Backward Chaining in Artificial Intelligence	Engineering Education (EngEd) Program	Section

Database Management Systems Laboratory

Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	Course Code	20IT3L04
Course Type	Laboratory	**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites		**Internal Assessment**	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	Populate and query a database using SQL DDL/DML Commands
2	Declare and enforce integrity constraints on a database
3	Writing Queries using advanced concepts of SQL
4	Programming PL/SQL including procedures, functions, cursors, and triggers

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Create database tables and perform various operations	K3
CO2	Implement PL/SQL programs	K3
CO3	Create stored packages for variables and cursors	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO2	3	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1	2	2	1

LIST OF EXPERIMENTS	
Note: For performing the experiments consider any case study (ATM/ Banking/ Library/Hospitalmanagement systems)	
1	Creation, altering and dropping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command.
2	Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS,

	UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3	Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4	Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5	i. Create a simple PL/SQL program which includes declaration section, executable section, and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raisedif no records were found) ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6	Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7	Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
8	Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9	Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10	Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11	Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12	Create a table and perform the search operation on table using indexing and non-indexingtechniques.
TEXTBOOKS/SUGGESTED READING:	
1	Oracle: The Complete Reference by Oracle Press
2	Nilesh Shah, "Database Systems Using Oracle‖, PHI, 2007
3	Rick F Vander Lans, ‒Introduction to SQL‖, Fourth Edition, Pearson Education, 2007

Skill Oriented Course
Mobile App Development through Android
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Skill Oriented Course	Course Code	20CS3S03
Course Type	Laboratory	L-T-P-C	0-0-4-2
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2	To understand how to work with various mobile application development frameworks.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	**Discuss** the components and different Layout for mobile application development framework for android.	K6
CO2	**Design** Simple GUI application with the **Use** of Built in components and widgets.	K6
CO3	**Define** a solution for complex problems	K1

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	-	-	-	-	-	3	-	-
CO2	2	2	-	-	2	-	-	-	-	1	-	-	3	3	-
CO3	2	2	1	-	2	-	-	-	-	1	-	-	3	3	-

COURSE CONTENT	
1	Introduction to mobile technologies and devices , Android platform and applications overview
2	Setting Android development environments
3	Writing Android applications, Understanding anatomy of an Android application
4	Develop an application that uses GUI components, Font and Colours
5	Develop an application that uses Layout Managers and event listeners.
6	Write an application that draws basic graphical primitives on the screen.
7	Develop an application that makes use of databases.
8	Develop an application that makes use of Notification Manager
9	Implement an application that uses Multi-threading
10	Develop a native application that uses GPS location information
11	Implement an application that writes data to the SD card.
12	Implement an application that creates an alert upon receiving a message
13	Write a mobile application that makes use of RSS feed
14	Develop a mobile application to send an email.
15	Develop a Mobile application for simple needs (Mini Project)

TEXT BOOKS	
1.	Build Your Own Security Lab, Michael Gregg, Wiley India.
REFERENCE BOOKS	
1.	Android Programming unleashed , B.M. Harwani, Pearson, 2013.
2.	Android Programming (Big Nerd Ranch Guide), by Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, Pearson, 2016
3.	Android Programming – Pushing the limits by Hellman by Erik Hellman, WILEY, 2013

	WEB RESOURCES
1.	The Complete Android N Developer Course –Udemy https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526
2.	Android Development Courses on Google developers training https://developers.google.com/training/android/
3.	Mobile Computing - Video course- NPTEL https://nptel.ac.in/courses/106/106/106106147/#
4.	Android Tutorial – Tutorial Point https://www.tutorialspoint.com/android/index.htm

Essence of Indian Traditional Knowledge
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Humanities and Social Sciences	Course Code	20HM4T06
Course Type	Mandatory	L-T-P-C	2-0-0-0
Prerequisites		Internal Assessment Semester End Examination Total Marks	

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Understand the concept of Traditional knowledge and its importance	Understanding
CO2	Know the need and importance of protecting traditional knowledge	Understanding
CO3	Know the various enactments related to the protection of traditional knowledge	Understanding
CO4	Understand the concepts of Intellectual property to protect the traditional knowledge	Understanding
CO5	Understand the importance of Traditional Knowledge in the development of different sectors	Understanding

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	3	-	1	-	2	-	-	-	-	-
CO2	-	-	2	-	-	2	-	2	1	-	-	2	-	-	-
CO3	-	-	1	-	-	3	2	3	1	2	-	1	-	-	-
CO4	-	-	-	-	-	2	1	3	1	1	-	1	-	-	-
CO5	1	-	1	-	-	3	1	1	1	3	-	1	-	-	-

COURSE CONTENT	
UNIT I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge
UNIT II	Protection of Traditional Knowledge: The need for protecting traditional knowledge - Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge
UNIT III	Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003.
UNIT IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.
UNIT V	Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

REFERENCE BOOKS	
1.	Traditional Knowledge System in India, by Amit Jha, 2009.
2.	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3.	Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4.	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5.	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6.	Pramod Chandra, India Arts, Howard Univ. Press, 1983.

7.	Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.
WEB RESOURCES	
1.	https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html
2.	http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf
3.	https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

Probability & Statistics
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Basic Sciences	Course Code	20BM4T05
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To familiarize the students with the foundations of probability and statistical methods
2	To impart probability concepts and statistical methods in various applications

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Classify the concepts of data science and its importance.	K2
CO2	Interpret the association of characteristics and through correlation and regression tools.	K3
CO3	Make use of the concepts of probability and their applications Apply discrete and continuous probability distributions .	K3
CO4	Design the components of a classical hypothesis test.	K4
CO5	Infer the statistical inferential methods based on small and large sampling tests .	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Descriptive statistics and methods for data science**: Data science – Statistics Introduction – Population vs Sample – Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability (spread or variance) – Skewness Kurtosis.
UNIT II	**Correlation and Curve fitting**: Correlation – correlation coefficient – rank correlation – regression coefficients and properties – regression lines – Method of least squares – Straight line – parabola – Exponential – Power curves.
UNIT III	**Probability and Distributions**: Probability – Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.
UNIT IV	**Sampling Theory**: Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate
UNIT V	**Tests of Hypothesis:** Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.
TEXTBOOKS	
1.	Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2.	S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
REFERENCE BOOKS	
1.	Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
2.	Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage
3.	Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4.	Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.
WEB RESOURCES	
1.	**UNIT I:** https://en.wikipedia.org/wiki/List_of_probability_distributions https://en.wikipedia.org/wiki/Binomial_distribution
2.	**UNIT II:**

	https://en.wikipedia.org/wiki/Normal_distribution
3.	**UNIT III:** https://en.wikipedia.org/wiki/Sampling_(statistics) https://nptel.ac.in/courses/111104073/
4.	**UNIT IV:** https://en.wikipedia.org/wiki/Statistical_hypothesis_testing https://machinelearningmastery.com/statistical-hypothesis-tests/
5.	**UNIT V:** https://en.wikipedia.org/wiki/Regression_analysis https://www.surveysystem.com/correlation.htm

Computer Organization
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Engineering Sciences	Course Code	20EC4T12
Course Type	Theory	L-T-P-C	3 – 0 – 0 – 3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will learn	
1	Principles and the Implementation of Computer Arithmetic
2	Operation of CPUs including RTL, ALU, Instruction Cycle and Busses
3	Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design
4	Memory System and I/O Organization
5	Principles of Operation of Multiprocessor Systems and Pipelining

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Develop a detailed understanding of computer systems	K2
CO2	Cite different number systems, binary addition and subtraction, standard, floating-pointand micro-operations	K2
CO3	Develop a detailed understanding of architecture and functionality of central processing unit	K4
CO4	Exemplify in a better way the I/O and memory organization	K3
CO5	Illustrate concepts of parallel processing, pipelining and inter processor communication	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of ProgramOutcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1							1				
CO2	1	2	2							1			1	
CO3	2	1	2							1				2
CO4	2	3	2							1			2	
CO5	1	2	1											1

COURSE CONTENT	
UNIT-I	Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.
UNIT-II	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. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.
UNIT-III	Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer. Microprogrammed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.
UNIT-IV	Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access
UNIT-V	Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration. Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

TEXT BOOKS	
1.	Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
2.	Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5/e, McGrawHill, 2002.
REFERENCE BOOKS	
1.	Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2.	Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3.	Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer,2006.

Data Mining
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Professional Core	Course Code	20 CS4T07
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand and implement classical models and algorithms in data ware housing and data mining.
2	To analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3	To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Summarize the architecture of data warehouse	Understanding
CO2	Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data.	Applying
CO3	Construct a decision tree and resolve the problem of model overfitting	Applying
CO4	Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation	Understanding
CO5	Apply suitable clustering algorithm for the given data set	Applying

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	3	2	2	1	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	1	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-	-	-	-

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

COURSE CONTENT	
UNIT I	**Data Warehouse and OLAP Technology:** An Overview: Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber)
UNIT II	**Data Mining:** Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality. Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan & Vipin)
UNIT III	**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction. **Model Overfitting:** Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan & Vipin)
UNIT IV	**Association Analysis:** Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Apriori Principle, Apriori Algorithm, Rule Generation, Compact Representation of Frequent Itemsets, FPGrowth Algorithm. (Tan & Vipin)
UNIT V	**Cluster Analysis:** Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means

Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin)

TEXT BOOKS	
1.	Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015.
2.	Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011
REFERENCE BOOKS	
1.	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010
2.	Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
3.	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008
4.	Data Mining Techniques, Arun K Pujari, Universities Press, 2013, 3rd edition,
WEB RESOURCES	
1.	NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview
2.	https://www.javatpoint.com/data-mining
3.	https://www.tutorialspoint.com/data_mining/index.htm

Java Programming

Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category	Professional Core	Course Code	20CS4T10
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Data Structures	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
1	To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
2	To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
3	To understand how to design applications with threads and JDBC connections in Java

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Differentiate the application of decision and iteration control structures.	K2
CO2	Implements the concepts of Java such as classes, method overloading and various keywords.	K3
CO3	Apply the concept of inheritance and interfaces.	K3
CO4	Able to implements the concepts of Packages and Exception handling.	K3
CO5	Able to Analyze & Implement the concepts of Multi threading and JDBC Connections.	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2

COURSE CONTENT	
UNIT I	Program Structure in Java: Introduction, Writing Simple Java Programs, Tokens in Java Programs, Command Line Arguments, Comments. Data Types, Variables, and Operators: Introduction, Data Types in Java, Static Variables and Methods, Attribute Final, Operators. Control Statements: If Expression, Switch Statement, Loops.
UNIT II	Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this. Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.
UNIT III	Arrays: Introduction, Operations on Array Elements, Sorting and Searching, Two-dimensional Arrays Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces
UNIT IV	Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Java.lang Package and its Classes, class Math, Wrapper Classes, Java util Classes and Interfaces, Time Package, Class Instant (java.time.Instant). Exception Handling: Introduction, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions
UNIT V	String Handling in Java: Introduction, Interface Char Sequence, Class String, String Methods, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder. Introducing the AWT: Graphics,Text, Layout Managers, Menus and Images Swing: Origins, Features, MVC Connection, Components and Containers Multithreaded Programming: Introduction, Thread Class, Main Thread- Creation of New

	Threads, Thread States Java Database Connectivity: Introduction, JDBC Architecture, Establishing JDBC Database Connections

TEXT BOOKS

1.	Introduction to Java Programming, 7th edition by Y Daniel Liang, Pearson
2.	The complete Reference Java, 8th edition, Herbert Schildt, TMH.

REFERENCE BOOKS

1.	JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2.	Murach's Java Programming, Joel Murach

WEB RESOURCES

1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://www.w3schools.com/java/java_data_types.asp
3.	https://docs.oracle.com/javase/tutorial/java/index.html

Managerial Economics and Financial Analysis
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

Course Category	Humanities and Social Sciences	Course Code	20HM4T01
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services	Applying
CO2	Assess the functional relation among production, cost of production, cost concepts and Break-Even Analysis.	Evaluating
CO3	Classify market structures for price and output decisions and Appraise the forms of business organizations and trade cycles in economic growth.	Understanding
CO4	Make use of the final accounting statements in financial decision making	Applying
CO5	Apply capital budgeting techniques in financial decision making	Applying

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	1	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	1	-	-	-	-	-	-	2	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	3	2	-	-	-

COURSE CONTENT	
UNIT I	Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Demand forecasting and Methods of demand forecasting (Opinion survey methods, Trend line by observation, least squares method and barometric techniques)
UNIT II	Production and Cost Analysis: Production function- Law of Variable proportions- Iso-quants and Isocosts- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems).
UNIT III	Introduction to Markets, Pricing Policies and Types of Business Organizations: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price and Output Determination. Pricing Policies: Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing. Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycles.
UNIT IV	Introduction to Accounting and Capital Budgeting: Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Final Accounts (Simple Problems)
UNIT V	Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods(Simple Problems)

TEXT BOOKS	
1.	Dr. A. R. Aryasri – Managerial Economics and Financial Analysis – TMH- 2018
2.	Dr. N. Appa Rao, Dr. P. Vijay Kumar - ‗Managerial Economics and Financial Analysis‗ - Cengage Publications – 2012
REFERENCE BOOKS	
1.	V. Maheswari -Managerial Economics - Sultan Chand & Sons – 2014.
2.	Suma Damodaran - Managerial Economics - Oxford - 2011.
3.	Vanitha Agarwal - Managerial Economics - Pearson Publications- 2011.

4.	V.Maheswari - Financial Accounting- Vikas Publications – 2018.
5.	S. A. Siddiqui & A. S. Siddiqui - Managerial Economics and Financial Analysis - New Age International Publishers – 2012

WEB RESOURCES	
1.	https://economictimes.indiatimes.com/definition/law-of-supply
2.	https://sites.google.com/site/economicsbasics/managerial-theories-of-the-firm
3.	https://www.managementstudyguide.com/capitalization.htm

R Programming Laboratory

Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

Course Category		Course Code	20CS4L10
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	Student will learn about the fundamentals of R programming, standard R libraries, solid understanding of R functions,write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Implement basic concepts of R programming, and its different module that includes conditional, looping, lists, Strings, Functions, Frames, Arrays, and File programming.	K3
CO2	Implement the concepts of R Script to extract the data from data frames and file operations.	K4
CO3	Implement the various statistical techniques using R. Extend the functionality of R by using add-on packages. Use R Graphics and Tables to visualize results of various statistical operations on data.	K6

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO2	2	2	3	3	3	-	-	-	-	-	-	3	3	3	3
CO3	2	3	3	3	3	-	-	-	-	-	-	3	3	3	3

COURSE CONTENT	
Week 1	Installing R and RStudio Basic functionality of R, variable, data types in R
Week 2	a) Implement R script to show the usage of various operators available in R language. b) Implement R script to read person_s age from keyboard and display whether he is eligiblefor voting ornot. c) Implement R script to find biggest number between two numbers. d) Implement R script to check the given year is leap year ornot.
Week 3	a) Implement R Script to create a list. b) Implement R Script to access elements in the list. c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation
Week 4	Implement R script to perform following operations: a) various operations on vectors b) Finding the sum and average of given numbers using arrays. c) To display elements of list in reverse order. d) Finding the minimum and maximum elements in the array.
Week 5	a) Implement R Script to perform various operations on matrices b) Implement R Script to extract the data from dataframes. c) Write R script to display file contents. d) Write R script to copy file contents from one file to another
Week 6	a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets. b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset
Week 7	a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disk location. b) Reading Excel data sheet in R. c) Reading XML dataset in R
Week 8	a) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram (Introduction toggplot2 graphics) b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations.
Week 9	a) Implement R Script to perform Normal, Binomial distributions. b) Implement R Script to perform correlation, Linear and multiple regression.
Week 10	Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding

Week 11	Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates,outliers, spelling
Week 12	Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Google Spreadsheets, API and web scraping examples

TEXT BOOKS	
1.	The R Book, by Michael J. Crawley, 2012. Wiley, 1076 p. ISBN-13: 978-0470973929
2.	An Introduction using R, by Michael J. Crawley, 2014. John Wiley & Sons, 360 p. ISBN-13: 978-1118941096
REFERENCE BOOKS	
1.	R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
2.	Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
3.	R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications
4.	Hands-On Programming with R by Grolemund, O Reilly Publications
5.	Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. - 2017 Edition
6.	R Fundamentals and Programming Techniques, ThomasLumely.
7.	R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison Wesley Series
8.	The Art of R Programming, Norman Matloff, Cengage Learning
9.	Maria Dolores Ugarte, Ana F.Militino, AlanT.Arnholt―Probability and Statistics with R, 2nd Edition, CRC Press,2016.
10.	R-programming for Data science, Roger D.Peng.
11.	An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani.
WEB RESOURCES	
1.	URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf (Online Resources)
2.	http://nptel.ac.in/courses/106104135/48
3.	http://nptel.ac.in/courses/110106064/
SOFTWARE Requirements	

1.	The R statistical software program. Available from: https://www.r-project.org/
2.	RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/

Data Mining using Python Laboratory
Common to CSE(AI&ML), CSE(AI), CSE(DS)

Course Category		Course Code	20CS4L11
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	Practical exposure on implementation of well-known data mining algorithms
2	Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Apply preprocessing techniques on real world datasets	K3
CO2	Apply apriori algorithm to generate frequent itemsets	K3
CO3	Apply Classification and clustering algorithms on different datasets.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3
CO2	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	2	3

COURSE CONTENT	
Use python library scikit-learn wherever necessary	
1	Demonstrate the following data preprocessing tasks using python libraries.

	a) Loading the dataset b) Identifying the dependent and independent variables c) Dealing with missing data
2	Demonstrate the following data preprocessing tasks using python libraries. a) Dealing with categorical data b) Scaling the features c) Splitting dataset into Training and Testing Sets
3	Demonstrate the following Similarity and Dissimilarity Measures using python a) Pearson's Correlation b) Cosine Similarity c) Jaccard Similarity d) Euclidean Distance e) Manhattan Distance
4	Build a model using linear regression algorithm on any dataset.
5	Build a classification model using Decision Tree algorithm on iris dataset
6	Apply Naïve Bayes Classification algorithm on any dataset
7	Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data.
8	Apply K- Means clustering algorithm on any dataset.
9	Apply Hierarchical Clustering algorithm on any dataset.
10	Apply DBSCAN clustering algorithm on any dataset.

TEXT BOOKS	
1.	Data Mining Concepts and Techniques Third Edition, Jiawei Han, Micheline Kamber, Jian Pei
REFERENCE BOOKS	
1.	Hands-On Machine Learning with Scikit-Learn and TensorFlow, OREILLY Concepts Tools and Techniques to build Intelligent systems
2.	Python for Everybody *By Dr Charles R. Severance*
WEB RESOURCES	
1.	https://analyticsindiamag.com/data-pre-processing-in-python/

2.	https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93
3.	https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e
4.	https://www.springboard.com/blog/data-mining-python-tutorial/
5.	https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c
6.	https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn
7.	https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/
8.	https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learnd690cbae4c5d

Java Programming Laboratory
Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT, ECE

Course Category		Course Code	20CS4L12
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment**	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	Practice programming in the Java
2	Gain knowledge of object-oriented paradigm in the Java programming language
3	Learn use of Java in a variety of technologies and on different platforms

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Evaluate default value of all primitive data type, Operations, Expressions, Controlflow, Strings	K3
CO2	Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism	K3
CO3	Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3
CO2	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3
CO3	3	3	3	2	0	0	0	0	0	0	0	0	3	2	3

COURSE CONTENT	
1	**Exercise - 1** (Basics) a) Write a JAVA program to display default value of all primitive data type of JAVA b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root. c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.
2	**Exercise - 2** (Operations, Expressions, Control-flow, Strings) a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort c) Write a JAVA program to sort for an element in a given list of elements using merge sort. d) Write a JAVA program using StringBuffer to delete, remove character.
3	**Exercise - 3** (Class, Objects) a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. b) Write a JAVA program to implement constructor.
4	**Exercise - 4** (Methods) a) Write a JAVA program to implement constructor overloading. b) Write a JAVA program implement method overloading.
5	**Exercise - 5** (Inheritance) a) Write a JAVA program to implement Single Inheritance b) Write a JAVA program to implement multi level Inheritance c) Write a java program for abstract class to find areas of different shapes
6	**Exercise - 6** (Inheritance - Continued) a) Write a JAVA program give example for ‒super‖ keyword. b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
7	**Exercise - 7** (Exception) a) Write a JAVA program that describes exception handling mechanism b) Write a JAVA program Illustrating Multiple catch clauses
8	**Exercise ‒ 8** (Runtime Polymorphism) a) Write a JAVA program that implements Runtime polymorphism b) Write a Case study on run time polymorphism, inheritance that implements in above problem
9	**Exercise ‒ 9** (User defined Exception) a) Write a JAVA program for creation of Illustrating throw b) Write a JAVA program for creation of Illustrating finally c) Write a JAVA program for creation of Java Built-in Exceptions d) d)Write a JAVA program for creation of User Defined Exception

10	**Exercise – 10** (Threads) a) Write a JAVA program that creates threads by extending Thread class .First thread display ‒Good Morning ‒every 1 sec, the second thread displays ‒Hello ‒every 2 seconds and the third display ‒Welcome‖ every 3 seconds ,(Repeat the same by implementing Runnable) **b)** Write a program illustrating **isAlive** and **join** () c) Write a Program illustrating Daemon Threads.
11	**Exercise - 11** (Threads continuity) a) Write a JAVA program Producer Consumer Problem b) Write a case study on thread Synchronization after solving the above producer consumer problem
12	**Exercise – 12** (Packages) a) Write a JAVA program illustrate class path b) Write a case study on including in class path in your os environment of your package. c) Write a JAVA program that import and use the defined your package in the previous Problem
13	**Exercise - 13** (Applet) a) Write a JAVA program to paint like paint brush in applet. b) Write a JAVA program to display analog clock using Applet. c) Write a JAVA program to create different shapes and fill colors using Applet.
14	**Exercise - 14** (Event Handling) a) Write a JAVA program that display the x and y position of the cursor movement using Mouse. b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet.
15	**Exercise-15** (AWT & Swings) a) Write a Java Program to create a frame with three buttons and Radio Button b) Write a Java Program to print text in different colors c) Write a JAVA program that to create a single ball bouncing inside a JPanel.
16	**Exercise-16** (JDBC) a) Write a Java program to Connect database b) Write a Java Program to insert, update, delete & select records

TEXT BOOKS	
1.	JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2.	The complete Reference Java, 8th edition, Herbert Schildt, TMH.
REFERENCE BOOKS	
1.	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2.	Murach's Java Programming, Joel Murach
WEB RESOURCES	

1.	https://nptel.ac.in/courses/106/105/106105191/
2.	https://www.w3schools.com/java/java_data_types.asp

Skill Oriented Course Applications of Python-NumPy & Pandas
Common to CSE(AI&ML) and CSE(AI)

Course Category	Skill Oriented Course	Course Code	20CS4S07
Course Type	Laboratory	**L-T-P-C**	0-0-4-2
Prerequisites		**Total Marks**	50

COURSE OBJECTIVES	
1	To understand the fundamentals of the Pandas library in Python and how it is used to handle data and also develop basic skills in data analysis and visualization

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Analyze how data is collected, managed and stored for processing	K4
CO2	Work with arrays, queries, and dataframes	K3
CO3	Query DataFrame structures for cleaning and processing and manipulating files. Understand best practices for creating basic charts	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	-	-	-	-	-	1	-	3	3	3
CO2	3	2	3	3	3	-	-	-	-	-	1	-	3	3	3
CO3	3	2	3	3	3	-	-	-	-	-	1	-	3	3	3

	COURSE CONTENT
1	NumPy Installation using different scientific python distributions(Anaconda, Python(x,y), WinPython, Pyzo)
2	NumPy Basics (np.array, np.arrange, np.linespace, np.zeros, np.ones, np.random.random, np.empty)
3	Arrays (array.shape, len(array), array.ndim, array.dtype, array.astype(type), type(array))
4	Array Manipulation (np.append, np.insert, np.resize, np.delete, np.concatenate, np.vstack, np.hstack)
5	Mathematical Operations(np.add, np.substract, np.divide, np.multiply, np.sqrt, np.sin, np.cos, np.log, np.dot, np.roots) , Statistical Operations(np.mean, np.median, np.std, array.corrcoef( ))
6	NumPy data types
7	**Pandas Data Series:** 1) Write a Pandas program to create and display a one-dimensional array-like object containing an array of data using Pandas module. 2) Write a Pandas program to convert a Panda module Series to Python list and it's type. 3) Write a Pandas program to add, subtract, multiple and divide two Pandas Series. 4) Write a Pandas program to convert a NumPy array to a Pandas series. Sample Series: NumPy array: [10 20 30 40 50] Converted Pandas series: 0 10 1 20 2 30 3 40 4 50 dtype: int64
8	**Pandas Data Frames:** Consider Sample Python dictionary data and list labels: exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'], 'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19], 'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1], 'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']} labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j'] 1) Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels. 2) Write a Pandas program to change the name 'James' to 'Suresh' in name column of the DataFrame. 3) Write a Pandas program to insert a new column in existing DataFrame. 4) Write a Pandas program to get list from DataFrame column headers. 5) Write a Pandas program to get list from DataFrame column headers.

9	**Pandas Index:** 1) Write a Pandas program to display the default index and set a column as an Index in a given dataframe. 2) Write a Pandas program to create an index labels by using 64-bit integers, using floating-point numbers in a given dataframe.
10	**Pandas String and Regular Expressions:** 1) Write a Pandas program to convert all the string values to upper, lower cases in a given pandas series. Also find the length of the string values. 2) Write a Pandas program to remove whitespaces, left sided whitespaces and right sided whitespaces of the string values of a given pandas series. 3) Write a Pandas program to count of occurrence of a specified substring in a DataFrame column. 4) Write a Pandas program to swap the cases of a specified character column in a given DataFrame.
11	**Pandas Joining and merging DataFrame:** 1) Write a Pandas program to join the two given dataframes along rows and assign all data. 2) Write a Pandas program to append a list of dictioneries or series to a existing DataFrame and display the combined data. 3) Write a Pandas program to join the two dataframes with matching records from both sides where available.
12	**Plotting:** 1) Write a Pandas program to create a horizontal stacked bar plot of opening, closing stock prices of any stock dataset between two specific dates. 2) Write a Pandas program to create a histograms plot of opening, closing, high, low stock prices of stock dataset between two specific dates. 3) Write a Pandas program to create a stacked histograms plot of opening, closing, high, low stock prices of stock dataset between two specific dates with more bins.

TEXT BOOKS	
1.	Wes McKinney, Python for Data Analysis, O_Reilly, 2nd Edition, 2017.
REFERENCE BOOKS	
1.	Sinan Ozdemir, Principles of Data Science, Packt Publishers, 2nd Edition, 2018
2.	John Paul Mueller, Luca Massaron, Python for Data Science for Dummies, 2nd Edition, Wiley, 2015.
3.	Rachel Schutt, Cathy O_Neil, Doing Data Science: Straight Talk from the Frontline, O_Reilly, 2014.
WEB RESOURCES	

1.	https://swayam.gov.in/nd1_noc19_cs60/preview
2.	https://towardsdatascience.com
3.	https://www.w3schools.com/datascience/
4.	https://github.com/jakevdp/PythonDataScienceHandbook
5.	https://www.kaggle.com/

Automata Theory & Compiler Design
Common to IT, CSE(AI), CSE(AI&ML), CSE(DS)
III Year I Semester

Course Category	Professional Core		Course Code	20IT5T05
Course Type	Theory		**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

1	To learn fundamentals of Regular and Context Free Grammars and Languages
2	To understand the relation between Contexts free Languages, PDA and TM
3	To study the various phases in the design of a compiler
4	To understand the design of top-down and bottom-up parsers
5	To understand syntax directed translation schemes
6	To learn to develop algorithms to generate code for a target machine

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1 Design DFA and NFA to accept given languages	K3
CO2 Able to use LEX and YACC tools for developing a scanner and a parser and to design and implement LL and LR parsers	K3
CO3 Able to design SDT	K3
CO4 Able to design algorithms to perform code optimization in order to improve the performanceof a program in terms of space and time complexity	K3
CO5 Ability to design algorithms to generate machine code	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1-**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Formal Language and Regular Expressions:** Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.
UNIT II	**Context Free grammars and parsing :** Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.
UNIT III	**Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. **Context Sensitive features –** Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.
UNIT IV	**Run time storage:** Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. **Code optimization:** Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.
UNIT V	**Code generation:** Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

TEXTBOOKS	
1.	Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2--8.
2.	Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCE BOOKS	
1.	Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.
2.	Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2-1-.
3.	Theory of Computation, V. Kulkarni, Oxford University Press, 2-13

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/104/106104028/
2.	https://nptel.ac.in/courses/106/104/106104123/

Operating Systems

Common to IT, CSE, CSE(AI), CSE(AI&ML), CSE(DS)

III Year I Semester

Course Category	Professional Core	Course Code	20IT5T04
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

1	Introduce to the internal operation of modern operating systems
2	Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems
3	Understand File Systems in Operating System like UNIX/Linux and Windows
4	Understand Input Output Management and use of Device Driver and Secondary Storage(Disk) Mechanism
5	Analyze Security and Protection Mechanism in Operating System

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Describe various generations of Operating System and functions of Operating System	K2
CO2	Comprehend the concept of program, process and thread and compare various CPU Scheduling Algorithms and Inter Process Communication problems	K2
CO3	Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques	K2
CO4	Apply process synchronization techniques to avoid deadlocks	K3
CO5	Outline File Systems in Operating System like UNIX/Linux and Windows	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1-**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	1	-	-	-	-	-	-	-	2	1	-
CO2	3	3	3	2	1	-	-	-	-	-	-	2	3	1	1
CO3	3	3	2	-	1	-	-	-	-	-	-	2	3	1	-
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	1	3
CO5	3	3	3	3	1	-	-	-	-	-	-	2	3	1	3

COURSE CONTENT	
UNIT I	Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.
UNIT II	Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem
UNIT III	Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.
UNIT IV	Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.
UNIT V	System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

TEXTBOOKS	
1.	Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2-13.
2.	Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2--8. (for Interprocess Communication and File systems.)

REFERENCE BOOKS	
1.	Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill,2-12.
2.	Stallings W, Operating Systems - Internals and Design Principles, 6th edition, Pearson Education,2--9
3.	Nutt G, Operating Systems, 3rd edition, Pearson Education, 2--4.

WEB RESOURCES	
1.	

Machine Learning
Common to CSE(AI), CSE(AI&ML), CSE(DS)
III B Tech I Semester

Course Category	Professional Core	Course Code	20AM5T02
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Probability and Statistics	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
2	Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Explain the fundamental usage of the concept Machine Learning system.	K1
CO2	Demonstrate on various regression Technique.	K2
CO3	Analyze the Ensemble Learning Methods.	K3
CO4	Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.	K4
CO5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning.	K5

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	--	--	--	--	2	2	2	1
CO2	3	2	1	--	--	--	--	--	--	--	--	1	1	1	1
CO3	3	2	1	--	--	--	--	--	--	--	--	--	1	1	1
CO4	3	2	1	--	--	--	--	--	--	--	--	--	1	1	1
CO5	3	2	1	--	--	--	--	--	--	--	--	--	1	1	1

COURSE CONTENT	
UNIT-I	**Introduction**- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.
UNIT-II	**Supervised Learning**: (Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes. Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines. Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.
UNIT-III	**Ensemble Learning and Random Forests**: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.
UNIT-IV	**Unsupervised Learning Techniques**: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.
UNIT-V	**Neural Networks**: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.

TEXT BOOKS	
1.	"Machine Learning" , Tom M. Mitchell, Tata Mc – Graw Hill Publications, 2nd Edition, 2021
2.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019.
REFERENCE BOOKS	
1.	Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020.
2.	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.
WEB RESOURCES:	
1	https:// https://onlinecourses.nptel.ac.in/noc21-cs24/preview

Surveying
Common to CSE, IT, CSE(AIML), CSE(AI), CSE(DS)

III Year I Semester

Course Category	Open Elective - I		Course Code	20CE5T01
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
1	Introduce the students to basic principles of surveying.
2	Demonstrate the basic surveying skills.
3	Perform various methods of linear and angles measurements.
4	Enable the students to use surveying equipment's
5	Integrate the knowledge and produce topographical map.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Illustrate the fundamentals in chain and plane table surveying.
CO2	Identify the angles on filed by compass survey.
CO3	Apply knowledge of leveling in surveying.
CO4	Measure the horizontal and vertical angles by using Theodolite and Total Station instruments.
CO5	Estimate the volume and area of irregular boundaries of filed.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	1	--	--	--	--	3	--	--	2	3	--	3
CO2	3	3	1	2	--	--	--	--	2	--	--	3	3	--	3
CO3	2	--	--	3	--	--	--	--	3	--	--	--	2	--	2
CO4	2	3	1	3	3	--	--	--	3	--	--	3	3	--	3
CO5	3	3	3	3	--	--	--	--	--	--	--	3	3	3	3

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Definition-Uses of surveying, Objectives, Principles and Classificationsof Surveying – Errors in survey measurements. **DISTANCEMEASUREMENTCONVENTIONS AND METHODS:** Use of chain and tape, Errors and corrections to linear measurements, overview of plane table surveying.
UNIT II	**COMPASS SURVEY:** Definition- Principles of Compass survey - Meridians, Azimuths and Bearings, declination. Computation of angle - Purpose and types of Traversing - traverse adjustments – Local attraction.
UNIT III	**LEVELING:** Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments- method of levelling. **CONTOURING:** Characteristics and uses of contours- methods of conducting contour surveys and their plotting.
UNIT IV	**THEODOLITE:** Theodolite, description, principles - uses – temporary and permanent adjustments, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Omitted Measurements. Introduction to geodetic surveying - Total Station and Global Positioning System. **CURVES:** Types of curves, design and setting out. **TACHEOMETRIC SURVEYING:** Stadia and tangential methods of Tachometry. **MODERN SURVEYING METHODS:** Principle and types of E.D.M. Instruments, Total station advantages and Applications. Introduction to Global Positioning System.
UNIT V	**COMPUTATION OF AREAS AND VOLUMES:** Computation of areas along irregular boundaries and regular boundaries. Embankments and cutting for a level section and two-level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

TEXT BOOKS	
1.	Surveying (Vol No.1, 2 &3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd, New Delhi.
2.	Text book of Surveying by C. Venkataramaiah, University press, India (P) limited.

REFERENCE BOOKS	
1.	Text book of Surveying by S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2.	Text book of Surveying by Arora (Vol No. 1&2), Standard Book House, Delhi.

WEB RESOURCES	
1.	https://lecturenotes.in/notes/2827-note-for-surveying-1-s-1-by-swadhina-priyadarsini
2.	https://nptel.ac.in/courses/1-51-7122/1
3.	https://nptel.ac.in/courses/1-51-7158/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Renewable Energy Engineering

Common to CSE, IT, CSE(AIML), CSE(AI), CSE(DS)
III Year I Semester

Course Category	Open Elective - I		Course Code	20EE5T13
Course Type	Theory		**L-T-P-C**	**3-0-0-3**
Prerequisites	NIL		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

	COURSE OBJECTIVES
1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics
2	To understand the concept of Wind Energy Conversion & its applications
3	To study the principles of biomass and geothermal energy
4	To understand the principles of Ocean Thermal Energy Conversion (OTEC), motion of waves and power associated with it
5	To study the various chemical energy sources such as fuell cell and hydrogen energy along with their operation and equivalent circuit

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage	K4
CO2	Illustrate the components of wind energy systems	K3
CO3	Illustrate the working of biomass, digesters and Geothermal plants	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves	K3
CO5	Evaluate the concept and working of Fuel cells & MHD power generation	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO3	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO4	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO5	3	1	1	1	-	-	1	-	-	-	-	1	2	2

COURSE CONTENT	
UNIT 1	**Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.
UNIT 2	**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.
UNIT 3	**Biomass and Geothermal Energy:** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems.
UNIT 4	**Energy From oceans, Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.
UNIT 5	**Chemical Energy Sources:** **Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.

TEXT BOOKS	
1	G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2-11
2	John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2-13
REFERENCE BOOKS	
1	S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2-11
2	John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2-13
3	Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2-15
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Optimization Techniques

Common to CSE, CSE (AIML), CSE(AI), CSE(DS)

III B Tech I Semester

Course Category	Open Elective - I	Course Code	20ME5T29
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Transforms and Vector Calculus, Data Structures	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Classical optimization techniques
2	Numerical methods for optimization
3	Genetic algorithm and Genetic programming
4	Multi-Objective Genetic algorithm
5	Optimization in design and manufacturing systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the Classical optimization techniques for single and multi-variable problems with and with and without constraints.	K4
CO2	Apply numerical methods for optimization of manufacturing related problems	K3
CO3	Apply the Principles of genetic algorithm and genetic programming to manufacturing related problems	K3
CO4	Analyze the Multi-Objective Genetic algorithm for industrial problems	K4
CO5	Solve engineering problems by using optimization techniques in design and manufacturing systems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	-	-	-	-	-	-	-	2	1	2
CO2	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO3	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO4	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2
CO5	2	3	2	2	1	-	-	-	-	-	-	1	2	1	2

COURSE CONTENT	
UNIT-I	CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.
UNIT-II	NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.
UNIT-III	GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA. GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.
UNIT-IV	MULTI-OBJECTIVE GA: Pareto's analysis, non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems.
UNIT-V	APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

TEXT BOOKS	
1.	Engineering Optimization Theory & Practice, Singiresu S. Rao New Age International Publishers, Ltd.
2.	Optimization for Engineering Design, Kalyanmoy Deb, PHI Publishers.
REFERENCE BOOKS	
1.	Genetic algorithms in Search, Optimization, and Machine learning, D.E.Goldberg, Addison-Wesley Publishers
2.	Multi objective Genetic algorithms, Kalyanmoy Deb, PHI Publishers
3.	Optimal design, Jasbir Arora, Mc Graw Hill (International) Publishers
4.	Optimum Design of Mechanical Elements, Ray C. Johnson, John Wiley & sons, Inc., New York.
WEB RESOURCES:	
1	https://nptel.ac.in/courses/111/1-5/1111-5-39/
2	https://nptel.ac.in/courses/1-6/1-8/1-61-8-56/
3	https://nptel.ac.in/courses/112/1-5/1121-5235/
4	https://onlinecourses.nptel.ac.in/noc21_me43/preview
5	https://www.nptel.ac.in/content/syllabus_pdf/1121-33-1.pdf

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Common to CSE, CSE(AIML), CSE(AI), CSE(DS)
III B Tech I Semester

Course Category	Open Elective - I	Course Code	20HM5T03
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	NIL	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	The purpose of the course is that the students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities, to develop the ability of analysing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities. The objective of the course is, further on, that the students develop the ability of analysing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development and, finally, to contribute to their entrepreneurial and managerial potentials.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Understand different Entrepreneurial traits.	K2
CO2	Identify and compare the financial institutions supporting entrepreneurship.	K4
CO3	Understand the functioning and problems faced by MSMEs (Micro Small Medium Enterprises)	K2
CO4	Identify Entrepreneurial opportunities for women.	K3
CO5	Analyze different market, technical factors and prepare a project report based on guidelines.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	3	2	1	3	3	-	-	-
CO2	-	-	-	-	-	1	-	3	-	2	3	1	-	-	-
CO3	-	-	-	-	-	1	1	3	1	1	-	3	-	-	-
CO4	-	-	-	-	-	1	-	3	1	1	-	3	-	-	-
CO5	-	1	1	-	-	1	2	3	1	3	3	3	-	-	-

COURSE CONTENT	
UNIT-I	**Introduction to Entrepreneurship:** Introduction to Entrepreneurship: Definition of Entrepreneur Entrepreneurial Traits. Entrepreneur vs. Manager, Creating and Starting the venture: Sources of new ideas, methods of generating ideas, creative problem solving – Writing Business Plan, Evaluating Business Plans
UNIT-II	**Institutional and financial support to Entrepreneurship** Institutional/financial support: Schemes and functions of Directorate of Industries, IFCI, District Industries Centers (DICs), Industrial Development Corporation (IDC), State Financial Corporation (SFCs), Small Scale Industries Development Corporations (SSIDCs). Khadi and Village Industries Commission (KVIC), Technical Consultancy Organization (TCO), Small Industries Service Institute (SISI), National Small Industries Corporation (NSIC), Small Industries Development Bank of India (SIDBI).(short answers only), Start up culture.
UNIT-III	**Micro, Small and Medium Enterprises**: Importance and role of MSMEs in economic development, Types of MSMEs, Policies and their support to MSMEs growth and growth strategies. Sickness in small business and remedies – small entrepreneurs in International business.
UNIT-IV	**Women Entrepreneurship and Start up Culture** Role & importance, profile of women Entrepreneur, problems of women Entrepreneurs, women Entrepreneurship Development in India - Steps taken by the Government to promote women entrepreneurship in India, Associations supporting women entrepreneurs. Successful Entrepreneurs (case studies).
UNIT-V	**Project Formulation and Appraisal** Preparation of Project Report –Content; Guidelines for Report preparation – Project Appraisal techniques –economic – Steps Analysis; Financial Analysis; Market Analysis; Technical Feasibility.

TEXT BOOKS	
1.	Vasanth Desai – Fundamentals of Entrepreneurship and Small business management – Himalaya publishing house – 2019
2.	Robert Hisrich, Michael Peters, Dean A. Sheperd, Sabyasachi Sinha – Entrepreneurship - TMH - 2020.
REFERENCE BOOKS	
1.	Vasant Desai – Entrepreneurship Management - Himalaya Publishing House- 2018.
2.	Robert J.Calvin - Entrepreneurial Management – TMH - 2009.
3.	Gurmeet Naroola - The entrepreneurial Connection – TMH - 2009.
4.	Aruna Kaulgud - Entrepreneurship Management - Vikas publishing house - 2009
WEB RESOURCES:	
1	https://nptel.ac.in/courses/110105067/50
2	http://www.yourarticlelibrary.com/project-management/5-methods-of-project-appraisal-explained/40771
3	https://springhouse.in/government-schemes-every-entrepreneur/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Software Engineering</mark>
Common to CSE, IT, CSE(AIML), CSE(AI), CSE(DS)
III BTech I Semester

Course Category	Professional Elective-I	Course Code	20CS4T08
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Data Structures	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

	COURSE OBJECTIVES
1	Give exposure to phases of Software Development, common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process
2	Give exposure to a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, traceability, and version control
3	Give exposure to Software Design techniques

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Ability to transform an Object-Oriented Design into high quality, executable code	K3
CO2	Skills to design, implement, and execute test cases at the Unit and Integration level	K3
CO3	Compare conventional and agile software methods	K4
CO4	Skills to design Software Architectural components.	K3
CO5	Analyze the interface analysis and Testing strategies.	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating,K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	-	3	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	1	2	-	-
CO3	3	2	1	3	2	-	-	-	2	-	-	2	3	-	3
CO4	3	2	3	2	3	-	-	-	2	-	-	2	3	3	3
CO5	3	3	3	2	3	-	-	-	2	-	-	3	3	3	3

COURSE CONTENT	
UNIT I	The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.
UNIT II	Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements.
UNIT III	Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling, Requirements Modeling for WebApps.
UNIT IV	Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development.
UNIT V	The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation, Elements of Software Qualtiy Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing.

TEXT BOOKS	
1.	Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2.	Software Engineering, Ian Sommerville, Ninth Edition, Pearson.

REFERENCE BOOKS	
1.	Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
2.	Software Engineering, Ugrasen Suman, Cengage.

WEB RESOURCES	
1.	https://nptel.ac.in/courses/106/105/106105182/
2.	https://nptel.ac.in/courses/106/105/106105182/
3.	https://nptel.ac.in/courses/106/101/106101061/
4.	https://www.coursera.org/learn/software-processes-and-agile-practices
5.	http://www.geeksforgeeks.org/software-engineering-gq/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Computer Vision
Common to CSE and CSE (AI)
III B Tech I Semester

Course Category	Professional Elective - I	Course Code	20AI5T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Transforms and Vector Calculus, Data Structures	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	To introduce students the fundamentals of image formation
2	To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;
3	To develop an appreciation for various issues in the design of computer vision and object recognition systems
4	To provide the student with programming experience from implementing computer vision and object recognition applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.	K1
CO2	Describe known principles of feature detection and matching	K2
CO3	Identify, formulate and solve problems in image processing and computer vision	K1
CO4	Describe basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal.	K2
CO5	Suggest a design of a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO2	2	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	1	2	-	-	-	-	-	-	-	-	1	1	1
CO4	1	3	2	3	-	-	-	-	-	-	-	-	1	1	1
CO5	3	2	3	1	2	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT-I	**Introduction:** Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighborhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization.
UNIT-II	**Feature Detection and Matching:** Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature-Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric Intrinsic Calibration.
UNIT-III	**Structure and Motion:** Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion.
UNIT-IV	**Image Stitching:** Motion Models, Global Alignment, Composing, Computational Photography: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis.
UNIT-V	**3D Reconstruction:** Shape From X, Active Range Finding, Surface Representation, Point-based Representation, Volumetric Representation, Model-based Reconstruction, Recovering Texture Maps and Albedos, Image- based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumigraphs, Environment Mattes, Video-based Rendering.

TEXT BOOKS	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2-11.
2.	Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2-12.
REFERENCE BOOKS	
1.	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2.	Haralick& Shapiro, "Computer and Robot Vision", Vol II
3.	G_erardMedioni and Sing Bing Kang "Emerging topics in computer vision"75
WEB RESOURCES:	
1	https://onlinecourses.nptel.ac.in/noc22_ee48/preview

Data Visualization Techniques

Common to to CSE(AI&ML), CSE(AI), CSE(DS)

III B Tech I Semester

Course Category	Professional Elective - I		Course Code	20DS5T10
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Understand the visualization process and visual representations of data
2	Learn visualization techniques for various types of data.
3	Explore the visualization techniques for graphs, trees, Networks.
4	Understand the visualization of maps, GIS and collaborative visualizations.
5	Discuss the recent trends in perception and visualization techniques.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Differentiate between Data Visualization and Infographics	K2
CO2	Evaluate Data Visualizations	K3
CO3	Apply various types of Visualizations	K3
CO4	Develop basic programs using D3.js	K2
CO5	Enumerate various Hierarchical patterns	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNIT-I	**Introducing Data Visualization:** Understanding Data Visualization, Recognizing the Traits of Good Data Viz, Embracing the Design Process, Ensuring Excellence in Your Data Visualization. **Exploring Common Types of Data Visualizations:** Understanding the Difference between Data Visualization and Infographics, Picking the Right Content Type, Appreciating Interactive Data Visualizations, Observing Visualizations in Different Fields, Using Dashboards, Discovering Infographics **(Text Book 1)**

UNIT-II	**Mastering Basic Data Visualization Concepts: Using Charts Effectively:** Deciding Which Charts to Use and When to Use Them **Adding a Little Context:** Making Text Useful, Exploring Text Analysis **Evaluating Real Data Visualizations:** Analyzing Data Visualizations by Category, Evaluating Data Visualizations **(Text Book 1)**
UNIT-III	**Defining an Easy-to-Follow Storyboard:** Business Intelligence Overview, Delving Into Your Story, Building Your First Storyboard. **Developing a Clear Mock-Up:** Getting Started with Your Mock-Up, Building Template Layouts. **Adding Functionality and Applying Color:** Recognizing the Human Components, Dipping Into Color. **Exploring User Adoption:** Understanding User Adoption, Considering Five UA Measurements, Marketing to Data Viz Users. **(Text Book 1)**
UNIT-IV	**D3.js fundamentals:** An introduction to D3.js, **How D3 works:** Data visualization is more than charts, D3 is about selecting and binding, D3 is about deriving the appearance of web page elements from bound data, **The power of HTML5:** The DOM, Coding in the console, SVG, CSS, JavaScript, Data standards: Tabular data, Nested data, Network data, Geographic data, Your first D3 app **(Text Book 2)**
UNIT-V	**Layouts**: Histograms, Pie charts, Stack layout, D3.js in the real world. **Complex data Visualization: Hierarchical visualization:** Hierarchical patterns, Working with hierarchical data, Pack layouts, Trees, Partition, Treemaps. **(Text Book 2)**

TEXT BOOKS	
1.	Data Visualization For Dummies by Mico Yuk, Stephanie Diamond, John Wiley & Sons, Inc, 2-14
2.	D3.js in Action, Elijah Meeks, Second Edition, Manning Publications, 2-18
REFERENCE BOOKS	
1.	Practical Python Data Visualization: A Fast Track Approach To Learning Data Visualization With Python by Ashwin Pajankar, Apress; 1st edition, 2-2-
2.	Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2-18
3.	Visual Data Mining: Techniques and Tools for Data Visualization and Mining by Tom Soukup, Ian Davidson, John Wiley & Sons, Inc, 2--2.
WEB RESOURCES:	
1	ibm.com/analytics/data-visualization
2	https://www.tibco.com/reference-center/guide-to-data-visualization
3	https://ocw.mit.edu/courses/res-6-- 9-how-to-process-analyze-and-visualize-data-january-iap-2-12/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

==DevOps==

Common to CSE, IT, CSE(AI), CSE(AI&ML), CSE(DS)
III BTech I Semester

Course Category	Professional Elective - I		Course Code	20IT5T07
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES
The objective of the course is to

1	DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.	K2
CO2	Describe DevOps & DevSecOps methodologies and their key concepts.	K2
CO3	Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models.	K2
CO4	Set up complete private infrastructure using version control systems and CI/CD tools.	K2
CO5	Know about DevOps maturity model.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO2	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO3	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO4	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO5	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2

COURSE CONTENT	
UNIT I	Phases of Software Development life cycle. Values and principles of agile software development.
UNIT II	**Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.
UNIT III	**DevOps adoption in projects**: Technology aspects, Agiling capabilities, Tool stack

	implementation, People aspect, processes.
UNIT IV	**CI/CD**: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices
UNIT V	**DevOps Maturity Model**: Key factors of DevOps maturity model, stages of DevOps maturity model, DevOps maturity Assessment

TEXT BOOKS

1.	The DevOps Handbook: How to Create World - Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. Gene Kim, Jez Humble, Patrick Debois, and John Willis
2.	Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, Jez Humble and David Farley
3.	Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davis & Ryn Daniels.

REFERENCE BOOKS

1.	Httermann, Michael, "DevOps for Developers", Apress Publication.
2.	Joakim Verona, "Practical DevOps", Pack publication

WEB RESOURCES

1.	https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises.
2.	http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration)
3.	https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat.
4.	https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps.
5.	https://mva.microsoft.com/training-topics/devops#!lang=1-33 – Lists no. of courses related to DevOps and various tools, methods used.
6.	http://devops.com/ - A good blog, has lots of contents.
7.	https://dzone.com/devops-tutorials-tools-news - Lots of l links and tutorials

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Operating Systems & Compiler Design using C Laboratory</mark>
Common to CSE (AI), CSE (AI&ML), CSE (DS)
III B. Tech I Semester

Course Category	Professional Core	Course Code	20AI5L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment Semester** **End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
The student will:	
1	To provide an understanding of the language translation peculiarities by designing a complete translator for a mini language.
2	To provide an understanding of the design aspects of operating system

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Analyze important algorithms eg. Process scheduling and memory management algorithms	K3
CO2	Categorize the operating system's resource management techniques, dead lock management techniques, memory management techniques	K4
CO3	To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO2	1	3	3	3	3	-	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3

Course Content	
	Part-A (OS)
1	Simulate the following CPU scheduling algorithms a) Round Robin b) Shortest Job First c) Priority
2	Multiprogramming-Memory management- Implementation of fork (), wait (), exec() and exit(), System calls
3	Simulate the following a) Multiprogramming with a fixed number of tasks (MFT) b) Multiprogramming with a variable number of tasks (MVT)
4	Simulate Bankers Algorithm for Dead Lock Avoidance

5	Simulate Bankers Algorithm for Dead Lock Prevention
6	Simulate the following page replacement algorithms. a) First In First Out b) Least Recently Used
7	Simulate the following File allocation strategies a) Sequenced b) Indexed
	Part-B (CD)
1	Write a Lex program to implement a Lexical Analyzer using LEX-tool.
2	Write a C Program to simulate Lexical Analyzer to validate a given input string.
3	Write a C Program to implement Brute force technique of Top down parsing.
4	Write a C Program to compute the First and Follow sets for the given Grammar.
5	Write a C Program to check the validity of input string using predictive parser.
6	Write a C program to implement LR Parser to accept the given input string.
7	Simulate the calculator using LEX and YACC tool.
8	Write a C program to implement Code Generation Algorithm for a given expression.

Machine Learning using Python Laboratory
III B. Tech I Semester
Common to CSE (AIML), CSE(AI), CSE(DS)

Course Category	Professional Core	Course Code	20AM5L02
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Python Programming	**Internal Assessment Semester** **End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES
The student will:
1   This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1 Implement procedures for the machine learning algorithms.	**K1**
CO2 Design and Develop Python programs for various Learning algorithms	**K2**
CO3 Apply appropriate data sets to the Machine Learning algorithms	**K3**
CO4 Develop Machine Learning algorithms to solve real world problems	**K4**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	--	--	--	--	2	2	2	3
CO2	3	2	1	--	--	--	--	--	--	--	--	1	1	1	3
CO3	3	2	1	--	--	--	--	--	--	--	--	--	1	1	3

List of Experiments	
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on agiven set of training data samples. Read the training data from a .CSV file.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent withthe training examples.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use anappropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Exercises to solve the real-world problems using the following machine learning methods: a) LinearRegression b) Logistic Regression c) Binary Classifier
5	Develop a program for Bias, Variance, Remove duplicates , Cross Validation

6	Write a program to implement Categorical Encoding, One-hot Encoding
7	Build an Artificial Neural Network by implementing the Back propagation algorithm and test thesame using appropriate data sets.
8	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print bothcorrect and wrong predictions.
9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
11	Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
12	Exploratory Data Analysis for Classification using Pandas or Matplotlib.
13	Write a Python program to construct a Bayesian network considering medical data. Use this model todemonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
14	Write a program to Implement Support Vector Machines and Principle Component Analysis.
15	Write a program to Implement Principle Component Analysis.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Commonn to **CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**
III BTech I Semester

Course Category	Skill Oriented		Course Code	20IT5S06
Course Type	Laboratory		**L-T-P-C**	1-0-2-2
Prerequisites			**Total Marks**	**50**

COURSE OBJECTIVES
The objectives of the course is to

1	To understand the concept of DevOps with associated technologies and methodologies.
2	To be familiarized with Jenkins, which is used to build & test software Applications & Continuous integration in Devops environment.

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Remember the importance of DevOps tools used in software development life Cycle	K1
CO2	Understand the importance of Jenkins to Build, Deploy and Test Software Applications	K2
CO3	Examine the test results of a java program in Jenkins	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes														
(1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO2	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2
CO3	1	1	2	1	3	-	-	-	-	-	-	-	-	3	2

COURSE CONTENT	
-	**Prerequisite:** To Understand the Concept of DevOps with related technologies which are used to Code, Build, Test, Configure & Monitor the Software Applications.
1	Installation of Jenkins
2	Configuration of Jenkins i.e. creating a first admin user and installing required plugins.
3	To Create a Freestyle project in Jenkins to test, and deploy Java or Web Applications using Netbeans or eclipse.
4	To Create a Pipeline project in Jenkins to test, and deploy Java or Web Applications using Netbeans or eclipse.
5	To do Source code management from GIT in Jenkins while developing a Java application

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6	To do a Controller test in Jenkins while developing a Java application

TEXT BOOKS	
1.	John Ferguson Smart, "Jenkins, The Definitive Guide", O'Reilly Publication.
2.	Learn to Master DevOps by StarEdu Solutions.
REFERENCE BOOKS	
1.	Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", Wiley Publication
2.	Httermann, Michael, "DevOps for Developers", A press Publication.
3.	Joakim Verona, "Practical DevOps", Pack publication
WEB RESOURCES	
1.	https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises.
2.	http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration)
3.	https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat.
4.	https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Commonn to **CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**
III BTech I Semester

Course Category	Mandatory course	Course Code	20HE5T02
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites		**Internal Assessment**	0
		Semester End Examination	0
		Total Marks	0

COURSE OBJECTIVES	
1	To get employment in corporate world.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Enables the student to be aware of integrated word building to use in communication.	K1
CO2	Grooms the learner in their mental flexibility to be fit in team for an organization.	K2
CO3	Strengthens in syntactic construction of the language.	K2
CO4	Empowers the learner in the language comprehension skills.	K2
CO5	Assists the learner to present academic and professional abilities through writing skills.	K1

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes														
(1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-

COURSE CONTENT	
Unit - I	**Vocabulary building /Language fluency.** Connotations - Synonyms and Antonyms - Prefix and Suffix - Phrasal Verbs – Collocations.
Unit - II	**Attitude/ Team Building** Types of attitudes – Positive attitude – Importance of team work- advantages of team work.
Unit - III	**Sentence Completion** Restatement – Comparison – Contrast - Cause and effect
Unit - IV	**Reading comprehension** Literal Comprehension - Interpretative Comprehension - Applied Comprehension - Affective Comprehension
Unit -V	**Resume Writing** Chronological resume - Functional resume

TEXT BOOKS	
1.	Soft Skills - Enhancing Employability: Connecting Campus with Corporate by M. S. RaoI K International Publishing House Pvt. Ltd.
2.	Enhancing Employability @ Soft Skills by Shalini Verma Pearson Education.
REFERENCE BOOKS	
1.	**Soft Skills at Work: Technology for Career Success: -** by Beverly Amer
2.	Resume To HR Interview Prep (Employability Enhancement Series) by Rajesh Vartak
WEB RESOURCES	
1.	https://www.twinkl.co.uk/search?q=employability
2.	https://www.realityworks.com/product/online-employability-skills-programs/
3.	https://connectingcredentials.org/resources/interactive-employability-skills-framework/
4.	https://oklahoma.gov/careertech/educators/resource-center/employability-and-adult-basic-education-resources.html
5.	https://barclayslifeskills.com/educators

Computer Networks
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT
III Year II Semester

Course Category	Professional Core	Course Code	20CS5T08
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Understand the basic taxonomy, terminology and architectures of the computer networks
2	Analyze the services, protocols and features of the various layers of computer networks.
3	Understand the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Enumerate the basic concepts of Computer Networks	K1
CO2	Analyze protocols implemented in Data Link Layer for error and flow control.	K4
CO3	Design applications using internet protocols.	K3
CO4	Implement routing and congestion control algorithms.	K3
CO5	Develop application layer protocols and understand socket programming.	K3

K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-C reating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	2	-	-	-	-	1	-	3	3	-
CO2	3	3	3	3	2	3	-	-	-	-	3	-	3	3	-
CO3	3	2	2	1	1	3	-	-	-	-	1	-	3	2	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	-

COURSE CONTENT	
UNIT I	**Introduction:** Network Types, LAN, MAN, WAN, Network Topologies Reference models-The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History. **Physical Layer –**Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.

UNIT II	**Data link layer:** Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. **Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi link PPP.
UNIT III	**Media Access Control: Random Access**: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA). **Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(1-- Mbps), Gigabit Ethernet, 1- Gigabit Ethernet.
UNIT IV	**The Network Layer Design Issues** – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices
UNIT V	**The Transport Layer:** Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP. **Application Layer** –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet ,- Resolution-Caching- Resource Records- DNS messages-Registrars-security of DNS Name Servers, SNMP.

TEXT BOOKS	
1.	Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2.	Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.
REFERENCE BOOKS	
1.	Data Communications and Networks- Achut S Godbole, AtulKahate ,Second Edition ,McGraw Hill Education
2.	Computer Networks, Mayank Dave, CENGAGE, First Edition,2-17
WEB RESOURCES	
1.	https://nptel.ac.in/courses/1-61-5-81
2.	https://nptel.ac.in/courses/1-61-5183

Deep Learning

Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT

III B Tech II Semester

Course Category	Professional Core		Course Code	20AM6T04
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites	Machine Learning		**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Learn deep learning methods for working with sequential data.
2	Learn deep recurrent and memory networks.
3	Learn deep Turing machines.
4	Apply such deep learning mechanisms to various learning problems.
5	Know the open issues in deep learning, and have a grasp of the current research directions.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning.	K1
CO2	Discuss the Neural Network training, various random models**.**	K2
CO3	Explain the Techniques of Keras, TensorFlow, Theano and CNTK.	K3
CO4	Classify the Concepts of CNN and RNN.	K4
CO5	Implement Interactive Applications of Deep Learning.	K5

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	--	--	--	--	--	--	2	2	2	3
CO2	2	2	2	1	1	--	--	--	--	--	--	2	1	1	2
CO3	2	1	1	2	2	--	--	--	--	--	--	1	1	1	2
CO4	2	2	2	1	1	--	--	--	--	--	--	1	1	1	2
CO5	3	2	1	1	1	--	--	--	--	--	--	1	1	1	3

COURSE CONTENT	
UNIT-I	**Fundamentals of Deep Learning**: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines, **Fundamentals of Machine Learning**: Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting. [**Text Book 2**]
UNIT-II	**Introducing Deep Learning**: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. [**Ref Book 1**]
UNIT-III	Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews, Binary Classification, Classifying newswires, Multiclass Classification. [Text Book 2]
UNIT-IV	**Convolutional Neural Networks**: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation. **Recurrent Neural Networks**: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. [**Ref Book 1**]
UNIT-V	**Interactive Applications of Deep Learning**: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. [**Text Book 1**] **Deep Learning Research**: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. [**Text Book 1**]

TEXT BOOKS	
1.	Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
2.	Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433.
REFERENCE BOOKS	
1.	Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
2.	Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412
3.	Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
4.	Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
5.	Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education,2004.
WEB RESOURCES:	
1	Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

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Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT
III BTech II Semester

Course Category	Professional Core	Course Code	20CS5T09
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Able to interpret algorithms and their time complexity
2	Able to interpret Greedy and Divide and Conquer methods using algorithms
3	Able to solve backtracking and dynamic programming problems
4	Able to identify NP-Hard & NP-Complete classes

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms	K4
CO2	List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method	K3
CO3	Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.	K3
CO4	Analyze design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches	K4
CO5	Demonstrate NP-Hard and NP-Complete classes, Cook's theorem	K2

K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 -	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-

COURSE CONTENT	
UNIT I	**Introduction:** Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms.
UNIT II	**Divide and Conquer:** General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort. **The Greedy Method:** The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths.
UNIT III	**Dynamic Programming:** The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, -/1 knapsack, The traveling salesperson problem.
UNIT IV	**Backtracking:** The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem.
UNIT V	**P and NP problems:** Basic concepts, Class P, Fractional Knapsack problem in P, Class NP, Fractional Knapsack problem in NP **NP-Hard and NP-Complete problems:** Basic concepts, non-deterministic algorithms, NP -Hard and NP-Complete classes, Cook's theorem.

TEXT BOOKS	
1.	Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press,2-1-.
2.	Introduction to Algorithms Thomas H. Cormen, PHI Learning,Fourth Edition 2-2-.
REFERENCE BOOKS	
1.	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press 2-15.
2.	Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publications,2-1-
3.	S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press,2-14.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/1-6/1-5/1-61-5164/

Software Project Management

Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
III BTech II Semester

Course Category	Professional Elective - II	Course Code	20CS5T12
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2	To compare and differentiate organization structures and project structures
3	To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Apply the process to be followed in the software development life-cycle models	K3
CO2	Apply the concepts of project management & planning	K3
CO3	Develop the project plans through managing people, communications and change	K3
CO4	Conduct activities necessary to successfully complete and close the Software projects	K2
CO5	Implement communication, modeling, and construction & deployment practices in software development	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	3	-	-	1	2	2	3	2	2	2	3
CO2	1	2	2	2	1	-	-	1	2	2	3	2	2	2	2
CO3	1	1	2	1	2	-	-	1	2	2	3	2	1	2	3
CO4	1	2	2	2	1	-	-	1	2	2	3	2	3	1	2
CO5	1	2	1	2	3	-	-	1	2	2	3	2	3	2	3

COURSE CONTENT	
UNIT I	**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. **The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.
UNIT II	**Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.
UNIT III	**Model based software architectures:** A Management perspective and technical perspective. **Work Flows of the process:** Software process workflows, Iteration workflows. **Checkpoints of the process: Major** mile stones, Minor Milestones, Periodic status assessments. **Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.
UNIT IV	**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations. **Process Automation:** Automation Building blocks, The Project Environment. **Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.
UNIT V	Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

TEXT BOOKS	
1.	Software Project Management, Walker Royce, PEA, 2--5.
2.	Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.7/e 2-13.
REFERENCE BOOKS	
1.	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2-16.
2.	Software Project Management, Bob Hughes,6/e, Mike Cotterell, TMH,2-17
3.	Software Project Management, Joel Henry, PEA,2--3
4.	Software Project Management in practice, Pankaj Jalote, PEA, 2--5

5.	Effective Software Project Management, Robert K.Wysocki, Wiley,2--6
6.	Project Management in IT, Kathy Schwalbe, Cengage,Third Edition 2--4
WEB RESOURCES	
1.	https://nptel.ac.in/courses/1-6/1-5/1-61-5218/

<mark>Game Theory</mark>
Common to CSE(AI), CSE(AI&ML), CSE(DS)
III B Tech II Semester

Course Category	Professional Elective - II	Course Code	20AM6T05
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Probability and Statistics	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Learn the various methods of Game Theory and how to get the solutions.
2	Learn about Mixed and Correlated Equilibrium Interpretations.
3	Learn about the various models of Knowledge and Equilibrium.
4	Apply Extensive games with perfect information.
5	Know about the Repeated games and its strategies.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Discuss the various methods of Game Theory concepts and how to get the solutions.	K1
CO2	Discuss about Mixed and Correlated Equilibrium Interpretations**.**	K2
CO3	Explain about the various models of Knowledge and Equilibrium.	K3
CO4	Learn about Extensive Games with Perfect Information.	K4
CO5	Implement about Repeated Games and its various strategies.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	--	--	--	--	--	--	2	2	2	3
CO2	2	2	2	1	1	--	--	--	--	--	--	2	1	1	2
CO3	2	1	1	2	2	--	--	--	--	--	--	1	1	1	2
CO4	2	2	2	1	1	--	--	--	--	--	--	1	1	1	2
CO5	3	2	1	1	1	--	--	--	--	--	--	1	1	1	3

COURSE CONTENT	
UNIT-I	**Introduction**: Game Theory, Games and Solutions, Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation Nash Equilibrium-Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games.
UNIT-II	**Mixed, Correlated, and Evolutionary Equilibrium -** Mixed Strategy, Nash Equilibrium Interpretations of Mixed Strategy, Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium, Rationalizability and Iterated Elimination of Dominated Actions. - Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.
UNIT-III	**Combinatorial games**: Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games.
UNIT-IV	Extensive Games with Perfect Information – Extensive Games with Perfect Information Subgame Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated Strategies.
UNIT-V	Cournot's Oligopoly, Bertrand's Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg's model of Duopoly, Buying Votes, Committee Decision making, Repeated Gmes, Prisoner's Dilemma, Supermodular Game and Potential games.

TEXT BOOKS	
1.	M. J. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994.
2.	Martin Osborne, An Introduction to Game Theory, Oxford University Press. 1994
REFERENCE BOOKS	
1.	D. Fudenberg and J. Tirole, Game Theory, MIT Press. 1991.
2.	J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, New York:n John Wiley and Sons.
3.	R.D. Luce and H. Raiffa, Games and Decisions, New York: John Wiley and Sons.
4.	G. Owen, Game Theory, (Second Edition), New York: Academic Press.
WEB RESOURCES:	
1	Swayam NPTEL: Game Theory: https://onlinecourses.nptel.ac.in/noc19_ge32/preview

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Virtual and Augmented Reality</mark>
CSE (AI)
III B Tech II Semester

Course Category	Professional Elective - II	Course Code	20AI6T03
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable field of Computer Science. The technology of VR and AR is really hitting the ground right now. Integrating AR/VR in development can provide many advantages like: Improved Experience for Learning in sectors like education, Increasing Efficiency In Business and many more.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	To understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR	K2
CO2	To understand geometric modeling and Virtual environment.	K2
CO3	To relate and differentiate VR/AR technology.	K4
CO4	To use various types of Hardware and software in virtual Reality systems	K3
CO5	To implement Virtual/Augmented Reality applications.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	1	2	-	-	-	-	-	-	-	-	1	2	3
CO3	3	2	1	2	3	-	-	-	-	-	-	-	-	-	3
CO4	1	3	2	3	3	-	-	-	-	-	-	-	2	3	-
CO5	3	2	3	1	2	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Introduction to Virtual Reality:** Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.
UNIT-II	**Computer Graphics And Geometric Modelling**: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models,

	Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.
UNIT-III	**Virtual Environment:** Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output: Visual /Auditory / Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system
UNIT-IV	**Augmented Reality:** Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.
UNIT-V	**Development Tools and Frameworks:** Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

TEXT BOOKS	
1.	Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2-16
2.	Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2-13.
REFERENCE BOOKS	
1.	Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2--9.
2.	John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2--7.
3.	John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2--7.
WEB RESOURCES:	
1	[Augmented Reality v/s Virtual Reality - javatpoint](#)

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

CSE (AI)

III B Tech II Semester

Course Category	Professional Elective - II	Course Code	20AI6T04
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Probability, Statistics, Applied Mathematics	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Deliver the need of the Industry and research services for any specific problem statement.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Define and describe expert system and its main constituents.	K2
CO2	Assemble various parts of knowledge and skills in order to devise the approach to solution.	K3
CO3	Distinguish class of problems suitable for solving with expert systems.	K1
CO4	Design and create expert system suitable for solving particular problem.	K4
CO5	Appraise the quality of solution and justify the employed techniques.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	1	2	3	2	2	-	-	-	-	-	-	-	1	2	3
CO3	2	3	3	2	2	-	-	-	-	-	-	-	-	-	3
CO4	1	2	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	1	2	3	3	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Introduction to Expert Systems:** The meaning of an expert system, problem domain and knowledge domain, the advantages of an expert system, general stages in the development of an expert system, general characteristics of an expert system, history and uses of expert systems today, rule-based expert systems, procedural and nonprocedural paradigms, characteristics of artificial neural systems.
UNIT-II	**The Representation of Knowledge:** The study of logic, difference between formal logic and

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	informal logic, meaning of knowledge, how knowledge can be represented, semantic nets, how to translate semantic nets into PROLOG, how to use logic and set symbols to represent knowledge, the meaning of propositional and first order predicate logic, quantifiers, imitations of propositional and predicate logic.
UNIT-III	**Methods of Inference:** Trees, lattices, and graphs, state and problem spaces, AND-OR trees and goals, methods of inference, rules of inference, limitations of propositional logic, logic systems, resolution rule of inference, resolution systems, and deduction, shallow and causal reasoning, applying resolution to first-order predicate logic, forward and backward chaining, additional methods of reference, Meta knowledge, the Markov decision process.
UNIT-IV	**Reasoning Under Uncertainty:** The meaning of uncertainty and theories devised to deal with it, types of errors attributed to uncertainty, errors associate, with induction, features of classical probability, hypothetical reasoning and backward induction, temporal reasoning, Markov chains, odds of belief, sufficiency and necessity, role of uncertainty in inference chains, implications of combining evidence, role of inference nets in expert systems
UNIT-V	**Design of Expert Systems:** How to select an appropriate problem, the stages in the development of an expert system, types of errors to expect in the development stages, the role of the knowledge engineer in the building of expert systems, the expected life cycle of an expert system, how to do a life cycle model, Expert System Design Examples

TEXT BOOKS	
1.	Joseph C. Giarratano , Expert Systems : Principles and Programming, 4th Edition, cengage learning, 2--4
2.	Dan w. Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, Pearson, 2-15.
REFERENCE BOOKS	
1.	Durkin, J., Expert systems Design and Development, Macmillan, 1994
2.	Elias M. Awad, Building Expert Systems, West Publishing Company 1996
3.	Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999.ISBN --2-187686-8.
WEB RESOURCES:	
1	Artificial Intelligence - Expert Systems (tutorialspoint.com)

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
III BTech II Semester

Course Category	Open Elective - II		Course Code	20CE6T40
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
1	To provide basic conceptual understanding of disasters.
2	To understand approaches of Disaster Management.
3	To build skills to respond to disaster.
4	To understand to reduce the intensity of future disasters.
5	To understand the Restoration of human life in the region.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Knowledge on characteristics of natural disasters
CO2	Planning on approaches of Disaster Management
CO3	Ability to plan and design the new skills in disaster response
CO4	Role of remote sensing system in disaster area response
CO5	Knowledge on the Restoration of human life in the region.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO2	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO3	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO4	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO5	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1

COURSE CONTENT	
UNIT I	**Natural Hazards and Disaster Management**: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.
UNIT II	**Man Made Disaster and Their Management Along With Case Study Methods Of The Following:** Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.
UNIT III	**Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses
UNIT IV	**Role of Technology in Disaster Managements:** Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations-roads and bridges mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS
UNIT V	**Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action

TEXT BOOKS	
1.	"Disaster Management guide lines", GOI-UND Disaster Risk program (2009-2012)
2.	Modh S. (2010) "Managing Natural Disasters", Mac Millan publishers India LTD.
REFERENCE BOOKS	
1.	Murty D.B.N. (2012) "Disaster Management", Deep and Deep Publication PVT.Ltd. New Delhi
WEB RESOURCES	
1	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

Fundamentals of Electric Vehicles

Common to All branches

III BTech I Semester

Course Category	Open Elective - II		Course Code	20EE6T19
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites	NIL		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
1	To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2	To understand various power converters used in electric vehicles.
3	To know various architecture of hybrid electric vehicles.
4	To be familiar all the different types of motors suitable for electric vehicles.
5	To have knowledge on latest developments in strategies and other storage systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate different types of electric vehicles..	K3
CO2	Select suitable power converters for EV applications.	K2
CO3	Design HEV configuration for a specific application.	K4
CO4	Choose an effective method for EV and HEV applications.	K3
CO5	Analyze a battery management system for EV and HEV	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program

Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	2	2	-	-	-	-	2	1	1
CO2	2	3	-	-	-	1	1	-	-	-	-	-	2	2
CO3	-	3	-	-	-	1	-	-	-	-	2	2	1	2
CO4	3	2	-	-	-	2	1	-	-	-	2	-	1	2
CO5	2	-	-	-	-	2	-	-	-	-	-	2	2	2

COURSE CONTENT	
UNIT 1	**Introduction** Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles.
UNIT 2	**Components of Electric Vehicles** Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.
UNIT 3	**Hybrid Electric Vehicles** Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.
UNIT 4	**Motors for Electric Vehicles** Characteristics of traction drive - requirements of electric machines for EVs – Different

	motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)
UNIT 5	**Energy Sources for Electric Vehicles** Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it's working.

TEXT BOOKS	
1	Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2-21.
2	Denton - Tom. Electric and hybrid vehicles. Rutledge - 2-2-.
REFERENCE BOOKS	
1	Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2-2-.
2	Chau - Kwok Tong. Electric vehicle machines and drives: design - Analysis and Application. John Wiley & Sons - 2-15.
3	Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2-15
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/1-81-617-
2	https://inverted.in/blog/fundamentals-of-electric-vehicles

==Introduction to Automobile Engineering==

Common to CE, EEE, ECE, CSE, CSE(AIML), CSE(AI), CSE(DS), IT

III BTech II Semester

Course Category	Open Elective - II	Course Code	20ME6T25
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To learn functions of different components in Automobiles
2	To impart knowledge on Transmission systems and Steering Systems.
3	To impart the knowledge on ignition system & suspension systems.
4	To impart the knowledge of Braking system and Engine specification.
5	To understand the concept of safety and Engine emission control systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the function of various components of automobile.	**K2**
CO2	Identify the merits and demerits of the various transmission and steering systems.	**K2**
CO3	Describe the concept of Ignition and Suspension systems.	**K2**
CO4	Explain the features of Braking system and Engine specification.	**K3**
CO5	Analyze the Engine emission control standards.	**K3**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1-**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	2	2	-	-	-	-	-	2	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	1	-	2	2	-	-	-	-	-	2	1
CO5	2	2	1	-	-	-	2	-	-	-	-	1	3	-

COURSE CONTENT	
UNIT 1	INTRODUCTION: Components of four-wheeler automobile-chassis and body-power unit-types of automobile engines, engine construction, oil filters, oil pumps, air filters, Fuel pump, nozzle, Types of carburetors.
UNIT 2	TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, Propeller shaft-Hotch-Kiss drive, Torque tube drive, universal joint, differential rear axles-types-wheels and tires. STEERING SYSTEM: Steering geometry-camber, castor, king pin rake, combined angle toe-in, center point steering. steering gears – types, steering linkages.
UNIT 3	IGNITION SYSTEM: Function of an ignition system, auto transformer, electronic ignition using contact triggers-spark advance and retard mechanism. SUSPENSION SYSTEM: Objects of suspension systems-rigid axle suspension system, torsion bar, shock absorber, independent suspension system.
UNIT 4	BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, pneumatic and vacuum brakes. ENGINE SPECIFICATION: Introduction-engine specifications with regard to power, speed,

	torque, no. of cylinders and arrangement.
UNIT 5	SAFETY SYSTEMS: Introduction, safety systems - seat belt, air bags, bumper, wind shield, suspension sensors, traction control, mirrors.
	ENGINE EMISSION CONTROL: Introduction-types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification.

TEXT BOOKS	
1	Automotive Mechanics / Heitner.
2	Automobile Engineering / William Crouse, TMH Distributors.
1	Automobile Engineering- P.S Gill, S.K. Kataria& Sons, New Delhi.
2	Automotive Engines Theory and Servicing, James D. Halderman and Chase D. Mitchell Jr., Pearson education inc.
3	Automotive Engineering / Newton Steeds & Garrett.
4.	Automotive Mechanics – Vol. 1 & Vol. 2 / Kripal Singh, standard publishers.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/1-7/1-6/1-71-6-8-/
2	http://gabook.cyou/file/nptel-automobile-engineering
3	https://nptel.ac.in/courses/1-7/1-6/1-71-6-88/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
III Year II Semester

Course Category	Open Elective - II	Course Code	20EC6T26
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES: By studying this course the student will learn	
1	the principle of various Transducers and their construction
2	the transducer construction, classification, principle of operation and characteristics
3	about transducers for measurement of physical parameters
4	Temperature measurement using transducers
5	Applications and principles of operation, standards and units of measurements

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	discuss role of transducers and Sensor in instrumentation	K1
CO2	Descriptive view for the transducer construction, classification, principle of operation and characteristics.	K2
CO3	Gain knowledge about transducers for measurement of displacement, strain, velocity, analyze transducers for measurement of pressure , force and flow	K3
CO4	analyze transducers for measurement of Temperature	K4
CO5	Analyze sensors used in industrial applications	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12
CO1	1	2	2	-	1	-	-	-	-	-	-	-
CO2	1	2	2	-	1	-	-	-	-	-	-	-
CO3	2	2	2	-	2	-	-	-	-	-	-	-
CO4	2	3	2	-	2	-	-	-	-	-	-	-
CO5	3	3	3	-	2	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Introduction:** Functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input

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UNIT II	**Transducers for motion and dimensional measurements:** Relative displacement, translation and rotational resistive potentiometers, resistance strain gauges, LVDT, synchros, capacitance transducers, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers, Gyroscopic sensors
UNIT III	**Transducers For Force Measurement**: Bonded strain gauge transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers. **Transducers For Flow Measurement:** Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter **Transducers For Pressure Measurement:** Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers.
UNIT IV	**Transducers For Temperature Measurement:** Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors.
UNIT V	**Smart sensors:** Introduction – Primary Sensors – Excitation – Amplification – Filters – 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 – Aerospace Sensors — Sensors for Manufacturing –Sensors for Environmental Monitoring

TEXT BOOKS	
1.	Sensors and Transducers, D. Paranaiba ,PHI Learning Private Limited.
2.	Mechatronics,W. Bolton ,Pearson Education Limited.
REFERENCE BOOKS	
1.	Transducers and Instrumentation, by D.V.S. Murthy (PHI)
2.	Instrumentation Measurement & Analysis, by B.C. Nakra, K.K. Choudry, (TMH)
WEB RESOURCES	
1.	https://youtu.be/hv-aBonZMRQ
2.	https://www.youtube.com/watch?v=qSa3GNjIyy-

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Computer Networks Laboratory
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT
III BTech II Semester

Course Category	Professional Core	Course Code	20CS5L09
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites		Internal Assessment	15
		Semester End Examination	35
		Total Marks	50

COURSE OBJECTIVES	
1	Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Develop various data link layer functionalities	K3
CO2	Analyze and identify appropriate routing algorithm for the network	K4
CO3	Analyze the network simulations in NS2	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	2	3	-
CO3	3	3	3	3	2	-	-	-	-	-	-	-	2	3	-

COURSE CONTENT	
List of Experiments	
1	Study of Network devices in detail and connect the computers in Local Area Network.
2	Write a Program to implement the data link layer farming methods such as i) Character stuffing ii) bit stuffing.
3	Write a Program to implement data link layer farming method checksum.
4	Write a program for Hamming Code generation for error detection and correction.
5	Write a Program to implement on a data set of characters the three CRC polynomials – CRC

	12, CRC 16 and CRC CCIP.
6	Write a Program to implement Sliding window protocol for Goback N.
7	Write a Program to implement Sliding window protocol for Selective repeat.
8	Write a Program to implement Stop and Wait Protocol.
9	Write a program for congestion control using leaky bucket algorithm
1-	Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph.
11	Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12	Write a Program to implement Broadcast tree by taking subnet of hosts.

13	Wireshark
	     i. Packet Capture Using Wire shark
	     ii. Starting Wire shark
	     iii. Viewing Captured Traffic
	     iv. Analysis and Statistics & Filters.

14	Execution of Nmap scan
15	Operating System Detection using Nmap

16	Do the following using NS2 Simulator
	     i. NS2 Simulator-Introduction
	     ii. Simulate to Find the Number of Packets Dropped
	     iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
	     iv. Simulate to Find the Number of Packets Dropped due to Congestion
	     v. Simulate to Compare Data Rate& Throughput.

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Algorithms for Efficient Coding using C Laboratory
Common to CSE(AI), CSE(AI&ML), CSE(DS)
III B. Tech II Semester

Course Category	Professional Core	Course Code	20AM6L03
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites	C Programming	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
The student will:	
1	To develop efficient coding for the algorithms with various inputs and algorithms.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1	Analyze the program execution time.	K4
CO2	Analyze how to get the time complexity of the programs.	K4
CO3	Implementation of various programs on Dynamic Programming, Back Tracking etc…	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	--	--	--	--	--	--	--	2	2	3
CO2	3	2	1	1	1	--	--	--	--	--	--	--	2	2	3
CO3	2	2	1	1	1	--	--	--	--	--	--	--	2	2	2

List of Experiments	
1	Develop a program and measure the running time for Binary Search with Divide and Conquer.
2	Develop a program and measure the running time for Merge Sort with Divide and Conquer.
3	Develop a program and measure the running time for Quick Sort with Divide and Conquer.
4	Develop a program and measure the running time for estimating minimum-cost spanningTrees with Greedy Method.
5	Develop a program and measure the running time for estimating Single Source Shortest Pathswith Greedy Method.
6	Develop a program and measure the running time for optimal Binary search trees with Dynamic Programming.
7	Develop a program and measure the running time for identifying solution for traveling

	sales person problem with Dynamic Programming..
8	Develop a program and measure the running time for identifying solution for 8-Queensproblem with Backtracking.
9	Develop a program and measure the running time for Graph Coloring with Backtracking..
10	Develop a program and measure the running time to generate solution of Hamiltonian Cycleproblem with Backtracking.
11	Develop a program and measure the running time running time to generate solution of Knapsack problem with Backtracking.

Deep Learning with Tensor flow Laboratory

Common to CSE(AI), CSE(AI&ML), CSE(DS)

III B. Tech II Semester

Course Category	Professional Core	Course Code	20AM6L04
Course Type	Laboratory	L-T-P-C	0-0-3-1.5
Prerequisites	Python Programming	Internal Assessment Semester End Examination Total Marks	15 35 50

COURSE OBJECTIVES
The student will:
1   Have a better knowledge about softwares like Keras, Tensorflow etc…

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1 Implement deep neural networks to solve real world problems.	K1
CO2 Choose appropriate pre-trained model to solve real time problem.	K2
CO3 Interpret the results of two different deep learning models.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	--	--	--	--	--	--	--	2	2	3
CO2	2	2	1	1	1	--	--	--	--	--	--	--	2	2	2
CO3	2	2	1	1	1	--	--	--	--	--	--	--	2	2	2

Software Packages required:
- **Keras**
- Tensorflow
- **PyTorch**

List of Experiments	
1	Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification..
2	Design a neural network for classifying movie reviews (Binary Classification) using IMDBdataset.
3	Design a neural Network for classifying news wires (Multi class classification) using Reutersdataset.
4	Design a neural network for predicting house prices using Boston Housing Price dataset.
5	Build a Convolution Neural Network for MNIST Hand written Digit Classification.

6	Build a Convolution Neural Network for simple image (dogs and Cats) Classification.
7	Use a pre-trained convolution neural network (VGG16) for image classification.
8	Implement one hot encoding of words or characters.
9	Implement word embeddings for IMDB dataset.
10	Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books
1.	Reza Zadeh and BharathRamsundar, "Tensorflow for Deep Learning", O'Reilly publishers,2018
Web Reference
1.	https://github.com/fchollet/deep-learning-with-python-notebooks

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Soft skills and Inter Personal Communication

Common to all Branches

III BTech II Semester

Course Category	Humanities		Course Code	20HE6S01
Course Type	Skill Oriented Course		**L-T-P-C**	1 – 0 – 2 – 2
Prerequisites	Life skills for better life		**Total Marks**	50

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the significance of soft skills and its importance towards his goal setting.
CO2	Develop interpersonal relations through effective communication and public speaking.
CO3	Build confidence exercising verbal and non-verbal techniques with analytical skills for his success.
CO4	Utilize various skills required to become a good leader and thorough professional.
CO5	Improve decision-making skills and problem-solving skills with emotional intelligence.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-
CO5	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-

	Syllabus
UNIT - I	1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. 2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.
UNIT-II	1. Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.

	2. <u>Public Speaking:</u> Skills, Methods, Strategies and Essential tips for effective public speaking.
	3. <u>Non-Verbal Communication:</u> Importance and Elements; Body Language.
UNIT-III	1. <u>Presentation Skills</u>: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness.
	2. <u>Group Discussion:</u> Importance, Planning, Elements, Skills assessed; effectively disagreeing, Initiating, Summarizing and Attaining the Objective.
	3. <u>Interview Skills</u>: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success.
	4. <u>Teamwork and Leadership Skills:</u> Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills
UNIT - IV	1. <u>Etiquette and Manners</u> – Social and Business.
	2. <u>Time Management</u> – Concept, Essentials, Tips.
	3. <u>Personality Development</u> – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.
	4. <u>Leadership and Assertiveness Skills:</u> A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills.
UNIT- V	1. <u>Emotional Intelligence:</u> Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence
	2. <u>Conflict Management:</u> Conflict - Definition, Nature, Types and Causes; Methods
	3. <u>Decision-Making and Problem-Solving Skills:</u> Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills.
	4. <u>Stress Management:</u> Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress.

Text books :	
1.	Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2-12.
2.	English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2-1-

WEB RESOURCES	
1.	https://nptel.ac.in/courses/1-91-7121/
2.	https://www.goskills.com/Soft-Skills

PRAGATI ENGINEERING COLLEGE

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CSE (Artificial Intelligence)

Commonn to **CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**

III   **BTech II Semester**

Course Category	Mandatory course	Course Code	20HE6T03
Course Type	Theory	L-T-P-C	2-0-0-0
Prerequisites		Internal Assessment	0
		Semester End Examination	0
		Total Marks	0

COURSE OBJECTIVES	
1	To get employment in corporate world.

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Endues an ability of an accurate usage of words in language.	K2
CO2	Develops logical inter-relation of words in usage.	K2
CO3	Helps to develop compendious usage in communication.	K2
CO4	Determines to concentrate on Non-Verbal interpretation.	K1
CO5	Enriches the ability in vocabulary usage.	K1

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes														
(1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-

COURSE CONTENT	
Unit - I	**Words often confused.** Commonly Confused Words – Homonym – Homograph- Homophone.
Unit - II	**Analogies/Jumbled Sentences** Opposite Analogy - Cause and Effect Analogy - Problem and Solution Analogy - Effort and Result Analogy. Spotting the transition words or the linking words- Identify the Theme of the paragraph.
Unit - III	**One-word substitutions, sentence corrections** Subject-Verb Agreement - Verb form - Logical Predication and Modifiers – Comparisons.
Unit - IV	**Body Language** Facial expressions - Body movement and posture – Gestures - Eye contact – Space – Voice.
Unit -V	**Development of Verbal Ability.** Vocabulary- Word analogy – Antonyms and Synonyms - Verbal Coherence & Cohesion

TEXT BOOKS	
1.	**Teaching Offender Education: Employability Activities: 14 Activities to Develop the Soft Skills for Working Life** by Teresa Maria O'Hara, Nutcracker Press UK.
2.	**BEST: Basic Employability Skills Training: Volume 1** by Sally J. Vonada
REFERENCE BOOKS	
1.	**Skills** by Dr. Rabindranath Athri
WEB RESOURCES	
1.	https://www.collegiateparent.com/academics/build-employable-skill-sets-online/
2.	https://cte.ed.gov/initiatives/employability-skills-framework
3.	https://www.collegiateparent.com/academics/build-employable-skill-sets-online/
4.	https://www.skillsyouneed.com/general/employability-skills.html
5.	https://www.realityworks.com/product/online-employability-skills-programs/

PRAGATI ENGINEERING COLLEGE
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CSE (Artificial Intelligence)

<mark>Reinforcement Learning</mark>
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
IV B Tech I Semester

Course Category	Professional Elective-III	Course Code	20AM7T06
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Machine Learning	**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	Learn various approaches to solve decision problems with functional models and algorithmsfor task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.
2	Learn Various policies regarding Dynamic Programming.
3	Learn the various methods of MonteCarlo Methods.
4	Learn about various methods in Off – policy with approximation.
5	Learn the various Policy Gradient Methods and its applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Remember the basic concepts of Reinforcement learning.	K1
CO2	Understand basic concepts of Dynamic Programming**.**	K2
CO3	Understand various methods and applications of reinforcement learning.	K2
CO4	Analyze various off-policy methods with approximations.	K4
CO5	Understand about Policy Gradient Methods.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	--	--	--	--	--	--	--	2	2	3
CO2	3	3	2	2	1	--	--	--	--	--	--	--	2	2	3
CO3	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2
CO4	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2
CO5	2	2	1	2	1	--	--	--	--	--	--	--	2	2	2

COURSE CONTENT	
UNIT-I	Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm
UNIT-II	Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returnsand Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration,Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of DynamicProgramming
UNIT-III	Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step $Q(\sigma)$
UNIT-IV	Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ – return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's $Q(\lambda)$ to Tree-Backup(λ)
UNIT-V	Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE - Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization fr Continuous Actions Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double Wagering, Optimizing Memory Control, Personalized Web Services

TEXT BOOKS	
1.	R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.
2.	Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.
REFERENCE BOOKS	
1.	Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.
WEB RESOURCES:	
1	Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2	https://www.coursera.org/learn/fundamentals-of-reinforcement-learning

PRAGATI ENGINEERING COLLEGE
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CSE (Artificial Intelligence)

<mark>Soft Computing</mark>

Common to CSE (AI) and CSE (AI&ML)

IV B Tech I Semester

Course Category	Professional Elective - III	Course Code	20AI7T05
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End	70
		Examination Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Artificial Intelligence, Various types of production systems, characteristics of production systems.
2	Neural Networks, architecture, functions and various algorithms involved.
3	Fuzzy Logic, Various fuzzy systems and their functions
4	Genetic algorithms, its applications and advances.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Learn about soft computing techniques and their applications	K2
CO2	Analyze various neural network architectures	K4
CO3	Understand perceptrons and counter propagation networks.	K2
CO4	Define the fuzzy systems	K1
CO5	Analyze the genetic algorithms and their applications.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	2	2
CO2	1	2	3	1	-	-	-	-	-	-	-	-	1	2	3
CO3	3	2	-	1	-	-	-	-	-	-	-	-	-	-	3
CO4	1	2	1	-	-	-	-	-	-	-	-	-	2	3	-
CO5	2	2	2	2	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Fuzzy Set Theory:** Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations. Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models.
UNIT-II	**Optimization:** Derivative based Optimization, Descent Methods, The Method ofSteepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms.
UNIT-III	**Artificial Intelligence:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning, Heuristic Search: Techniques for Heuristic search Heuristic Classification.
UNIT-IV	**Neuro Fuzzy Modeling:** Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum.
UNIT-V	**Applications Of Computational Intelligence:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

TEXT BOOKS	
1.	J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2--4, Pearson Education 2--4
2.	N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2--6.
REFERENCE BOOKS	
1.	Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2--6, New Delhi.
2.	Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3.	Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4.	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,
5.	R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.
6.	AmitKonar, "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", CRC Press, 2--8
WEB RESOURCES:	
1	www.myreaders.info/html/soft_computing.html

PRAGATI ENGINEERING COLLEGE
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CSE (Artificial Intelligence)

Block Chain Technologies

Commonn to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT

IV **Year I Semseter**

Course Category	Professional Elective - III		Course Code	20IT7T16
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES

The objective of the course is to

1	To understand block chain technology and Crypto currency works

COURSE OUTCOMES		Cognitive level
Upon successful completion of the course, the student will be able to:		
CO1	Demonstrate the block chain basics, Crypto currency	K2
CO2	To compare and contrast the use of different private vs. public block chain and use cases	K2
CO3	Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins	K3
CO4	Classify Permission Block chain and use cases – Hyper ledger, Corda	K2
CO5	Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	-	-	-	-	-	-	2	1	-
CO2	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO3	2	3	1	2	1	-	-	-	-	-	-	-	1	1	1
CO4	2	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO5	3	3	1	1	1	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT I	**Introduction:** Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets.
UNIT II	Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

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UNIT III	**Introduction to Bitcoin:** Bitcoin Block chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc. Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics.
UNIT IV	Ethereum, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency
UNIT V	Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems, Supply chain management.

TEXT BOOKS	
1.	Blockchain Blue print for Economy by Melanie Swan

REFERENCE BOOKS	
1.	Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st Edition, by Daniel Drescher

WEB RESOURCES	
1.	https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
2.	https://www.coursera.org/learn/social-network-analysis

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(Autonomous)
CSE (Artificial Intelligence)

<mark>Speech Processing</mark>
Common to CSE (AI) and CSE (AI&ML)
IV B Tech I Semester

Course Category	Professional Elective - III		Course Code	20AI7T06
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			**Internal Assessment Semester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will:	
1	To introduce speech production and related parameters of speech.
2	To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
3	To understand different speech modeling procedures such as Markov and their implementation issues.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Model speech production system and describe the fundamentals of speech.	K3
CO2	Extract and compare different speech parameters.	K2
CO3	Choose an appropriate statistical speech model for a given application.	K1
CO4	Design a speech recognition system.	K3
CO5	Use different speech synthesis techniques.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	-	-	-	-	-	-	-	-	2	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	2	3
CO3	2	1	1	1	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Fundamentals of Digital Speech Processing:** Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

UNIT-II	**Time Domain Models for Speech Processing:** Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.
UNIT-III	**Linear Predictive Coding (LPC) Analysis:** Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.
UNIT-IV	**Homomorphic Speech Processing:** Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The HomomorphicVocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach : spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach
UNIT-V	**Automatic Speech:** Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS.

TEXT BOOKS	
1.	L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education.
2.	Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2---.
REFERENCE BOOKS	
1.	L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education.
2.	Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Edition., PE.
3.	Ben Gold & Nelson Morgan, "Speech & Audio Signal Processing", 1st Edition, Wiley
WEB RESOURCES:	
1	Speech & Audio Processing	Tutorial Lessons	JCBRO (jcbrolabs.org)

<mark>Cloud Computing</mark>
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT, EEE
IV BTech I Semester

Course Category	Professional Elective - IV	Course Code	20CS7T12
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To explain the evolving computer model caned cloud computing
2	To introduce the various levels of services that can be achieved by cloud
3	To describe the security aspects in cloud

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Illustrate the key dimensions of the challenge of Cloud Computing	K2
CO2	Classify the Levels of Virtualization and mechanism of tools	K3
CO3	Analyze Cloud infrastructure including Google Cloud and Amazon Cloud	K4
CO4	Design Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud	K3
CO5	Analyze control storage systems and cloud security, the risks involved its impact and develop cloud application	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
CO2	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
CO3	2	1	3	1	3	-	-	-	-	-	-	-	3	3	3
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	2	1	3	3	3	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT	
UNIT I	**Systems Modeling, Clustering and Virtualization:** Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency
UNIT II	**Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.
UNIT III	**Cloud Platform Architecture:** Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure
UNIT IV	**Cloud Resource Management and Scheduling:** Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing.
UNIT V	**Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system.

TEXT BOOKS	
1.	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier,2-14
REFERENCE BOOKS	
1.	Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier,First Edition,2-13
2.	Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press,2-14
3.	Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH,2--9
4.	Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH
WEB RESOURCES	
1.	https://onlinecourses.nptel.ac.in/noc22_cs2-/preview

==Big Data Analytics==

Common to CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS)
IV Year I Semester

Course Category	Professional Elective - III		Course Code	20DS6T02
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites	Data Mining		**Internal Assessment**	**30**
			Semester End Examination	**70**
			Total Marks	**100**

COURSEOBJECTIVES

1	To optimize business decisions and create competitive advantage with Big Data analytics
2	To learn to analyze the big data using intelligent techniques
3	To introduce programming tools PIG & HIVE in Hadoop echo system

COURSEOUTCOMES		Cognitive
Upon successful completion of the course, the student will be able to:		**level**
CO1	Illustrate big data challenges in different domains including social media, transportation, finance and medicine	K2
CO2	Enumerate and apply the features of Cassandra	K2
CO3	Design and develop Hadoop and Map Reduce programs	K3
CO4	Perform data analysis using Apache Spark	K2
CO5	Analyze the data analytics process with a case study	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO2	3	1	1	2	2	-	-	-	-	-	-	1	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO4	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1
CO5	3	3	3	2	2	-	-	-	-	-	-	1	2	2	1

COURSE CONTENT	
UNIT I	**Types of Digital Data:** Classification of Digital Data. Introduction to Big Data: Characteristic of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data? **Big Data Analytics:** Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments. The Big Data Technology Landscape: NoSQL. **(Text Book 1)**
UNIT II	**Introduction to Cassandra:** Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live,

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	Alter Commands, Import and Export. **(Text Book 1)**
UNIT III	**Hadoop** : Hadoop Overview, HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator). **MAPREDUCE:** Introduction to MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. **(Text Book 1)**
UNIT IV	**Introduction to Data Analysis with Spark**: What is Apache Spark, A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. **Programming with RDDs:** RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. **(Text Book 2)**
UNIT V	**JasperReport using Jaspersoft:** Introduction to JasperReports, Connecting to MongoDB NoSQL Database, Connecting to Cassandra NoSQL Database. **Few Interesting Differences:** Difference between Data Warehouse and Data Lake, Difference between RDBMS and HDFS, Difference between HDFS and HBase, Difference between Hadoop MapReduce and Spark, Difference between Pig and Hive **(Text Book 1)**

TEXT BOOKS	
1.	Big Data and Analytics by Seema Acharya, Subhashini Chellappan, Second Edition, Wiley India Pvt. Ltd., 2-19
2.	Learning Spark: Lightning-Fast Big Data Analysis by Andy Konwinski, Holden Karau, Matei Zaharia, Patrick Wendell, First Edition, O'Reilly, 2-15
REFERENCE BOOKS	
1.	Big Data Analytics, by Radha Shankarmani, M Vijayalakshmi, Second Edition, Wiley India Pvt. Ltd., 2-16
2.	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2-12.
3.	Hadoop: The Definitive Guide by Tom White, O'Reilly Media, Inc., 2--9
4.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2-14.
WEB RESOURCES	
1.	http://hadoop.apache.org/
2.	https://nptel.ac.in/courses/1-61-4189/
3.	https://www.edx.org/course/big-data-fundamentals
4.	https://www.coursera.org/specializations/big-data
5.	https://www.wileyindia.com/big-data-and-analytics-2ed.html

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NOSQL Databases

Common to CSE(AI&ML), CSE(AI), CSE(DS)

IV BTech I Semester

Course Category	Professional Elective IV	Course Code	20DS7T09
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Database Management Systems	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph)
2	Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases
3	Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases

COURSEOUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Discuss about Aggregate Data Models	K2
CO2	Explain about Master-Slave Replication, Peer-to-Peer Replication	K2
CO3	Describe the Structure of Data, Scaling, Suitable Use Cases	K2
CO4	Make use of Complex Transactions Spanning Different Operations	K2
CO5	Identify Routing, Dispatch and Location-Based Services	K2

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2-Medium,3–High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-0	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	-	-	-		-	-	-	-	3	-
CO2	2	3	3	1		-	-	-	1	-	-	1	1	1	2
CO3	1	1	2	1	1	-	-	-	1	-	-	1	1	1	1
CO4	3	3	1	3		-	-	-	1	-	-	1	1	1	2
CO5	3	3	1	3	1	1	-	-	1	1	-	-	1	1	2

COURSE CONTENT	
UNIT I	**Introduction:** Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL. **Aggregate Data Models:** Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.
UNIT II	**More Details on Data Models:** Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access **Distribution Models:** Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication.
UNIT III	**Key-Value Databases:** What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets.
UNIT IV	**Document Databases:** What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure
UNIT V	**Graph Databases:** What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use

TEXTBOOKS	
1.	Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2-12
2.	Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2-13. (ISBN-13: 978-9351192-22)

REFERENCEBOOKS	
1.	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2-15. (ISBN13: 978-9332557338)
2.	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2-13. (ISBN-13: 978-93511-2694)

WEB RESOURCES	
1.	https://www.guru99.com/nosql-tutorial.html/
2.	https://www.w3resource.com/mongodb/nosql.php/

Video Analytics
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
IV B Tech I Semester

Course Category	Professional Elective - IV	Course Code	20AM7T07
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Data Science through Python	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
The student will:	
1	To know the fundamentals of digital image processing, image and video analysis
2	To understand the real time use of image and video analytics
3	To demonstrate real time image and video analytics applications and others

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1	Describe the fundamental principles of image and video analysis and have an idea of their application	K2
CO2	Apply various operations on Images	K2
CO3	Perform various Image and Video Transformations	K3
CO4	Enumerate various principles of Object detection and recognition	K2
CO5	Apply image and video analysis in real world problems	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	--	--	--	--	--	--	--	1	1	1
CO2	3	1	1	2	2	--	--	--	--	--	--	1	--	--	1
CO3	3	3	3	2	2	--	--	--	--	--	--	1	2	2	1
CO4	3	3	3	2	2	--	--	--	--	--	--	1	2	2	1
CO5	3	3	3	2	2	--	--	--	--	--	--	1	2	2	1

COURSE CONTENT	
UNIT-I	**Digital image representation-** Visual Perception- Sampling and Quantization- Basic Relations between Pixels- Mathematical Tools Used in Digital Image Processing: Fundamental Operations –Vector and Matrix Operations- Image Transforms (DFT, DCT,DWT, Hadamard).
UNIT-II	**Fundamentals of spatial filtering**: Spatial correlation and convolution-smoothing, blurring-sharpening- edge detection - Basics of filtering in the frequency domain: smoothing- blurring-sharpening--Histograms and basic statistical models of image.
UNIT-III	**Colour models and Transformations** – Image and Video segmentation-Image and video demonising- Image and Video enhancement- Image and Video compression
UNIT-IV	Object detection and recognition in image and video-Texture models Image and Video 25 classification models- Object tracking in Video
UNIT-V	Applications and Case studies- Industrial- Retail- Transportation & Travel- Remotesensing-Video Analytics in WSN: IoT Video Analytics Architectures

TEXT BOOKS	
1.	R.C. Gonzalez and R.E. Woods.” Digital Image Processing”. 3rd Edition. Addison Wesley, 2007
2.	Computer Vision: Algorithms and Applications, by Richard Szeliski.
REFERENCE BOOKS	
1.	Jean-Yves Dufour, “Intelligent Video Surveillance Systems”, Wiley, 2013
2.	Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012
3.	Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola, “Intelligent Transp Systems: Technologies and Applications”, Wiley, 2015
4.	Multiple View Geometry in Computer Vision (2nd edition) by Richard hartley and AndrewZisserman
WEB RESOURCES:	
1	https://developer.nvidia.com/blog/free-self-paced-online-course-for-intelligent-video-analytics-now-available/
2	https://www.microfocus.com/en-us/products/ai-video-analytics/overview
3	https://www.udemy.com/course/machine-learning-on-videos-using-python/
4	http://szeliski.org/Book/

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Recommender Systems</mark>
Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS)
IV B Tech I Semester

Course Category	Professional Elective-V		Course Code	20AM7T08
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites	Machine Learning		Internal Assessment	30
			Semester End Examination Total	70
			Marks	100

COURSE OBJECTIVES	
The student will:	
1	To develop state-of-the-art recommender systems that automates a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of recommender systems.	K1
CO2	Carry out performance evaluation of recommender systems based on various metrics**.**	K2
CO3	Implement machine-learning and data-mining algorithms in recommender systems data sets.	K3
CO4	Design and implement a simple recommender system	K4
CO5	Implement various recommender systems like Paradigms etc..	K5

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	--	--	--	--	--	--	1	1	1	3
CO2	3	1	1	2	2	--	--	--	--	--	1	--	--	1	3
CO3	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO4	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO5	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3

COURSE CONTENT	
UNIT-I	An Introduction to Recommender Systems: Goals of Recommender Systems, Basic Models of Recommender Systems, Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications.
UNIT-II	Neighborhood-Based Collaborative Filtering: Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-Based Methods
UNIT-III	Model-Based Collaborative Filtering: Decision and Regression Trees, Rule-Based Collaborative Filtering, Naïve Bayes Collaborative Filtering, Latent Factor Models, Integrating Factorization and Neighborhood Models
UNIT-IV	Content-Based Recommender Systems: Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations Knowledge-Based Recommender Systems: Constraint-Based Recommender Systems, Case-BasedRecommenders, Persistent Personalization in Knowledge-Based Systems.
UNIT-V	Evaluating Recommender Systems: Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures..

TEXT BOOKS	
1.	Charu .C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2.	Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press, (2011), 1st ed.
REFERENCE BOOKS	
1.	Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook,Springer(2011), 1st ed.
2.	Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning,Springer (2013), 1st edition.
3.	J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge,2012
WEB RESOURCES:	
1.	Swayam NPTEL: https://nptel.ac.in/courses/106105152w

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Common to CSE, CSE(AI), CSE(AI&ML)
IV BTech I Semester

Course Category	Professional Elective - V	Course Code	20CS6T16
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Become familiar with all phases of OOAD
2	Master the main features of the UML.
3	Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains
4	Learn the Object design Principles and understand how to apply them towards Implementation

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Analyze the nature of complex system and its solutions	K4
CO2	Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships	K2
CO3	Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications	K4
CO4	Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams	K4
CO5	Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems	K4

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	3	3

COURSE CONTENT	
UNIT I	**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation
UNIT II	**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.
UNIT III	**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.
UNIT IV	**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System
UNIT V	**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams **Case Study:** Weather Forecasting

TEXT BOOKS	
1.	Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , "Object- Oriented Analysis and Design with Applications", 3rd edition, 2022, PEARSON.
2.	Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
REFERENCE BOOKS	
1.	Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2.	Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3.	Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4.	Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.
WEB RESOURCES	
1.	http://www.digimat.in/nptel/courses/video/106105153/L51.html

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AI Chatbots

Common to CSE (AI), CSE (AI&ML), CSE (DS)

IV B Tech I Semester

Course Category	Professional Elective - V		Course Code	20AI7T07
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites			Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
2	Identify best practices for defining a chatbot use case, and use a rapid prototyping framework to develop a use case for a personalized chatbot.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop an in-depth understanding of conversation design, including on Boarding	K3
CO2	Develop an in-depth understanding of conversation design, including on flows, utterances	K3
CO3	Develop an in-depth understanding of conversation design, including on entities, and personality.	K3
CO4	Design, build, test, and iterate a fully-functional, interactive chatbot using a commercial platform.	K3
CO5	Deploy the finished chatbot for public use and interaction.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1-	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	-	-	-	-	-	-	2	2
CO2	2	3	3	2	3	-	-	-	-	-	-	-	1	2	3
CO3	2	3	3	2	3	-	-	-	-	-	-	-	-	-	3
CO4	2	3	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	-	-	3	-	3	-	-	-	-	-	-	-	2	2	3

COURSE CONTENT	
UNIT-I	**Introduction:** Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR)
UNIT-II	**Chatbot Development Essentials:** Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent
UNIT-III	**Building a Chatbot Solution:** Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots
UNIT-IV	**Natural Language Processing, Understanding, and Generation:** Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.
UNIT-V	**Introduction to Microsoft Bot, RASA, and Google Dialog flow:** Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module

TEXT BOOKS	
1.	Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks", ISBN 978-1-4842-5-34-1, Apress,2-19
2.	. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2-17. ISBN 978-1788294669.
REFERENCE BOOKS	
1.	Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2-19. ISBN 978-3-3--4298
2.	. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2-13. ISBN 978- -231168564.
3.	Abhishek Singh, Karthik Ramasubramanian and Shrey Shivam, Building an Enterprise Chatbot (1 ed.), Springer, 2-19. ISBN 978-148425-334
WEB RESOURCES:	
1	Introduction to Chatbot | Artificial Intelligence Chatbot Tutorial (mygreatlearning.com)

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

Semantic Web
Common to CSE, CSE(AI), CSE(AI&ML)
IV B Tech I Semester

Course Category	Professional Elective - V	Course Code	20AI7T09
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Computer Networks	Internal Assessment	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The student will:	
1	To learn Web Intelligence.
2	To learn Knowledge Representation for the Semantic Web.
3	To learn Ontology Engineering.
4	To learn Semantic Web Applications, Services and Technology.
5	To learn Social Network Analysis and semantic web.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate social network analysis and measures.	K1
CO2	Analyze random graph models and navigate social networks data.	K2
CO3	Apply the network topology and Visualization tools.	K3
CO4	Analyze the experiment with small world models and clustering models.	K4
CO5	Compare the application driven virtual communities from social networkStructure.	K5

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	--	--	--	--	--	--	1	1	1	3
CO2	3	1	1	2	2	--	--	--	--	--	1	--	--	1	3
CO3	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO4	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3
CO5	3	3	3	2	2	--	--	--	--	--	1	2	2	1	3

COURSE CONTENT	
UNIT-I	Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.
UNIT-II	Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.
UNIT-III	Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines
UNIT-IV	Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,
UNIT-V	Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

TEXT BOOKS	
1.	Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
2.	Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
Reference Books	
1.	Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R.Studer, P. Warren, John Wiley & Sons.
2.	Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRCPublishers,(Taylor & Francis Group).
3.	Information sharing on the semantic Web – Heiner Stucken schmidt; Frank Van Harmelen,Springer Publications.
4.	Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.
WEB RESOURCES:	
1	Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs56/preview

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Highway Engineering</mark>
Common to All Branches
IV Year I Semester

Course Category	Open Elective-III	Course Code	20CE7T11
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Internal Assessment	30
	------	Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To introduce the students with the principles and practice of transportation engineering which focuses on Highway Engineering.
2	Ability to mathematically develop and interpret design standards for horizontal and vertical geometry and super elevation
3	To provide basic knowledge on materials used in pavement construction.
4	To enable the students to have a strong analytical and practical knowledge of Planning, Designing of Pavements.
5	To provide basic knowledge in traffic engineering, and transportation planning.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Plan highway network for a given area.
CO2	Design the Highway geometrics based on highway alignment.
CO3	Characterize the pavement materials like aggregates, Bituminous materials &construction.
CO4	Judge suitability of pavement materials and design flexible and rigid pavements.
CO5	Design Intersections and prepare traffic management plans.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	
CO2	1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	2	1	-	-	-	-	-	-	-	-	1	2	-
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-	

COURSE CONTENT	
UNIT I	**Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.
UNIT II	**Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria-Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.
UNIT III	**Highway Materials:** Sub-grade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties -Tests on Bitumen .
UNIT IV	**Design of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors **Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements. **Rigid Pavements:** Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.
UNIT V	**Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC method.

TEXT BOOKS	
1.	Highway Engineering' by Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P) Ltd., New Delhi.
2.	Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A, Nem Chand Bros, Roorkee.
REFERENCE BOOKS	
1.	Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall of India Pvt. Ltd; New Delhi.
2.	'Highway Engineering' by Srinivasa Kumar R, Universities Press, Hyderabad
WEB RESOURCES	
1.	https://nptel.ac.in/downloads/105101087/

Battery Management Systems and Charging Stations

Common to All Branches

IV BTech II Semester

Course Category	Open Elective-III		Course Code	20EE7T29
Course Type	Theory		L-T-P-C	3-0-0-3
Prerequisites	NIL		Internal Assessment	30
			Semester End Examination	70
			Total Marks	100

	COURSE OBJECTIVES
1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics
2	To understand the concept of Wind Energy Conversion & its applications
3	To study the principles of biomass and geothermal energy
4	To understand the principles of Ocean Thermal Energy Conversion (OTEC), motion of waves and power associated with it
5	To study the various chemical energy sources such as fuell cell and hydrogen energy along with their operation and equivalent circuit

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage	K4
CO2	Illustrate the components of wind energy systems	K3
CO3	Illustrate the working of biomass, digesters and Geothermal plants	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves	K3
CO5	Evaluate the concept and working of Fuel cells & MHD power generation	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO3	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO4	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO5	3	1	1	1	-	-	1	-	-	-	-	1	2	2

COURSE CONTENT	
UNIT 1	**Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.
UNIT 2	**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.
UNIT 3	**Biomass and Geothermal Energy:** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and

	Environmental problems.
UNIT 4	**Energy From oceans, Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.
UNIT 5	**Chemical Energy Sources:** **Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.

TEXT BOOKS	
1	G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011
2	John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013
REFERENCE BOOKS	
1	S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011
2	John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013
3	Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

Common to All Branches

IV YEAR – I SEMESTER

Course Category	Open Elective - III	Course Code	20EC7T40
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Basic Electrical and Electronics Engineering	Internal Assessment Semester End Examination Total Marks	30 70 100

COURSE OBJECTIVES	
Student will learn	
1	The building block for differential amplifier and operational amplifier using DC amplifiers and applications of OP-AMP.
2	a Voltage Regulator ,Types of Voltage Regulators and their working and use of a different voltage regulators for real time applications
3	The characteristics and operation of SCR and Thyristor and techniques to turn Off a Thyristor
4	The operation and applications of important switching devices such as DIAC and TRIAC much used in power electronics
5	The different electronic devices such as Electronic timers and Electronic DC Motor and Control, Electric Welding methods, high frequency heating ,ultrasonic generation required for industrial applications

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the concept of DC amplifiers.	K2
CO2	Analyze and design different voltage regulators for real time applications	K2
CO3	Describe the basis of SCR and Thyristor	K2
CO4	Determine the performance of DIAC and TRIAC	K2
CO5	Develop real time application using electronics	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	1	-
CO2	2	2	2	-	-	-	-	-	-	-	1	1
CO3	2	2	2	-	-	-	-	-	-	-	1	1
CO4	2	2	2	-	-	-	-	-	-	-	1	1
CO5	2	2	2	-	-	-	-	-	-	-	1	1

COURSE CONTENT	
UNIT I	**DC Amplifiers:** Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.
UNIT II	**Regulated Power Supplies:** Block diagram, Principle of voltage regulation, Series and Shunttype Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection. Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators - Current boosting
UNIT III	**SCR and Thyristor:** Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR.
UNIT IV	**Applications of SCR in Power Control:** Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave. DIAC, TRIAC and Thyristor Applications: Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation
UNIT V	**Industrial Applications -I:** Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital Timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control. **Industrial Applications –II**: High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications

TEXT BOOKS	
1.	Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
2.	Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972
REFERENCE BOOKS	
1.	Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edition, 2003
2.	Thyristors and applications – M. Rammurthy, East-West Press, 1977.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/108102145

==Organizational Behavior==

Common to CSE, CSE(AI), CSE(AI&ML)

IV YEAR – I SEMESTER

Course Category	Open Elective - III	Course Code	20HM7T09
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
Student will learn

1	

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1 Understand the meaning and importance of Organizational Behaviour to start and survive in corporate environment.	K2
CO2 Demonstrate how the perception can integrate in human behaviour , attitudes and values.	K2
CO3 Understand the importance of Groups and Teams in organizations for better Decision making.	K2
CO4 Understand the need for change and its importance in organizations.	K2
CO5 Understand the culture of organizations and to apply techniques in dealing with stress in organizations.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	2	2	2	-	2
CO2	-	-	-	-	-	1	-	3	2	3	-	2
CO3	-	-	-	-	-	1	-	2	3	3	-	2
CO4	-	-	-	-	-	1	-	3	3	2	-	2
CO5	-	-	-	-	-	3	-	1	2	2	-	2

COURSE CONTENT	
UNIT I	**Introduction to Organizational Behaviour:** Concept-Nature and scope-Importance of Organizational Behaviour-Key elements of Organizational Behaviour-Role of managers in Organizational Behaviour-Approaches to Organizational Behaviour-Perspectives of Human Behaviour-Challenges and Opportunities for Organizational Behaviour.
UNIT II	**Perceptual Management:** Nature-Process of Perception- Organization and Interpretation-Influencing factors- Importance of Perception in OB - Perceptual Errors-Attitudes and Values –Changes and Behaviour Modification Techniques-Impression Management.
UNIT III	**Introduction to Groups and Teams:** Meaning –Importance of Groups - Foundations of Group Behaviour –Reasons for Group formation-Group and Team-Types of Groups-Stages of Group development –Meaning and Importance of Teams- Factors affecting Group and Team performance-Types of teams-Creating an effective Team.
UNIT IV	**Organization Change and Development:** Definition and Meaning - Need for change-Forces for changes in Organization-Types of change-Organizational Resistance-Strategies overcome Resistance-Process of change-Meaning and Definition of Organization Development-OD interventions.
UNIT V	**Organizational Culture and Organizational Stress:** Organizational culture: Meaning and Nature of Organizational Culture-Functions-Types-Creating and maintain Organizational Culture-Managing Cultural Diversity. Organizational Stress: Definition and Meaning-Sources of stress-Impact of stress on organizations-Stress Management Techniques.

TEXT BOOKS	
1.	K.Aswathappa: "Organizational Behaviour-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2017
2.	Stephen P. Robbins, Timothy, A. Judge: "Essentials of Organizational Behaviour" Pearson,2017
3.	Pareek Udai, Sushma Khanna: "Understanding Organizational Behaviour", Oxford University Press, New Delhi, 2016

REFERENCE BOOKS	
1.	Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2015
2.	Steven L McShane, Mary Ann Von Glinow, Radha R Sharma: "Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2017.
3.	Jerald Greenberg and Robert A Baron: "Behavior in Organizations", PHI Learning Private Limited, New Delhi, 2013.
4.	Jai B.P.Sinha: "Culture and Organizational Behavior", Sage Publication India Private Limited, New Delhi, 2009.
5.	New strom W. John& Davis Keith, Organisational Behaviour--Human Behaviour at Work, 12/e, TMH, New Delhi, 2009.

WEB RESOURCES	
1.	https://www.diversityresources.com/cultural-diversity-workplace/
2.	https://www.chanty.com/blog/problem-solving-techniques/
3.	https://www.simplypsychology.org/perspective.html#:~:text=The%20five%20major%20perspectives%20in,%2C%20behavioral%2C%20cognitive%20and%20humanistic
4.	https://theintactone.com/2019/06/18/mpob-u3-topic-6-perception-process-and-errors

PRAGATI ENGINEERING COLLEGE
(Autonomous)
CSE (Artificial Intelligence)

<mark>Water Resource Engineering</mark>
Common to CSE, CSE(AI), CSE(AI&ML)
IV BTech I Semester

Course Category	Open Elective-IV		Course Code	20CE7T18
Course Type	Theory		**L-T-P-C**	3-0-0-3
Prerequisites			**Internal Assessment**	30
			Semester End Examination	70
			Total Marks	100

	COURSE OBJECTIVES	
1	To introduce hydrologic cycle and its relevance to Civil engineering.	
2	Make the students understand physical processes in hydrology and, components of the hydrologic cycle.	
3	Appreciate concepts and theory of physical processes and interactions.	
4	Learn measurement and estimation of the components hydrologic cycle.	
5	Provide an overview and understanding of Unit Hydrograph theory and its analysis.	
6	Understand flood frequency analysis, design flood, flood routing.	
7	Appreciate the concepts of groundwater movement and well hydraulics	
8	Learn overview of flood routing and its effects.	
9	Has to be understood and identify the flood occurring areas nearby.	

	COURSE OUTCOMES
	Upon successful completion of the course, the student will be able to:
CO1	Explain the theories and principles governing the hydrologic processes and list out the forms of precipitation in real conditions.
CO2	Apply key concepts to several practical areas of engineering hydrology and related design aspects.
CO3	Design major hydrologic components for a need-based structures.
CO4	Estimate flood magnitude and carry out flood routing.
CO5	Demonstrate the recuperation test process in open wells.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO2	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO3	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO4	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO5	3	2	2	2	1	2	--	--	--	--	1	--	1	--	2

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF) curves, Depth-Area Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm, problems on average rainfall on towns
UNIT II	**ABSTRACTIONS FROM PRECIPITATION:** Introduction, Initial abstractions. EVAPORATION: Factors affecting, measurement, reduction, Analytical methods of Evaporation estimation. **EVAPOTRANSPIRATION:** Factors affecting, measurement, control, Potential Evapotranspiration over India. **INFILTRATION:** Factors affecting, Infiltration capacity curve, measurement, Infiltration Indices. Problems on ϕ-Index and W-Index.
UNIT III	RUNOFF: Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. HYDROGRAPH ANALYSIS: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. Problems on unit hydrograph.
UNIT IV	FLOODS: Causes and effects, frequency analysis - Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Design flood, Design storm. FLOOD ROUTING: Hydrologic storage routing, channel and reservoir routing- Muskingum and Puls methods of routing, flood control in India. ADVANCED TOPICS IN HYDROLOGY: Rainfall-Runoff Modelling, Instantaneous Unit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model.
UNIT V	GROUNDWATER: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, specific capacity, permeability, transitivity and storage coefficient, types of wells, well loss, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

TEXT BOOKS	
1.	„Engineering Hydrology‟ by Subramanya, K, Tata McGraw-Hill Education Pvt. Ltd, (2013), NewDelhi.
2.	„Engineering Hydrology‟ by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi.
3.	"Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jainand A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi.
REFERENCE BOOKS	
1.	'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2.	'Hydrology' by Raghunath. H.M., New Age International Publishers,(2010).
3.	'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International,(1994).
4.	'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications,(2011).
5.	'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt.Ltd., Transportation Engineering-Id., (2011), NewDelhi.
6.	'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press,(2010).
WEB REFERENCES	
1.	https://www.digimat.in/nptel/courses/video/105104103/L01.html

Course Category	Open Elective - IV	Course Code	20ME7T38
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To demonstrate the importance and solar radiation, solar energy collection and storage
2	To understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy
3	To interpret energy efficient electrical and mechanical systems
4	To develop energy efficient processes
5	To understand features and benefits of green buildings

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:	Cognitive Level
CO1	Illustrate the importance and solar radiation, solar energy collection and storage.	K2
CO2	Understand the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy.	K2
CO3	Analyze energy efficient electrical and mechanical systems.	K2
CO4	Understand features and benefits of green buildings.	K2
CO5	Understand the different types of unconventional machining methods and principles of finishing processes.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	3	-	3	-	-	2
CO2	3	2	2	-	3	-	-	-	3	-	3	-	-	2
CO3	3	2	2	-	3	-	-	-	3	-	3	-	-	2
CO4	3	2	3	-	3	-	-	-	3	-	3	-	-	2
CO5	3	2	3	-	3	-	-	-	3	-	3	-	-	2

COURSE CONTENT	
UNIT I	**SOLAR RADIATION**: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells. **SOLAR ENERGY COLLECTION**: Flat plate and concentrating collectors, classification of concentrating collectors, orientation. **SOLAR ENERGY STORAGE AND APPLICATIONS**: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.
UNIT II	**WIND ENERGY**: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement. **BIO-MASS**: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects. **GEOTHERMAL ENERGY**: Resources, types of wells, methods of harnessing the energy. **OCEAN ENERGY**: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.
UNIT III	**ENERGY EFFICIENT SYSTEMS:** **ELECTRICAL SYSTEMS**: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management. **MECHANICAL SYSTEMS**: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmentally friendly and Energy efficient compressors and pumps**.**

UNIT IV	**ENERGY EFFICIENT PROCESSES:** Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmentally friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.
UNIT V	**GREEN BUILDINGS:** Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmentally friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

TEXT BOOKS	
1.	Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2.	Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3.	Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013
REFERENCE BOOKS	
1.	Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2.	Principles of Solar Engineering - D.YogiGoswami, Frank Krieth & John F Kreider/Taylor & Francis
3.	Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
4.	Renewable Energy Technologies -Ramesh & Kumar /Narosa
5.	Non conventional Energy Source- G.D Roy/Standard Publisher
6.	Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt. Ltd

<mark>Biomedical Instrumentation</mark>

Common to CSE, CSE(AI), CSE(AI&ML)

IV Year I Semester

Course Category	Open Elective - IV	Course Code	20EC7T41
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Analog circuits	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES: In this course the student will	
1	Study the physiological relation of human body – environment and Identify various errors that occur while measuring living system
2	Study various types of Electrodes and Transducers used in biomedical measurements
3	Learn Anatomy of Heart, Respiratory system and the measuring instruments.
4	Learn various fundamental blocks in patient care and monitoring
5	Study various diagnostic and therapeutic techniques

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Acquainted with the function of human body and measure active and resting potentials of cell bodies.	K2
CO2	Measure the Bioelectric potential using appropriate electrodes and Transducers.	K2
CO3	Know the mechanism and measurement of ECG for the Cardiac cycle and respiratory system	K2
CO4	Monitor the Patient care monitoring system and applications of therapeutic equipment	K2
CO5	Know the working principles of diagnostic equipment	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	2	-	-	-	-	-	-	-	-	-	-	1
CO4	-	1	2	2	-	-	-	-	-	-	-	-	-	1
CO5	-	1	1	1	2	-	-	-	-	-	-	-	1	-

COURSE-CONTENT	
UNIT-I	**INTRODUCTION-TO-BIOMEDICAL-INSTRUMENTATION:**-Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man Instrument System, Problems Encountered in Measuring a Living System, Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials ECG, EEG and EMG, Bio amplifiers
UNIT-II	**ELECTRODES-AND-TRANSDUCERS:**-Introduction-to-Electrode-Theory,-Biopotential Electrodes, Examples of Electrodes, Basic Transducer principles, Biochemical Transducers, The Transducer and Transduction principles, Active Transducers, Passive Transducers.
UNIT-III	**CARDIOVASCULAR-SYSTEM-AND-MEASUREMENTS:**-The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart sound, Plethysmography, Angiogram and Angioplasty **RESPIRATORY SYSTEM AND MEASUREMENTS:** The Physiology of the Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment.
UNIT-IV	**PATIENT-CARE-AND-MONITORING:**-Elements of Intensive Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient Monitoring equipmentOther Instrumentation for Monitoring Patients, Pacemakers, Defibrillators, Ventilators, Radio Frequency applications of Therapeutic use, ECG & EEG Recorders.
UNIT-V	**DIAGNOSTIC-TECHNIQUES-AND-BIO-TELEMETRY:**-Principles of Ultrasonic Measurement, Ultrasonic imaging, Ultrasonic Applications of Therapeutic uses, Ultrasonic diagnosis, X Ray and Radio Isotope instrumentations, CAT Scan, Emission Computerized Tomography, MRI, and Telemedicine Technology.

TEXT-BOOKS	
1.	Fundamentals-of-biomedical-instrumentation-–Dr.O.N.Pandey,-S.K.Kataria-&-sons,4-th-edition,2012
2.	Bio-Medical-Instrumentation-–-Leslie-Cromwell,-Fred-J.Weibell,-Erich-A.-Pfeiffer,-2nd-edition,-PHI,-2011.
REFERENCE-BOOKS	

1.	Hand-Book-of-Bio-Medical-Instrumentation–-R.S.Khandapur,-McGrawHill,-2nd-edition,-2003.
2.	Biomedical-Instrumentation–-Dr.-M.-Arumugam,-Anuradha-Publications,-2006

WEB-RESOURCES	
1.	http://www.digimat.in/nptel/courses/video/108105101/L28.html

Marketing-Management

Common to CSE, CSE(AI), CSE(AI&ML)

IV Year I Semester

Course Category	Open Elective - IV	Course Code	20HM7T04
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES: In this course the student will	
1	

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1	Understand the concepts of Marketing and Marketing Environment.	K2
CO2	Analyze the consumer behavior and market segmentation in order to maintain better consumer relations and product positioning respectively.	K4
CO3	Make use of strategies and make decisions based on product life cycle and product mix concepts.	K3
CO4	Understand the pricing effects and select a better distribution channel to reach the consumer.	K2
CO5	Understand the promotional methods and importance.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	-	1	1	1	-	1	1	-	-	-
CO2	-	-	1	-	-	1	-	2	1	-	1	-	-	-
CO3	-	-	1	2	1	2	1	1	-	-	1	1	-	-
CO4	-	-	1	-	-	1	-	1	-	-	1	-	-	-
CO5	-	-	-	-	-	1	1	1	1	1	1	1	-	-

COURSE-CONTENT	
UNIT-I	**Introduction to Marketing**: Market and Marketing, Functions, importance and problems of marketing – Marketing Environment, Approaches to the study of marketing – Institutional Approach, Commodity approach, Management approach, systems approach to marketing. Marketing Mix(7 p's of Marketing.)
UNIT-II	**Consumer Behavior and CRM:** Meaning and features and Factors influencing Consumer Behavior – Theories of Buying Behavior (Economic theories – Marshallion model, psychological theories, psycho-analytic theories, socio-cultural theories) – buying decision process - Customer Relationship Management. **Market Segmentation:** Market Segmentation – Bases of Segmenting Consumer Market and Industrial Market – Target Marketing – Product differentiation – Product Positioning.
UNIT-III	**Product decision**: New product development – Product mix – management of product life cycle – product strategies – product additions and deletions. Branding, packaging and labeling – product differentiation – planned obsolescence.
UNIT-IV	**Pricing and Channels of distribution:** **Pricing:** Pricing objectives – Pricing methods – Pricing strategies. **Channels of Distribution:** Nature and types of marketing channels – wholesale distribution- retail distribution – direct marketing – selection of channels, Logistics, Third Party Service providers.
UNIT-V	**Promotion :** Nature and Importance of promotion – promotional methods of personal selling : objectives and function, Advertising objectives – Message content – media selection – Advertising agency – Advertising Budgets – Measuring Advertising effectiveness; Sales promotion Techniques – Social Media Promotion

TEXT-BOOKS	
1.	Phil T.Kotler – Marketing Management - Pearson Education limited – 2019
2.	S.A.Sherlekar – Marketing Management - Himalaya Publishing House - 2019
3.	Dr. K.Karunakaran – Marketing Management Himalaya Publishing House – 2010

REFERENCE-BOOKS	
1.	Priyanka Goel - Marketing Management – Atlantic publications - 2019
2.	Philip Kotler and Lane Keller - Marketing Management – Pearson Educaion ltd - 2017
3.	L.Natarajan – Marketing Management – Margham Publications - 2012

WEB-RESOURCES	
1.	https://www.tutorialspoint.com/marketing_management/marketing_management_functions
2.	https://keydifferences.com/difference-between-branding-and-packaging.html
3.	https://smallbusiness.chron.com/product-mix-639.html

Universal-Human-Values-2:-Understanding-Harmony
Common to CSE, CSE(AI), CSE(AI&ML)
IV Year I Semester

Course Category	Humanities including Management	Course Code	20HM7T11
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES: In this course the student will	
1	

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	**Cognitive Level**
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K2
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K1
CO3	Understand the role of a human being in ensuring harmony in society and nature.	K2
CO4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	K1
CO5	Understand the current scenario in Technology with respect to the Professional Ethics	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	3	-	-	-	3	-	-
CO2	-	-	-	-	-	3	-	3	3	-	-	-	-	-
CO3	-	-	-	-	-	3	2	3	3	-	-	-	-	-
CO4	-	-	-	-	-	3	-	3	3	-	-	-	-	-
CO5	-	-	-	-	-	3	-	3	3	-	-	-	-	-

COURSE-CONTENT	
UNIT-I	**Introduction to Value Education:** Value Education, Definition, Concept and Need for Value Education, Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.
UNIT-II	**Harmony in the Human Being:** Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.
UNIT-III	**Harmony in the Family and Society and Harmony in the Nature:** Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.
UNIT-IV	**Social Ethics:** The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities.
UNIT-V	**Professional Ethics:** Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario, Vision for Holistic Technologies, Production System and Management Models.

TEXT-BOOKS	
1.	A.N Tripathy, New Age International Publishers, 2003
2.	Bajpai. B. L , , New Royal Book Co, Lucknow, Reprinted, 2004
3.	Bertrand Russell Human Society in Ethics & Politics
REFERENCE-BOOKS	
1.	Corliss Lamont, Philosophy of Humanism
2.	Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3.	Gaur. R.R. , Sangal. R , Bagaria. G.P, Teachers Manual Excel Books, 2009

4.	I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar
5.	Mortimer. J. Adler, – Whatman has made of man
6.	William Lilly Introduction to Ethic Allied Publisher
WEB-RESOURCES	
1.	https://www.tandfonline.com/doi/abs/10.2753/RSP1061-1967330482?journalCode=mrsp20
2.	https://www.thefbcg.com/resource/building-family-harmony-starts-with-living-our-values/#:~:text=What%20does%20family%20harmony%20mean,family%20as%20a%20larger%20unit

Machine-Learning-with-Go-(Infosys-Spring-Board)

Common to CSE, CSE(AI), CSE(AI&ML)

IV Year I Semester

Course Category	Skill Oriented Course	**Course Code**	20AM7S05
Course Type	Laboratory	**L-T-P-C**	1-0-2-2
Prerequisites		**Total Marks**	50

COURSE OBJECTIVES	
The student will:	
1	To turn the students into a productive, innovative data analyst who can leverage Go to build robust and valuable applications
2	To introduce the technical aspects of building predictive models in Go, but also helps you understand how machine learning workflows are applied in real-world scenarios.
3.	To understand how to gather, organize, and parse real-work data from a variety of sources.
4	To develop a solid statistical toolkit that will allow you to quickly understand gain intuition about the content of a dataset.
5	To implement essential machine learning techniques (regression, classification, clustering, and so on) with the relevant Go packages.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Understand the software Bash Shell.	K2
CO2	Understand the software Go – an editor.	K2
CO3	Understand various programs on CSV. file	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	--	--	--	--	--	--	2	3	1
CO2	3	3	2	2	1	--	--	--	--	--	--	2	3	1
CO3	3	3	2	2	1	--	--	--	--	--	--	2	3	1

	List of Experiments	
1	a)	Write a Go program to read CSV file and find the maximum value in a particular column.
	b)	Write a Go program to read iris dataset which is in csv format and demonstrate handling ofunexpected fields, types and manipulating CSV data.
2	a)	Demonstrate how JSON data can be parsed using Go.
	b)	Demonstrate how to connect and Querying SQL like databases (Postgres MySQL, SQLLite) using Go.
3	Demonstrate how to cache data in memory using Go.	
4	a)	Demonstrate how to represent matrices and vectors in Go.
	b)	Write a Go program to get statistical measures like mean, median, standard deviation andso on for anydataset.
	c)	Write a Go program to visualize data distributions using Histogram, Box Plots..
5	a)	Write a Go program to demonstrate Mean Squared Error(MSE), Mean Absolute Error(MAE) , R^2 (R Squared).
	b)	Write a Go program to compute Accuracy, Precision , Recall, AUC (Area Under Cover).
6	a)	Demonstrate how to build a linear regression model using Go.
	b)	Demonstrate how to build a multiple linear regression model using Go.
7	Demonstrate how to build a logistic regression model using Go.	
8	Apply k-nearest neighbor classifier on iris dataset using Go.	
9	Build a decision tree on iris dataset using Go.	
10	Demonstrate K-Means clustering method using Go.	
11	Build auto regressive models for time series data using Go	
12	Demonstrate how to build a simple neural network using Go	

References	
1	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094429286873602333_shared /overview

MEAN-Stack-Technologies-- MongoDB,-Express.js,-Angular-JS-Node.js,-and-AJAX

CSE, CSE(AI&ML), CSE(AI), CSE(DS)

IV BTech I Semester

Course Category	Skill Oriented Course	Course Code	20CS7S07
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Total Marks**	50

COURSE OBJECTIVES	
1	To design dynamic web sites and web applications with Mean Stack Technologies

COURSE OUTCOMES		BTL
Upon successful completion of the course, the student will be able to:		
CO1	Develop a basic web server using Node.js and also working with Node Package Manager (NPM).	K3
CO2	Apply Angular built-in or custom pipes to format the rendered data	K3
CO3	Make use of MongoDB queries to perform CRUD operations on document database	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2
CO2	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2
CO3	3	2	3	3	2	0	0	0	0	0	0	0	3	3	2

COURSE CONTENT

Software configuration and installation:

1. MongoDB

   TOC - MongoDB Essentials - A Complete MongoDB Guide | Infosys Springboard (onwingspan.com)

2.   Angular

   Setup details: Angular Application Setup - Internal - Viewer Page | Infosys Springboard

(onwingspan.com)

List of Experiments

1	a) Course Name: Node.js Module Name: How to use Node.js Verify how to execute different functions successfully in the Node.js platform. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19002830632103186000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course b) Course Name: Node.js Module Name: Create a web server in Node.js Write a program to show the workflow of JavaScript code executable by creating web server in Node.js. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28177338996267815000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
2	a) Course Name: Node.js Module Name: Modular programming in Node.js Write a Node.js module to show the workflow of Modularization of Node application. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28865394191004004000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course b) Course Name: Node.js Module Name: Restarting Node Application Write a program to show the workflow of restarting a Node application. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9174073856000159000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course c) Course Name: Node.js Module Name: File Operations Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node. https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33376440180246100000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course
3	a) Course Name: Express.js Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_29394215542149950000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

b) Course Name: Express.js

Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares

In myNotes application: (i) we want to handle POST submissions. (ii) display customized error messages. (iii) perform logging.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13930661312009580000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

c) Course Name: Express.js

Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults

Write a Mongoose schema to connect with MongoDB.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035588775485440691_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

d) Course Name: Express.js

Module Name: Models

Write a program to wrap the Schema into a Model object.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035593896869888662_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

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Course Name: Express.js

Module Name: CRUD Operations

Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035684270129152696_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

4 Course Name: Express.js

Module Name: API Development

In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details bas

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035745250975744755_shared?collectionId=lex_32407835671946760000_shared&colle

ctionType=Course

Course Name: Express.js

Module Name: Why Session management, Cookies

Write a program to explain session management using cookies.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24299316914857090000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

Course Name: Express.js

Module Name: Sessions

Write a program to explain session management using sessions.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_905413034723449100_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

Course Name: Express.js

Module Name: Why and What Security, Helmet Middleware

Implement security features in myNotes application

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_31677453061177940000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course

Course Name: Typescript

Module Name: Basics of TypeScript

On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28910354929502245000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

5

Course Name: Typescript

Module Name: Function

Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass the selected product object to the next

screen.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10783156469383723000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Parameter Types and Return Types

Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271291242705715290 1_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course   Name: Typescript

Module Name: Arrow Function

Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equ

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271291087550054490 4_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Optional and Default Parameters

Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function shoul

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271291494064128090 6_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

6	Course Name: Typescript
	Module Name: Rest Parameter
	Implement business logic for adding multiple Product values into a cart variable which is type of

string array.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292186091520909_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Creating an Interface

Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292524427673690_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Duck Typing

Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logic to populate the Product details.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292599545856091_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Function Types

Declare an interface with function type and access its value.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271294894534656091_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

7	a) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Installing MongoDB on the local computer, Create MongoDB Atlas Cluster Install MongoDB and configure ATLAS https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01281821437313024030083_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course b) Course Name: MongoDB Essentials - A Complete MongoDB Guide Module Name: Introduction to the CRUD Operations Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove() https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01281821874166169630118_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course
8	a) Course Name: MongoDB Essentials - A Complete MongoDB Guide

Module Name: Create and Delete Databases and Collections
Write MongoDB queries to Create and drop databases and collections.
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_0128182165411921 9230121_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course

b) Course Name: MongoDB Essentials - A Complete MongoDB Guide
Module Name: Introduction to MongoDB Queries
Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01328908162645196 82505_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course

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9

a) Course Name: Angular JS
Module Name: Angular Application Setup
Observe the link http://localhost:4200/welcome on which the mCart application is running. Perform the below activities to understand the features of the application.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24049616594198490000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

b) Course Name: Angular JS
Module Name: Components and Modules
Create a new component called hello and render Hello Angular on the page
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28217843279641040000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

c) Course Name: Angular JS
Module Name: Elements of Template
Add an event to the hello component template and when it is clicked, it should change the courseName.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19226434057992030000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

d) Course Name: Angular JS
Module Name: Change Detection
progressively building the PoolCarz application
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_25609816371207710000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

a) Course Name: Angular JS

Module Name: Structural Directives - ngIf

Create a login form with username and password fields. If the user enters the correct credentials, it should render a "Welcome <<username>>" message otherwise it should render "Invalid Login!!! Please try again..." message

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_0127637402260439042595_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

b) Course Name: Angular JS

Module Name: ngFor

Create a courses array and rendering it in the template using ngFor directive in a list format.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32795774277593590000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

c) Course Name: Angular JS

Module Name: ngSwitch

Display the correct option based on the value passed to ngSwitch directive.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_23388127475984175000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

d) Course Name: Angular JS

Module Name: Custom Structural Directive

Create a custom structural directive called 'repeat' which should repeat the element given a number of times.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24073319904331424000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

	TEXT BOOKS
1.	MongoDB – The Definitive Guide, 3rd Edition,2019, Kristina Chodorow, O'Reilly
2	Programming the World Wide Web, 8th Edition,2014 Robet W Sebesta, Pearson.
3	Pro Mean Stack Development, 1st Edition,2016 ELadElrom, Apress O'Reilly.
4	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition,2014 SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
WEB RESOURCES	
1	Node JS Download **Node.js** from the official site Setup details : How to use Node.js - Viewer Page | Infosys Springboard (onwingspan.com)
2	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview (MongoDB)
3	https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS)