INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)

Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
COMPUTER SCIENCE AND ENGINEERING

ACADEMIC REGULATIONS, COURSE CATALOGUE AND SYLLABI
MT23

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2023 - 2024)

INSTITUTE VISION | MISSION | QUALITY POLICY

VISION

To bring forth students, professionally competent and socially progressive, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

The Vision of the department is to produce competent graduates suitable for industries and organizations at global level including research and development with Social responsibility.

MISSION

To provide an open environment to foster professional and personal growth with a strong theoretical and practical background having an emphasis on hardware and software development making the graduates industry ready with social ethics.

Further the Department is to provide training and to partner with Global entities in education and research.

M.TECH - PROGRAM OUTCOMES (POs)

Upon completion of M.Tech Computer Science and Engineering, the students will be able to:

PO1:	Independently carry out research / investigation and development work to solve practical problems.
PO2:	Write and present a substantial technical report / document
PO3:	Demonstrate a degree of mastery in computer science and engineering emerging areas such as data science, cyber security and application development
PO4:	Apply advanced level knowledge, techniques, skills, and modern tools in the field of computer science and engineering and its allied areas.
PO5:	Function effectively as a member or leader in diverse teams to carry out development work, and produce solutions that meet the specified needs with frontier technologies in multidisciplinary environments
PO6:	Engage in life-long learning for continuing education in doctoral level studies and professional development.

CONTENTS

"Take up one idea.
Make that one idea you're life-think of it, dream of it, and live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success" Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a subject offered by the institute for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Aerospace Engineering, Computer Science and Engineering, Embedded Systems, Electrical Power Systems, CAD/CAM, Structural Engineering etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research-based work to be taken up by a student during his / her second year to achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "MT23" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', him', 'his', occur, they imply 'she', 'her', 'hers' also.

PREFACE

Dear Students,

The focus at IARE is to deliver value-based education with academically well qualified faculty and infrastructure. It is a matter of pride that IARE continues to be the preferred destination for students to pursue an engineering degree.

In the year 2015, IARE was granted academic autonomy status by University Grants Commission, New Delhi under Jawaharlal Nehru Technology University Hyderabad. From then onwards, our prime focus is on developing and delivering a curriculum which caters to the needs of various stakeholders. The curriculum has unique features enabling students to develop critical thinking, solve problems, analyze socially relevant issues, etc. The academic cycle designed on the basis of Outcome Based Education (OBE) strongly emphasizes continuous improvement and this has made our curriculum responsive to current requirements.

The curriculum at IARE has been developed by experts from academia and industry and it has unique features to enhance problem solving skills apart from academic enrichment. The curriculum of M.Tech program has been thoroughly revised as per AICTE / UGC / JNTUH guidelines and have incorporated unique features such as competency training / coding, industry driven elective, internship and many more. The curriculum is designed in a way so as to impart engineering education in a holistic approach towards Excellence.

I hope you will have a fruitful stay at IARE.

Dr. L V Narasimha Prasad
Principal

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2023 - 24)

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choose Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work /mini project work with seminar/ viva / seminars / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:
1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2. MEDIUM OF INSTRUCTION

The medium of instruction shall be **English** for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3. ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.
b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4. UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M.Tech program will be placed in one of the groups as listed in the Table 1.

Table 1: Group of Courses

S. No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Electrical Power Systems	Electrical and Electronics Engineering	PS
3	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Aerospace Engineering	Aeronautical Engineering	AE

5. TYPES OF COURSES

Courses in a program may be of four kinds: **Core, Elective, Open and Mandatory courses.**

5.1   Core Courses:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in said discipline of study.

5.2   Elective Courses:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

There shall be five professional core elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor / mentor. In addition, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

5.3 Open Elective Courses:

An elective may be discipline centric focusing on those courses which add generic proficiency to the students or may be chosen from supportive / general discipline called as "Open Elective".

5.4 Mandatory Audit Courses:

The student may opt for audit courses, starting in first semester onwards. Audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Student can choose one audit course from the list. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

For mandatory non-credit Audit courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. These marks should also be uploaded along with the internal marks of other subjects.

No marks or letter grades shall be allotted for mandatory non-credit Audit courses. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6. SEMESTER STRUCTURE

The M.Tech. Programs in institute are of semester pattern, with four semesters consisting of Two academic years. Each academic year having Two Semesters: Odd and Even. Each Semester shall be of 22 weeks of duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

The two-year M.Tech. program consists of 68 credits and the student has to register for all 68 credits and earn all 68 credits for the award of M.Tech. degree. There is NO exemption of credits in any case.

UGC/AICTE specified definitions/descriptions are adopted appropriately for various terms and abbreviations used in these PG academic regulations, as listed below:

Each Semester shall have 'Continuous Internal Assessment (CIA)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Design/Drawing Subject', or 'Mini Project with Seminar', or 'Dissertation', as the case may be.

Before commencement of the class work, all the eligible students are required to register the courses through Samvidha (Student Management Portal) without fail.

7. PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 6.0/10.0 CGPA.

b) In the event of non-completion of project work and / or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the project. In such a case, the candidate will not be permitted to submit the report earlier than three months and not later than six months from the date of registration.

8. CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Professional core courses, Professional elective courses, Audit courses, Open elective courses, Laboratory courses, Mini project with seminar, Phase-I Dissertation and Phase-II Dissertation.

Each Theory and Laboratory course carries credits based on the number of Hours / Week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.

- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.

- **Dissertation Work / Project work:** 1 credit for 2 hours of project work per week.

Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations and mandatory courses (Non-credit Audit Courses) will not carry any credits.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Core Courses	3	3
2	Professional Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	2	2
7	Phase - I Dissertation	20	10
8	Phase - II Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04) + Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (04)	04@2credits	08
Mini Project with Seminar (01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Phase-I Dissertation	1 @10credit	10
Phase-II Dissertation	1 @16credits	16
TOTAL CREDITS		**68**

9. EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, out of which 40 marks for Continuous Internal Assessment (CIA) and 60 marks for Semester End Examination (SEE).

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 60 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern shall be as defined below. Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 12 marks. There could be a maximum of two / three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty / teacher handling the course. CIA is conducted for a total of 40 marks, with 30 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). **Two CIE Tests are Compulsory** and sum of the two tests, along with the scores obtained in the assignment and AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduct of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.

Table 4: Outline of the Continuous Internal Assessments (CIA – 1 and CIA – 2) and SEE

Activities	CIA - 1	CIA - 2	SEE	Total Marks
Continuous Internal Examination (CIE)	10 marks	10 marks		20 marks
Assignment / Quiz	05 marks	05 marks		10 marks
Alternative Assessment Tool (AAT)	05 marks	05 marks		10 marks
Semester End Examination (SEE)			60 marks	60 marks
Total	--	--	100 marks	

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

Assignment:

To improve the writing skills in the course an assignment will be evaluated for 05 marks. Assignment has to submit either at the end of the CIE1 or CIE2 for the questions provided by each course coordinator in that semester. Assignments to be handed in as loose paper collection stapled together at the top left corner. The assignment should be presented as a professional report. It must consist of a cover sheet, content page, and should have an introduction, a body, a conclusion or recommendation, and a reference page**.**

Quiz: It is online proctor based online examination conducted either at the end of the CIE1 or CIE2.

The choice of conduction of Assignment / Quiz in CIE1 or CIE2 is purely choice of course handling faculty.

Alternative Assessment Tool (AAT):

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. **The AAT may include,** Course related term paper, Technical seminar, Term paper, Case Study, Paper presentations conducted by reputed organizations relevant to the course etc.

The choice of selection of AAT is based on course handling faculty.

Note:

First mid-term examination shall be conducted on 50% of the syllabus, and the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

The semester end examinations (SEE), for theory courses, will be conducted for 60 marks consisting of five questions (numbered from 1 to 5) carrying 12 marks each. Each of these questions is from each module and may contain sub-questions, for each question there will be an "either" "or" choice, which means, there will be two questions from each module, student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

9.2 Laboratory Course: For practical courses there shall be a Continuous Internal Assessment (CIA) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of Preparation / Performance in the laboratory / Calculations and graphs / Results and error analysis / Viva-voce) which shall be evaluated for **10 marks**.

2. Viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned – **10 marks.**

3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for **10 marks.**

4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

5. The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the Principal. The Semester End Examination held for 3 hours and total 60 marks are divided and allocated as shown below:

   1. 10 marks for write-up
   2. 15 for experiment/program
   3. 15 for evaluation of results
   4. 10 marks for presentation on another experiment/program in the same laboratory course
   5. 10 marks for viva-voce on concerned laboratory course

9.3 Project work

Normally, the project work should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized Educational Institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

Registration of Dissertation Work: A candidate is permitted to register for the Dissertation Work after satisfying the attendance requirement in all the courses, both theory and laboratory. After satisfying the attendance requirement candidate must present in Dissertation Work Review - I, in consultation with his Supervisor, the title, objective and plan of action of his/her Dissertation work to the Project Review Committee (PRC) for approval within four weeks from the commencement of III semester. Only after obtaining the approval of the PRC can the student initiate the Dissertation work.

9.3.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I Dissertation of project work shall be evaluated by Project Review

Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Supervisor / Guide and Head of the Department.

9.3.2   The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final viva voce examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for presentation / publication in a conference / journal and produce the proof of acceptance of the paper from the organizers / publishers.

9.3.3   The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Supervisor/Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

The evaluation of the project work and the marks allotted are as under:

S. No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Supervisor / Guide	40
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, Supervisor / Guide and HOD.	60
		Total (Phase – I)		100
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and Supervisor / Guide wherein the HOD convenes its meeting.	40
4		End Semester Examination (An open seminar followed by viva- voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and Supervisor / Guide wherein the HOD shall be the chairman of the committee.	60
		Total (Phase-II)		100

9.3.4   As soon as a student submits project work, Principal shall appoint the external examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.3.5   The Principal shall schedule the End Semester Examination in project work soon after the completion of the study of program and a student can appear for the same provided s/he has earned successfully all the requisite credits. The student shall produce the dissertation duly certified by the guide and HOD during the Examination.

9.3.6   The project reports of M.Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the Controller of Examinations. The results of the project work evaluation will be declared by the Controller of Examinations only after the successful completion of the courses by those students.

10. ATTENDANCE REQUIREMENTS AND DETENTION POLICY
The programs are offered based on a unit system with each course being considered a unit. Attendance is calculated separately for each course.

10.1 Attendance in all classes (Lectures/Laboratories) is compulsory. The minimum required attendance in each theory course (*also mandatory Audit Courses*) including the attendance of mid-term

examination / Laboratory etc. is 75%. Two periods of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course. A student shall not be permitted to appear for the Semester End Examinations (SEE), if s/he attendance is less than 75%.

10.2 **A** student's Seminar report and presentation on Mini Project shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in seminar presentation classes on Mini Project during that semester.

10.3 **Condoning of shortage of attendance** (between 65% and 75%) up to a maximum of 10% (considering the days of attendance in sports, games, NCC, NSS activities and medical grounds) in each course (Theory /Laboratory / Mini Project with Seminar) of a semester shall be granted by the institute academic committee on genuine reasons.

10.4 A prescribed fee per course shall be payable for condoning shortage of attendance.

10.5 Shortage of Attendance below 65% in any course shall in **no case be condoned.**

10.6 A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Lab/Mini Project with Seminar) in any semester, is considered as 'Detained in that course(s), and is not eligible to write Semester End Examination(s) of such course(s), (in case of Mini Project with Seminar, s/he Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and s/he has to seek re-registration for those course(s) in subsequent semesters, and attend the same as and when offered.

10.7 A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.

10.8 **a)** A student shall put in a minimum required attendance in at least **three theory courses (excluding *mandatory (non-credit audit)* course)** in first semester for promotion to second semester.

b) A student shall put in a minimum required attendance in at least **three theory courses (excluding *mandatory (non-credit audit)* course)** in second semester for promotion to third semester.

11. CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 COE shall invite external examiners to evaluate all the semester end examinations answer scripts on a prescribed date(s).

11.3 Laboratory examinations are conducted by involving external examiners.

11.4 Examinations Control Office headed by COE shall consolidate the marks awarded by internal and external examiners and award grades.

12. SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

    i. Not less than 40% marks (16 out of 40 marks) for each theory course in the CIA.

    ii. Not less than 40% marks (24 out of 60 marks) for each theory course in the SEE.

    iii. A minimum of 50% marks (50 out of 100 marks) for each theory course considering both CIA and SEE.

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Mini project with Seminar / Dissertation Project, if s/he secures.

    i. Not less than 40% marks (16 out of 40 marks) in the CIA.

ii. Not less than 40% marks (24 out of 60 marks) in the SEE.

iii. A minimum of 50% marks (50 out of 100 marks) considering both CIA and SEE.

If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10 point grading system with the following letter grades as given below:

% of Marks Secured in a Subject / Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above ($\geq$ 90%, $\leq$ 100%)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq$ 80%, <90%)	A+ (Excellent)	9
Below 80% but not less than 70% ($\geq$ 70%, <80%)	A (Very Good)	8
Below 70% but not less than 60% ($\geq$ 60%, <70%)	B+ (Good)	7
Below 60% but not less than 50% ($\geq$ 50%, <60%)	B (above Average)	6
Below 50% (<50%)	F (Fail)	0
Absent	**AB (Absent)**	**0**

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: "O", "A+", "A", "B+", "B".

13.3 A student obtaining grade "F" shall be considered failed and will be required to reappear in the examination.

13.4 "SA" denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.5 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n}\left(C_i\,G_i\right) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course and n represent the number of courses in which a student's is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m}\left(C_j\,S_j\right)/\sum_{j=1}^{m}C_j$$

Where, S_j is the SGPA of the jth semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration of calculation of SGPA

Course	Credits	Letter Grade	Grade Points	Credit Points (Credit x Grade)
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	B	6	4 x 6 = 24
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B	6	3 x 6 = 18
	21			159

Thus, SGPA = 159 / 21 = 7.57

15.2 Illustration of calculation of CGPA

Semester	Credits	SGPA	Credits * SGPA
Semester I	24	7	24 * 7 = 168
Semester II	24	6	24 * 6 = 144
Semester III	24	6.5	24 * 6.5 = 156
Semester IV	24	6	24 * 6 = 144
	96		612

Thus, *CGPA = 612 / 96 = 6.37*

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS
The following academic requirements shall be met for the award of M .Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 68 credits.

17.2 A student who fails to earn 68 credits within four consecutive academic years from the year of his/her admission (with CGPA $\geq$ 6.0), shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE
After a student has earned the requirements prescribed for the completion of the program and is eligible for the award of M.Tech degree, he shall be placed in one of the following three classes based on the CGPA:

Classification of degree will be as follows:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$6.00 \leq$ CGPA < 6.75

Note: A student with final CGPA (at the end of the M.Tech Program) < 6.00 shall not be eligible for the Award of Degree.

All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

19. TERMINATION FROM THE PROGRAM
The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

20. WITH-HOLDING OF RESULTS
If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

21. DISCIPLINE
Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

22. GRIEVANCE REDRESSAL COMMITTEE
The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

23. TRANSITORY REGULATIONS

A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

Semester End Examination in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman, BOS concerned.

24. REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. Shall IARE award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built-in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Program Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. IARE has introduced its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. Can IARE have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. Can IARE give a provisional degree certificate?

Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore, with the prior permission of the University the college will be entitled to give the provisional certificate.

10. Will Academic Autonomy make a positive impact on the Placements or Employability?
Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?
Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Is it possible to have complete Internal Assessment for Theory or Practicals?
Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. Why Credit based Grade System?
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. What exactly is a Credit based Grade System?
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B, C, D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. What are the norms for the number of Credits per Semester and total number of Credits for UG/PG program?
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. What is a Semester Grade Point Average (SGPA)?
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n}\left(C_i\,G_i\right) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. What is a Cumulative Grade Point Average (CGPA)?
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{n}\left(C_i\,S_i\right)/\sum_{j=1}^{n}C_i$$

Where, S_i is the SGPA of the ith semester and C_i is the total number of credits in that semester and j represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. Is there any Software available for calculating Grade point averages and converting the same into Grades?
Yes, The institute has its own MIS software for calculation of SGPA, CGPA, etc.

19. Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?
No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. Will there be any Revaluation or Re-Examination System?
No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. How fast syllabi can be and should be changed?
Autonomy allows us the freedom to change the syllabi as often as we need.

22. Will the Degree be awarded on the basis of only final year performance?
No. The CGPA will reflect the average performance of all the semester taken together.

23. What are Statutory Academic Bodies?
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24. Who takes Decisions on Academic matters?
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25. What is the role of Examination committee?
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc., fall within the duties of the Examination Committee.

26. Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28. Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. Who will keep the Student Academic Records, University or IARE?

It is the responsibility of the Dean of Academics of the Autonomous College to keep and preserve all the records.

30. What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31. Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32. Shall we get autonomy for PG and Doctoral Programs also?

Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICALENGINEERING
(AUTONOMOUS)

COURSE CATALOGUE
REGULATIONS: MT-23
COMPUTER SCIENCE AND ENGINEERING

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCSD01	Mathematical Foundations of Computer Science	PCC	Core	3	0	0	3	40	60	100
BCSD02	Advanced Data Structures	PCC	Core	3	0	0	3	40	60	100
	Professional Elective - I	PE	Elective	3	0	0	3	40	60	100
	Professional Elective - II	PE	Elective	3	0	0	3	40	60	100
BHSD01	Research Methodology & IPR	--	--	2	0	0	2	40	60	100
	Audit Course - I	Audit - I	Audit	2	0	0	0	--	--	--
PRACTICAL										
BCSD11	Advanced Data Structures Laboratory	PCC	Core	0	0	4	2	40	60	100
BCSD12	Data Science Laboratory	PCC	Core	0	0	4	2	40	60	100
TOTAL				**16**	**00**	**08**	**18**	**280**	**420**	**700**

*Professional Elective- I and Professional Elective- I Lab must be of same course.

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCSD13	Advanced Algorithms	PCC	Core	3	0	0	3	40	60	100
BCSD14	Advanced Computer Architecture	PCC	Core	3	0	0	3	40	60	100
	Professional Elective - III	PE	Elective	3	0	0	3	40	60	100
	Professional Elective - IV	PE	Elective	3	0	0	3	40	60	100
	Audit Course - II	Audit - II	Audit	2	0	0	0	--	--	--
PRACTICAL										
BCSD23	Advanced Algorithms Laboratory	PCC	Core	0	0	4	2	40	60	100
BCSD24	Cyber Security Laboratory	PCC	Core	0	0	4	2	40	60	100
BCSD25	Mini Project with Seminar	PCC	Core	0	0	4	2	40	60	100
TOTAL				**14**	**00**	**12**	**18**	**280**	**420**	**700**

* Professional Elective- III and Professional Elective- III Lab must be of same course.

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
	Professional Elective - V	PE	Elective	3	0	0	3	40	60	100
BCSD30	Open Elective	OEC	Elective	3	0	0	3	40	60	100
PROJECT										
BCSD34	Dissertation Work Review - II	Major Project	Core	0	0	12	6	40	60	100
TOTAL				**06**	**00**	**12**	**12**	**120**	**180**	**300**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BCSD35	Dissertation Work Review - III	Major Project	Core	0	0	12	6	40	60	100
BCSD36	Dissertation Viva-Voce	--	Core	0	0	28	14	40	60	100
TOTAL				**00**	**00**	**32**	**20**	**80**	**120**	**200**

ELECTIVE COURSES

PROGRAM CORE ELECTIVES (PCE)

S.No	Course Code	Course Name	Professional Electives
1	BCSD03	Data Science	I
2	BCSD04	Artificial Intelligence and Machine learning	I
3	BCSD05	Advanced Computer Networks	I
4	BCSD06	Mobile Application Development	I
5	BCSD07	Agile and Microservices	II
6	BCSD08	Soft Computing	II
7	BCSD09	Applied Cryptography	II
8	BCSD10	Internet of Things and Applications	II
9	BCSD15	Cyber Security	III
10	BCSD16	Deep Learning	III
11	BCSD17	Computer Vision	III
12	BCSD18	Digital Forensics	III
13	BCSD19	GPU Computing	IV
14	BCSD20	Mining Massive Datasets	IV
15	BCSD21	Natural Language Processing	IV
16	BCSD22	Edge Computing	IV
17	BCSD26	Blockchain Technologies	V
18	BCSD27	Malware Analysis and Reverse Engineering	V
19	BCSD28	Augmented Reality and Virtual Reality	V
20	BCSD29	Quantum Computing	V

OPEN ELECTIVE COURSES FOR OTHER DEPARTMENTS

S.No	Course Code	Course Name
1	BCSD30	Cyber Physical Systems
2	BCSD31	Parallel and Distributed Computing
3	BCSD32	Software Project Management
4	BCSD33	Mobile Computing

AUDIT COURSES – I AND II

S.No	Course Code	Course Title
1	BHSD02	English for Research Paper Writing
2	BHSD03	Disaster Management
3	BHSD04	Sanskrit for Technical Knowledge
4	BHSD05	Value Education
5	BHSD06	Constitution of India
6	BHSD07	Pedagogy Studies
7	BHSD08	Stress Management by Yoga
8	BHSD09	Personality Development through Life Enlightenment Skills

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD01	**Core**	3	0	0	3	30	70	100

Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 48**

I. COURSE OVERVIEW:

This course will discuss fundamental concepts in mathematics with emphasis on their applications to computer science. Topics include probability, distribution, multivariant statistical models, computer applications, trees and graphs. This course is appropriate for communications and networking, storage and retrieval of information.

II. COURSE OBJECTIVES:

The students will try to learn:
I. The mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
II. The mathematical and logical basis to many modern techniques in information technology.
III. Gain knowledge about various sampling and classification problems.

III. COURSE OUTCOMES:

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

CO1	Make use of distribution theory for depicting the expected outcome of products based on data related to supply and demand.
CO2	Apply Central Limit Theorem and Probability inequalities for estimating population parameters in the data generating process/experiment.
CO3	Build statistical models based on random sampling data for getting unbiased estimates in performing data analysis.
CO4	Examine regression and multivariate statistical models for solving classification and curve fitting problems in data analysis.
CO5	Identify appropriate techniques of graphs and combinatorial theory for finding solutions to shortest path and enumeration problems.
CO6	Choose appropriate mathematical and statistical techniques for solving applications in emerging areas of Information Technology.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

MODULE-II: RANDOM SAMPLES (10)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

MODULE-III: STATISTICAL INTERFACE (09)

Statistical inference, Introduction to multivariate statistical models: regression and classificationproblems, Principal components analysis, The problem of over fitting model assessment.

MODULE-IV: GRAPH THEORY (09)

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

MODULE-V: COMPUTER SCIENCE AND ENGINEERING APPLICATIONS (10)

Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

V. TEXT BOOKS:

1. John Vince, "Foundation Mathematics for Computer Science", Springer 2015.
2. K. Trivedi. "Probability and Statistics with Reliability, Queuing, and Computer Science Applications". Wiley, 2016.
3. M. Mitzenmacher and E. Upfal." Probability and Computing: Randomized Algorithms and Probabilistic Analysis". Wiley, 2005.

VI. REFERENCE BOOKS:

1. Alan Tucker, "Applied Combinatorics", Wiley, 2012.

VII. WEB REFERENCES:

1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

VIII. E-TEXTBOOKS:

1. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. https://www.cs.bris.ac.uk/~flach/mlbook/.
3. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.

INSTITUTE OF AERONAUTICAL ENGINEERING
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Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ADVANCED DATA STRUCTURES							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
BCSD02	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:
This course covers the overview of advanced data structures for storing and organizing the data. Topics covered include algorithm analysis, dictionaries, hashing, trees, and graphs. The course is to teach the students how to select and apply data structures that are appropriate for problems that they might encounter in problem-solving in engineering areas.

II. COURSE OBJECTIVES:
The students will try to learn:

I. The performance trade-offs of different algorithms/implementations and asymptotic analysis of their running time and memory usage.

II. Choose appropriate data structures, understand the ADT/libraries, and use them to design algorithms for a specific problem

III. The knowledge of basic abstract data types (ADT) and associated algorithms to perform various operations on different types of data structures.

IV. The fundamentals of how to store, retrieve, and process the data efficiently and come up with an analysis of efficiency and proof of correctness.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to

CO1   Analyze the performance of the algorithms using mathematical tools such as asymptotic notations.

CO2   Implement ADTs, Lists, and their operations

CO 3   Construct hash tables by using hash functions and perform various operations on hash tables

CO 4   Organize data in the form of trees and graphs for retrieving information effectively

CO 5   Assess the efficiency of a binary search tree (BST), AVL trees, Red Black, and splay trees for searching

CO 6   Apply the concepts of text compression and pattern matching to solve problems effectively

IV. COURSE CONTENT:
MODULE-I: OVERVIEW OF DATA STRUCTURES (09)
Algorithm analysis: Algorithms; Performance analysis: Time complexity and space complexity, asymptotic notation: Big Oh, omega and theta notations, complexity analysis examples; Data structures: Linear and nonlinear data structures, ADT concept, linear list ADT, stack and queue ADTs, array and linked list representations; Circular queue: Insertion and deletion, de queue ADT, priority queue ADT, implementation using heaps, insertion into a max heap, deletion from a max heap, singly linked lists, doubly linked lists, circular linked list.

MODULE-II: DICTIONARIES, HASH TABLES (10)
Dictionaries: Linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution, separate chaining, open addressing, linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

MODULE-III: TREES AND GRAPHS (09)
Trees: Ordinary and binary tree terminology, properties of binary trees, binary tree ADT, representations, recursive and nonrecursive traversals, threaded binary trees.

Graphs: Graphs terminology, graph ADT, representations, graph traversals; Search methods: DFS and BFS; Applications of Graphs: Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for single source shortest path problem.

MODULE-IV: SEARCH TREES I (10)
Binary search tree: Binary search tree ADT, insertion, deletion, and searching operations, finding the parent of a given node, attaining a reference to a node, finding the smallest and largest values in the binary search tree; Balanced search trees: AVL trees, definition, height of an AVL tree; Operations: Insertion, deletion, and searching.

MODULE-IV: SEARCH TREES II (10)
Red-Black and Splay Trees; B trees: Definition, operations, and applications; R trees: Nearest neighbor query, join and range queries; Comparison of search trees; Text compression: Huffman coding and decoding; Pattern matching: KMP algorithm.

V TEXT BOOKS:
1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd Edition, 2008.
2. G.A.V.Pai, "Data Structures and Algorithms", Tata McGraw Hill, NewDelhi,1st Edition,2008
3. Reema Thareja, S. Rama Sree, Advanced Data Structures, Oxford University Press, 2018

VI. REFERENCE BOOKS:
1. D. Samanta, "Classic Data Structures", Prentice Hall of India Private Limited, 2nd Edition, 2003.
2. Aho, Hop craft, Ullman, "Design and Analysis of Computer Algorithms", Pearson Education India, 1st Edition, 1998.
3. Goodman, Hedetniemi, "Introduction to the Design and Analysis of Algorithms", Tata McGraw Hill, New Delhi, India, 1st Edition, 2002.
4. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Course Technology, 3rd Edition, 2005.

VII. WEB REFERENCES:
1. http://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
2. http://www.geeksforgeeks.org/b-tree-set-1-introduction-2/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

VIII. E-TEXTBOOKS:
1. https://comsciers.files.wordpress.com/2015/12/horowitz- -of-computer-algorithms-2nd-edition.pdf

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COURSE CONTENT

DATA SCIENCE								
I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD03	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:

Data Science is a field of study that deals with the collection, analysis, and processing various data or information to extract solutions. It deals with the understanding of many structured and unstructured data with specialized knowledge to get the required insights. It is that part of science which also requires knowledge about business or commerce related fields.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   The fundamental knowledge on basics of data science and R programming.
II. The programs in R language for understanding and visualization of data using statisticalfunctions and plots.
III. How to apply hypotheses and data into actionable predictions.
IV. A range of machine learning algorithms along with their strengths and weaknesses.
V.   The document and transfer the results and effectively communicate the findings usingvisualization techniques.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to

CO1	Explore the fundamental concepts of data science
CO2	Make use of various data description functions in R programming forexhibiting various stages of the data science process.
CO 3	Identify interfacing packages for handling SQL and NoSQL databases forperforming data analysis.
CO 4	Evaluate data models using clustering and classification techniques.
CO 5	Solve various real-time problems on various hypothesis conditions by usingartificial neural networks.
CO 6	Illustrate delivering results through documentation and visualizationtechniques

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Data science process, roles, stages in data science project, working with data from files, working with relational databases, exploring data, managing data, data cleaning and sampling for modeling. Introduction to R: Introduction to various data types, reading and writingdatasets, working with different file types .txt, .csv, outliers, R functions and loops; Summary statistics: Summary, str, aggregate, subset, head, tail; Probability distribution.

MODULE-II: SQL, NOSQL AND DATA ANALYSIS (10)

SQL using R, excel and R, introduction to No SQL, connecting R to No SQL databases, R with XML, JSON; Correlation analysis; Covariance analysis, ANOVA, forecasting, heteroscedasticity,

autocorrelation; Regression analysis: Regression modeling, multiple regression.

MODULE-III: DATA ANALYSIS (10)
Data analysis: Introduction, Terminology and concepts, Central tendencies and distributions, Variance, Basic machine learning algorithms, Linear regression, SVM Cluster analysis: K-means algorithm, Naive Bayes memorization methods, evaluating clustering models and validating models.

MODULE-IV: ARTIFICIAL NEURAL NETWORKS (09)
Artificial neural networks: Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back propagation algorithm Evaluation hypotheses: Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypothesis,comparing learning algorithms.

MODULE-V: DELIVERING RESULTS (09)
Documentation and deployment, producing effective presentations, introduction to graphical analysis, plot() function, displaying multivariate data, matrix plots, multiple plots in one window, exporting graph, using graphics parameters, case studies.

V. TEXT BOOKS:
1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 1st edition, 2014.
2. William N. Venables, David M. Smith, "An Introduction to R", Network Theory Limited, 2nd edition, 2009.
3. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Taylor & Francis CRCPress, 2nd edition, 2011.

VI. REFERENCE BOOKS:
1. G. Jay Kerns, "Introduction to Probability and Statistics Using R", Youngstown State University,USA, 1st edition, 2011.
2. William W Hsieh, "Machine Learning Methods in the Environmental Sciences", Neural Networks, Cambridge University Press, 1st edition, 2009.
3. Chris Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, 1st edition,1995.
4. Peter Flach, "Machine Learning", Cambridge University Press, 1st edition, 2012.

VII. WEB REFERENCES:
1. http://www.tutorialspoint.com/r/
2. https://en.wikipedia.org/wiki/R_programming_language.
3. http://www.r-bloggers.com/how-to-learn-r-2/#h.obx6jyuc9j7t.

VIII. E-TEXT BOOKS:
2. https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
3. https://www.cs.bris.ac.uk/~flach/mlbook/.
4. http://mylovelibrabry.com/emylibraryus/free.php?asin=1466583282.

COURSE CONTENT

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD04	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:

The course Artificial Intelligence and Machine Learning which includes theories, standards, methods and innovations of various different domains like mathematics, cognitive science, electronics and embedded systems to make intelligent systems that mimic human behaviour. It focus on collecting, categorizing, strategizing, analyzing and interpreting data. It is a specialised branch that deals with the development of embedded systems like robotics and IoT based applications. It also incorporates the concepts of machine learning and deep learning model building for solving various computational and real-world business problems.

II. COURSE OBJECTIVES:

The students will try to learn:

    I.   The methods of solving problems using Artificial Intelligence.
    II. The knowledge representation techniques, reasoning techniques and planning.
    III. The concepts of expert systems and machine learning.

III. COURSE OUTCOMES:

  After successful completion of the course, students should be able to

CO1	Understand the history of artificial intelligence (AI) and its foundations
CO2	Understand a very broad collection of machine learning algorithms and problems
CO3	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
CO4	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO5	Demonstrate proficiency in applying scientific method to models of machine learning.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS (09)
Human Brain, Model of an artificial Neuron, Basic concepts of Neural Networks, Fundamentals of Biological Neural Network and Artificial Neural Network, Evolution of Neural Networks, Characteristics of Neural Networks, Learning Methods – supervised, unsupervised and reinforcement, Taxonomy of Neural Network Architectures, Terminologies – weights, bias, threshold, learning rate, Applications of Neural Networks.

MODULE-II: SUPERVISED NEURAL NETWORKS (10)
Hebb Network theory and training algorithm, Perceptron Networks architecture and training algorithm, Backpropagation Network architecture and training algorithm, Associative Memory Network architecture and training algorithm**.**

MODULE-III: UNSUPERVISED NEURAL NETWORKS (09)
Hopfield Networks architecture and training algorithm, Counterpropagation Networks architecture and training algorithm, Adaptive Resonance Theory Network architecture and training algorithm.

MODULE-IV: ADVANCED NEURAL NETWORKS (10)
Kohonen Self-Organising Feature Maps architecture and training algorithm, Learning Vector Quantization architecture and training algorithm, Boltzmann Machine, Cognitron Network, Neocognitron Network, Optical Neural Networks Electro-optical Multipliers and Holographic Correlators.

MODULE-IV: DEEP LEARNING (10)
Machine learning basics, Simple Machine Learning Algorithm -- Linear Regression, underfitting and overfitting challenges in Machine Learning, Supervised Learning approach for Support Vector Machine, Deep Feedforward Networks, Convolutional Networks, Deep Recurrent Networks, Deep Boltzmann Machine, Applications in Speech Recognition and Natural Language Processing.

V TEXT BOOKS:
1. Sivanandam, S Sumathi, S N Deepa; "Introduction to Neural Networks", 2nd edition.,TATA McGraw HILL : 2005.
2. Tom M.Mitchell, "MGH Machine Learning".
3. Lawrence Rabiner and Biing, Hwang Juang. "Fundamentals of Speech Recognition",

VI. REFERENCE BOOKS:
1. Simon Haykin, "Neural networks A comprehensive foundations", 2nd edition., Pearson Education, 2004.
2. B Yegnanarayana, "Artificial neural networks", 1st ed., Prentice Hall of India P Ltd, 2005.
3. Li Min Fu, "Neural networks in Computer intelligence", 1st edition., TMH, 2003.

VII. WEB REFERENCES:
1. https://www.udemy.com/course/learn-android-application-development-y/
2. https://www.tutorialspoint.com/android/index.htm
3. https://www.geeksforgeeks.org/android-app-development-fundamentals-for-beginners/

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COURSE CONTENT

ADVANCED COMPUTER NETWORKS							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD05	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:

This is an advanced level undergraduate course in computer networking. The course is designed to include materials relevant to the industry, for example IP routing and traffic engineering. The course deals with the principles, architectures, algorithms, and protocols related to the Internet, with emphasis on routing, transport protocol design, flow control and congestion control, quality of service, traffic engineering and MPLS.

II. COURSE OBJECTIVES:

The students will try to learn:

IV. The advanced networking concepts for next generation network architecture and design.
V. Transport-layer services and principles of congestion control.
VI. The basic taxonomy and terminology of the computer networking area.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to

CO1 Understand advanced concepts and next generation networks.

CO2 Analyze TCP/IP variants, network Algorithm's, Protocols and their functionalities

CO 3 Analyze the performance of various server implementations

CO 4 Choose different routing protocols in the given network situation

CO 5 Configure various application layer protocols

COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Review of Computer Networks, Devices and the Internet: Internet, Network edge, Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, Networking and Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing. Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure. The Link Layer and Local Area Networks-Link Layer, Introduction and Services, Error- Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization.

MODULE-II: DATA LINK PROTOCOLS (09)

Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes.
Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, NonLeast-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer**.**

MODULE-III: LOGICAL ADDRESSING (10)
Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6.

Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms.

MODULE-IV: TRANSPORT AND APPLICATION LAYER PROTOCOLS (10)
Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of Network Applications.

MODULE-IV: THE WEB AND HTTP, FILE TRANSFER (09)
The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server
Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

V TEXT BOOKS:
1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross, Pearson, 6th edition, 2012.
2. Computer Networks and Internets, Duglas E. Comer, 6th edition, Pearson education.

VI. REFERENCE BOOKS:
1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson, 3rd edition, 2012.
2. Computer Networks , Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall.

COURSE CONTENT

MOBILE APPLICATION DEVELOPMENT							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD06	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:
. This course focuses on the java API'S and tools necessary for developing mobile applications. It covers the necessary language features for mobile programming and focuses particularly on the Mobile Information Device Profile used in mobile phone application development. This course is used to build a mobile application interface using J2ME, connecting via HTTP to the web tier interface of a Java application.

II. COURSE OBJECTIVES:
The students will try to learn:

I	The fundamentals of Android operating systems.
II	The skills of using Android software development tools
III	How to deploy mobile applications with reasonable complexity on mobile platform
IV	The programs running on mobile devices.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to

CO1	Select suitable software tools and APIs for the development of a particular mobile application.
CO2	Use Intents to dial a number to send SMS Broadcast Receivers
CO 3	Demonstrate creating a file and reading data from files using Persistent Storage
CO 4	Use a content provider for inserting, deleting, retrieving and updating data using SQLite
CO 5	Develop mobile applications with good design and interactive features for mobile devices.

IV. COURSE CONTENT:
MODULE-I: INTRODUCTION TO ANDROID OPERATING SYSTEM (09)
Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes.

MODULE-II: ANDROID USER INTERFACE (10)
Measurements – Device and pixel density independent measuring UNIT – s Layouts – Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non editableTextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment 79|Page states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities**.**

MODULE-III: INTENTS AND BROADCASTS (10)

ntents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts.

MODULE-IV: STORAGE (09)

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

MODULE-IV: SQ Lite (10)

The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server
Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tool Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

V TEXT BOOKS:

4. Reto Meier, "Professional Android 4 Application Network Development", Wiley India, (Wrox), 2012.
5. James C Sheusi, "Android Application Development for Java Programmers", Cengage Learning, 2013.

VI. REFERENCE BOOKS:

4. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013

VII. Web References:

1. https://www.udemy.com/course/learn-android-application-development-y/
2. https://www.tutorialspoint.com/android/index.htm
3. https://www.geeksforgeeks.org/android-app-development-fundamentals-for-beginners/

VIII. E-BOOKS:

1. https://web.stanford.edu/class/cs231m/lectures/lecture-2-android-dev.pdf

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COURSE CONTENT

SOFT COMPUTING							

I Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD08	**Core**	3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:

This course covers the basics of intelligence techniques and methodologies of soft computing that differ from conventional artificial computations. This course is used for approximate calculations to provide imprecise but useable solutions to complex problems. This course includes intelligence systems, artificial neural network models, fuzzy logic and its inference system, and neuro-fuzzy systems. The applications are used in pattern recognition, image processing, computer vision, and information retrieval.

II. COURSE OBJECTIVES:

The students will try to learn:
I. The fuzzy logic and reasoning for handling uncertainty in problem solving
II. Introduce the ideas of neural networks, and fuzzy logic.
III. The basics of intelligence techniques and methodologies of soft computing
IV. The design and analysis of problem-solving using concepts of neural networks, neuro modeling,neural network paradigms.

III. COURSE OUTCOMES:

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

CO 1	Recognize the importance of knowledge representation and processing in intelligent system
CO 2	Describe the characteristics and constitutes of soft computing for decisionmaking systems.
CO 3	Demonstrate the models of artificial neural systems for classificationproblems.
CO 4	Apply the learning rules and its working principle for computer vision and image processing applications.
CO 5	Compare the importance of auto and hetero associative memories for distinct cases of neural network systems.
CO6	Construct the Genetic algorithm and search space, general genetic algorithms

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO NEURAL NETWORKS (10)

Introduction: Fundamental concept, the evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, backpropagation network, radial basis function network.

MODULE-II: ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS (09)

Associative memory networks: Training algorithms for pattern association, auto-associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto-associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

MODULE-III: FUZZY LOGIC (10)
Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, and non-iterative fuzzy sets.

Membership functions: Fuzzification, methods of membership value assignments, defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

MODULE-IV: FUZZY ARITHMETIC (10)
Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.

MODULE-V: GENETIC ALGORITHMS (09)
Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of traveling salesman problem using genetic algorithm approach, and genetic algorithm-based internet search technique, soft computing-based hybrid fuzzy controllers.

V. TEXT BOOKS:
1. J.S.R.Jang,C.T.Sun,E.Mizutani, "Neuro,Fuzzy and Soft Computing", Pearson Education, 1st edition, 2004.
2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2nd edition, 2007.

VI. REFERENCE BOOKS:
1. S.Rajasekaran, G.A.V.Pai,"Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI, 1st edition, 2003.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd edition, 1997.
3. StamatiosV.Kartalopoulos"Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

VII. WEB REFERENCES:
1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft_computing.html

VIII E-Text Books:
1. https://www.books.google.co.in/books?id=bVbj9nhvHd4C
2. https://www.books.google.co.in/books?id=GrZHPgAACAAJ&dq=1.+J.S.R.Jang,+C.T.Sun+and+E. Mizut ani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.

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COURSE CONTENT

ADVANCED DATA STRUCTURES LABORATORY							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD11	**Core**	0	0	4	2	40	60	100

Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**	**Total Classes:45**

I. COURSE OVERVIEW:

The course covers the selection and application of advanced data structures as tools for algorithm design to solve problems. The topics include binary trees, binary search trees, and graph traversals. The course enables the students to select and apply data structures that are appropriate for problems in problem-solving in engineering areas.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The linear and nonlinear data structures and their implementations.
II. Algorithms analysis based on their time and space complexity.
III. Appropriate data structure and algorithm design method for a specific application.
IV. The graph traversals algorithms to solve real-world challenges such as finding the shortest paths onhuge maps and assembling genomes from millions of pieces**.**

III. COURSE OUTCOMES:
After successful completion of the course, students will be able to:
CO1 Apply the divide and conquer technique using data structures and ADT/libraries to solve the problems

CO2 Use stack operations for evaluating mathematical expressions and implement operations of queues

CO3 Demonstrate collision resolution techniques with hashing technique

CO4 Implement operations on sets for graph applications

CO5 Use graph traversal algorithms to search vertex in modeling data for graph applications.

CO6 Apply tree algorithms to solve real life problems

IV. COURSE CONTENT:
Week 1: DIVIDE AND CONQUER – 1
a. Implement Quick Sort on 1D array of Student structure (contains student name, student_roll_no, total_marks), with key as student_roll_no and count the number ofswap performed.

b. Implement Merge Sort on 1D array of Student structure (contains student_name, student_roll_no, total_marks), with key as student_roll_no and count the number of   swap performed

Week 2: DIVIDE AND CONQUER – 2

a. Design and analyze a divide and conquer algorithm for following maximum sub-array sum problem: given an array of integers find a sub-array [a contagious portion of the array] which gives the maximum sum.

b. Design a binary search on 1D array of Employee structure (contains employee_name, emp_no, emp_salary), with key as emp_no and count the number of comparisons happened.

Week 3: IMPLEMENTATION OF STACK AND QUEUE

a. Implement 3 stacks of size 'm' in an array of size 'n' with all the basic operations such as Is Empty(i), Push(i), Pop(i), Is Full(i) where 'i' denotes the stack number (1,2,3), Stacks are not overlapping each other.

b. Design and implement Queue and its operations using Arrays.

Week 4: HASHING TECHNIQUES

Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques

    a. Linear probing
    b. Quadratic probing
    c. Random probing
    d. Double hashing/rehashing

Week 5: APPLICATIONS OF STACK

Write C programs for the following:
a. Uses Stack operations to convert infix expression into postfix expression.
b. Uses Stack operations for evaluating the postfix expression.

Week 6: BINARY SEARCH TREE

Write a program for Binary Search Tree to implement the following operations:

    a. Insertion
    b. Deletion
        i. Delete node with only child
        ii. Delete node with both children
    c. Finding an element
    d. Finding Min element
    e. Finding Max element
    f. The left child of the given node
    g. Right child of the given node
    h. Finding the number of nodes, leaves nodes, full nodes, ancestors, and descendants.

Week 7: DISJOINT SET OPERATIONS

a. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with a simple implementation of Union operation.

b. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V, E) using the linked list representation with a weighted-union heuristic approach.

Week 8: GRAPH TRAVERSAL TECHNIQUES
a. Print all the nodes reachable from a given starting node in a digraph using the Breadth First Search (BFS) method.
b. Check whether a given graph is connected or not using the Depth First Search(DFS) method.
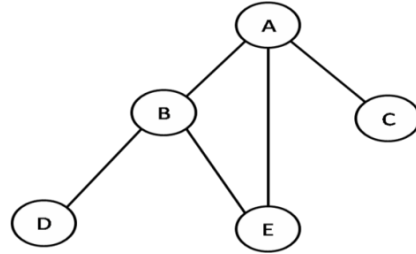
Week-9: SHORTEST PATHS ALGORITHM
From a given vertex in a weighted connected graph, find shortest paths to other vertices usingDijkstra's algorithm.
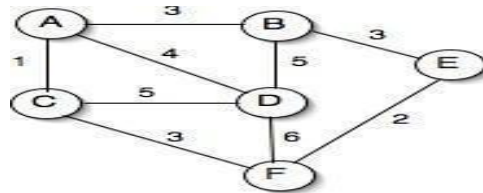
Week 10: MINIMUM COST SPANNING TREE
Find the Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.

Week 11: TREE TRAVESRSALS
Perform various tree traversal algorithms for a given tree.

Week 12: ALL PAIRS SHORTEST PATHS
Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.

Week 13: Huffman coding and decoding
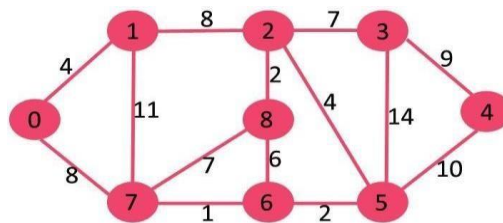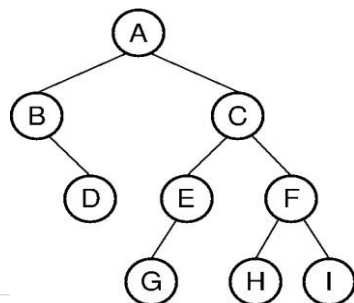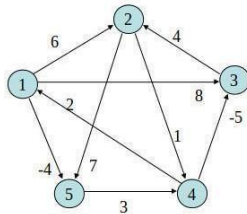Design and implement Huffman coding and decoding. Implement an algorithm to generate the Huffman codes for a given set of characters and their frequencies. The input includes the frequencies of characters in the data stream. The output should be a set of binary codes assigned to each character

Week 14: Knuth-Morris-Pratt (KMP) algorithm
Design and implement the Knuth-Morris-Pratt (KMP) algorithm for string matching. Implement the pre-processing phase of the KMP algorithm, where a partial match table is constructed for a given pattern.

V. REFERENCE BOOKS:
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India. 4th edition, 2014.
2. Reema Thareja, S. Rama Sree, Advanced Data Structures, Oxford University Press, 2018
3. G.A.V.Pai, "Data Structures and Algorithms", Tata McGraw Hill, NewDelhi,1st edition,2008
4. Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd edition, 2014.
5. Ellis Horowitz, Sartaj Sahni, Sagathevan Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press Private Limited, India, 2nd edition, 2008.
6. Adam Drozdek, "Data Structures and Algorithms in C++", Thomson Course Technology, 3rd edition, 2005

VI. WEB REFERENCES:
1. http://www.tutorialspoint.com/data_structures_algorithms
2. http://www.geeksforgeeks.org/data-structures/
3. http://www.studytonight.com/data-structures/
4. http://www.coursera.org/specializations/data-structures-algorithms

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<div align="center">

COURSE CONTENT

</div>

DATA SCIENCE LABORATORY							
I Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD12	**Core**	0	0	4	2	40	60	100

Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: 45**	**Total Classes: 45**

I. COURSE OVERVIEW:

The course covers the basics of data analytics and R programming. Data analysis with statistical programming, analysis, and visualization of processed data is implemented using R programming. It includes the basics of mathematics, probability and statistical methods, and data communication. It also teaches students how to interpret large datasets and identify patterns to create predictive models.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The concept of R objects.
II.   Make use of different types of datasets for analysis using R.
III. Relations among variables using statistical analysis.
IV.   The different data models for predictions using R

III. COURSE OUTCOMES:

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

CO1   Make Use of the container Data types for display the functional values.

CO2   Demonstrate the reading and writing operations from the web, and disk.

CO3   Illustrate the nature and relationships of data with effective visualizations for exploring the data.

CO4   Analyze the linear data models in data exploration.

CO5   Develop the classification and clustering models to label the data

IV. COURSE CONTENT:
Week 1: R AS CALCULATOR APPLICATION

a. Using with and without R objects on console
b. Using mathematical functions on console
c. Write an R script, to create R objects for the calculator application and save them in a specified location in the disk

Week 2: DESCRIPTIVE STATISTICS IN R

a. Write an R script to find basic descriptive statistics using summary, str, and quartile functions on mtcars and cars data sets.

b. Write an R script to find a subset of the dataset by using subset (), and aggregate () functions on the iris dataset.

Week 3: READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading different types of data sets (.txt, .csv) from the web and disk and writing in files in specific disk locations.

b. Reading Excel data sheet in R.
    Reading XML dataset in R.

Week 4: VISUALIZATIONS

a. Find the data distributions using box and scatter plot.
b. Find the outliers using plot.
c. Plot the histogram, bar chart and pie chart on sample data.

Week 5: CORRELATION AND COVARIANCE

a. Find the correlation matrix.
b. Plot the correlation plot on the dataset and visualize giving an overview of relationships among data on iris data.
c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Week 6: REGRESSION MODEL

Import data from web storage. Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained, and rank of the student. Also check whether the model is fit or not.
require (foreign), require(MASS).

Week 7: MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on the above dataset.

Week 8: REGRESSION MODEL FOR PREDICTION

Apply regression Model techniques to predict the data on the above dataset.

Week 9: IMPLEMENT SVM CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose a classifier for the classification problem.
c. Evaluate the performance of the classifier.

Week 10: IMPLEMENT NAÏVE BAYES CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose a classifier for the classification problem.
c. Evaluate the performance of the classifier.

Week 11: IMPLEMENT DECISION TREE CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose a classifier for the classification problem.
c. Evaluate the performance of the classifier.

Week 12: IMPLEMENT ENSEMBLE CLASSIFICATION MODEL

a. Install relevant package for classification.
b. Choose a classifier for the classification problem.
c. Evaluate the performance of the classifier.

Week 13: IMPLEMENT K-MEANS CLUSTERING MODEL

a. Clustering algorithms for unsupervised classification.
b. Plot the cluster data using R visualizations.

Week 14: IMPLEMENT DBSCAN CLUSTERING MODEL
   a. Clustering algorithms for unsupervised classification.
   b. Plot the cluster data using R visualizations

V. REFERENCE BOOKS:

1. Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st edition, 2012.

VI. Web References:

1. http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/
2. http://www.ats.ucla.edu/stat/r/dae/rreg.htm
3. http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html
4. http://www.ats.ucla.edu/stat/r/data/binary.csv

COURSE CONTENT

RESEARCH METHODOLOGY AND IPR							

I Semester: AE, CSE, ES, EPS, CAD/CAM & STE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSD01	**Core**	L	T	P	C	CIA	SEE	Total
		2	0	0	2	40	60	100

Contact Classes: 48	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 48
Prerequisite: NIL			

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The Knowledge on formulate the research problem, characteristics of a good research and interpretation of collected data.
II. The importance of research ethics while preparing literature survey and writing thesis to achieve plagiarism free report.
III. The intellectual property rights such as patent, trademark, geographical indications and copyright for the protection of their invention done.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1   Interpret the technique of determining a research problem for a crucial part of the research study.

CO 2   Examine the way of methods for avoiding plagiarism in research.

CO 3   Apply the feasibility and practicality of research methodology for a proposed project.

CO 4   Make use of the legal procedure and document for claiming patent of invention.

CO 5   Identify different types of intellectual properties, the right of ownership and scope of protection to create and extract value from IP.

CO 6   Defend the intellectual property rights throughout the world with the involvement of world intellectual property organization

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches

of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

MODULE-II: RESEARCH ETHICS (09)
Effective literature studies approaches, analysis Plagiarism and Research ethics.

MODULE-III: RESEARCHPROPOSAL (09)
Effective technical writing, how to write report, Paper Developing a Research Proposal.

Format of research proposal, presentation and assessment.

MODULE-IV: PATENTING (10)
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE-V: PATENT RIGHTS (10)
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

V. TEXT BOOKS:

1. Panneerselvam, Ramasamy. Research methodology. PHI Learning Pvt. Ltd., 2014.
2. Goddard, Wayne, and Stuart Melville. Research methodology: An introduction. Juta and Company Ltd, 2004.
3. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for beginners". 2nd edition, 2007

VI. REFERENCE BOOKS:
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed books, 2000.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962

VII. ELECTRONICS RESOURCES:
1. https://wac.colostate.edu/docs/books/try/chapter1.pdf
2. https://www.scribbr.com/dissertation/methodology/
3. http://nptel.ac.in/courses/107108011/

VIII. MATERIALS ONLINE:
1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation

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COURSE CONTENT

ENGLISH FOR RESEARCH PAPER WRITING							
I Semester: AE, CSE, ES, EPS, CAD/CAM & STE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD02	**Audit**	-	-	-	-	-	-	-

Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: Nil**
Prerequisite: NIL			

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE OBJECTIVES:
The students will try to learn:
I. How to improve the writing skills and level of readability.
II. The methodology that what to write in each section the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1   Interpret the technique of determining a research problem for a crucial part of the research study

CO 2   Examine the way of methods for avoiding plagiarism in research

CO 3   Apply the feasibility and practicality of research methodology for a proposed project.

CO 4   Make use of the legal procedure and document for claiming patent of invention.

CO 5   Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP

IV. SYLLABUS:
MODULE – I: PLANNING AND PREPARATION
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

MODULE – II: ABSTRACT
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and Introduction.

MODULE – III: DISCUSSION AND CONCLUSIONS
Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are

needed when writing an Introduction, skills needed when writing a Review of the Literature.

MODULE – IV: DISCUSSION AND CONCLUSIONS
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

MODULE – V: QUALITY AND TIME MAINTENANCE
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

V. TEXT BOOKS:
1. Goldbort R, "Writing for Science", Yale University Press. 2011.
2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

VI. REFERENCE BOOKS:
1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's Book.

VII. WEB REFERENCES:
1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf

VIII. E-TEXT BOOKS:
1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

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COURSE CONTENT

DISASTER MANAGEMENT								
I Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD03	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE OBJECTIVES:

The students will try to learn:

I.   How to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. How critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. The understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. The strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1   Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.
CO 2   Understand how to react effectively to natural, manmade, and planetary hazards
CO 3   Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.
CO 4   Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery
CO 5   Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities

IV. SYLLABUS

MODULE – I: INTRODUCTION

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

MODULE – II: REPERCUSSIONS OF DISASTERS AND HAZARDS

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

MODULE – III: DISASTER PRONE AREAS IN INDIA

Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.

MODULE – IV: DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

MODULE – IV: RISK ASSESSMENT & DISASTER MITIGATION

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

V. TEXT BOOKS:
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.

VI. REFERENCE BOOKS:
1. Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
2. Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

VII. WEB REFERENCE:
1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf

VIII. E-TEXT BOOKS:
1. Disaster management by Vinod k. Sharma

COURSE CONTENT

SANSKRIT FOR TECHNICAL KNOWLEDGE							
I Semester: AE, CSE, ES, EPS, CAD/CAM & STE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	T	P	C	CIA	SEE	Total
BHSD04	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:
In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE OBJECTIVES:
The students will try to learn:
I.   A working knowledge in illustrious Sanskrit, the scientific language in the world.
II.   The Sanskrit to improve brain functioning.
III.   The Sanskrit language to develop the logic in mathematics, science & other subjects enhancing the memory power.
IV.   The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

III. COURSE OUTCOMES:
   After successful completion of the course, students should be able to

CO 1   Understand the basic Sanskrit grammar

CO 2   Formulate simple sentences

CO 3   Apply order and roots

CO 4   Understand Ancient Sanskrit literature about science & technology

CO 5   Develop logical thinking being a logical language in technical concepts

IV. SYLLUBUS:
MODULE – I: INTRODUCTION
Alphabets in Sanskrit, Past/Present/Future Tense.

MODULE – II: SENTENCES
Simple Sentences

MODULE – III: ROOTS
Order, Introduction of roots

MODULE – IV: SANSKRIT LITERATURE
Technical information about Sanskrit Literature

MODULE – V: TECHNICAL CONCEPTS
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

V. TEXT BOOKS:
1. Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi.

VI. REFERENCE BOOKS:
1. Dr.Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, New Delhi.

VII. WEB REFERENCES:
1. http://learnsanskritonline.com/

VIII. E-TEXT BOOKS:
1. Prathama Deeksha-Vempati Kutumb Shastri, "Teach Yourself Sanskrit", Rashtriya Sanskri Sansthanam, New Delhi Publication.

COURSE CONTENT

VALUE EDUCATION								
III Semester: AE, CSE, ES, EPS, CAD/CAM & STE								

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BHSD05	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:
In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE OBJECTIVES:
The students will try to learn:
  I.   The value of education and self- development.
  II. Imbibe good values in students.
  III. The importance of character.

III. COURSE OUTCOMES:
  After successful completion of the course, students should be able to:

CO 1   Understand the significance of ethical human conduct and self-development

CO 2   Adopt value-based living and holistic technologies to save nature

CO 3   Inculcate positive thinking, dignity of labor and religious tolerance

CO 4   Develop the overall Character and Competence through self-management

CO 5   Practice Self-control. Honesty through Studying effectively all religious messages

IV. SYLLABUS:
MODULE – I: VALUES AND SELF-DEVELOPMENT
Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

MODULE – II: CULTIVATION OF VALUES
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

MODULE – III: PERSONALITY AND BEHAVIOR DEVELOPMENT
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth.

Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

MODULE – IV: CHARACTER AND COMPETENCE
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

MODULE – V: SELF CONTROL
All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

V. TEXT BOOKS:
1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

VI. WEB REFERENCES:
1. http://www.best-personal-development-books.com/personal-value-development.html
2. http://nptel.ac.in/courses/109104068/

VII. E-TEXT BOOKS:
1. R.P. Shukla, "Value education and human rights".

INSTITUTE OF AERONAUTICAL ENGINEERING
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Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

CONSTITUTION OF INDIA							
II Semester: AE, CSE, ES, EPS, CAD/CAM & STE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BHSD06	**Audit**	-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:
The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE OBJECTIVES:
The students will try to learn:
I.   The premises informing the twin themes of liberty and freedom from a civil right perspective.
II. The growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. The role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.
CO 2	Understand the Constitutional Rights and and duties
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary
CO 4	Analyse the decentralization of power between central, state and local self-government.
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

IV. SYLLABUS:
MODULE – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

MODULE – II: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

MODULE – III: ORGANS OF GOVERNANCE

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

MODULE – IV: LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zilla Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

MODULE – V: ELECTION COMMISSION

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

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

VI. REFERENCE BOOKS:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

VII. WEB REFERENCES:
1. http://www.constitution.org/cons/india/p18.html

VIII. E-TEXT BOOKS:
1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

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COURSE CONTENT

PEDAGOGY STUDIES								
II Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD07	**Audit**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II. COUSE OBJECTIVES:
The students will try to learn:

I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. The critical evidence gaps to guide the development.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1   Identify the Methodology and conceptual framework of teachers education.
CO 2   Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
CO 3   Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners.
CO 4   Classify the importance of class room practice, curriculum and learning in Professional Development.
CO 5   Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

IV. SYLLABUS:
MODULE – I: INTRODUCTION (04)

Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and searching.

MODULE – II: THEMATIC OVERVIEW

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

MODULE – III: PEDAGOGICAL PRACTICES

Evidence on the effectiveness of pedagogical practices. Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

MODULE – IV: PROFESSIONAL DEVELOPMENT

Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

MODULE – V: RESEARCH GAPS

Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.

V. TEXT BOOKS:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

VI. REFERENCE BOOKS:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and
   Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

VII. WEB REFERENCE:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

VIII. E-TEXT BOOKS:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE CONTENT

STRESS MANAGEMENT BY YOGA								
II Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD08	Audit	L	T	P	C	CIA	SEE	Total
		-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:
In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:
The students will try to learn:
I.   How to achieve overall health of body and mind.
II. How to overcome stress.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1   Understand Ashtanga yog and its importance

CO 2   Identify the Dos and Do nots of Life by practicing the Yam and Niyam

CO 3   Interpret the Shaucha and its components

CO 4   Make use of breathing techniques and Asan and Pranayam

CO 5   Develop healthy mind in a healthy body thus improving social health also

IV. SYLLABUS:
MODULE – I: INTRODUCTION
Definitions of Eight parts of yog. (Ashtanga)

MODULE – II: YAM AND NIYAM
Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha.

MODULE – III: SHAUCHA
 Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE – IV: ASAN AND PRANAYAM
Asan and Pranayam. Various yog poses and their benefits for mind & body

MODULE – V: BREATHING TECHNIQUES
Regularization of breathing techniques and its effects-Types of pranayam

V.TEXT BOOKS:
1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

VI.REFERENCE BOOKS:
1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur.

VII. WEB REFERENCES:
1. https://americanyoga.school/course/anatomy-for-asana/
2. https://www.yogaasanasonline.com/

VIII. E-TEXT BOOKS:
1. Todd A. Hoover, M. D. D., Ht, "Stress Management by Yoga".

COURSE CONTENT

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS								
II Semester: AE, CSE, ES, EPS, CAD/CAM & STE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BHSD09	Audit	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	-	-	-	-
Contact Classes: Nil	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: Nil**		
Prerequisite: NIL								

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:
The students will try to learn:
I.   How to achieve the highest goal happily.
II.   How a person become with stable mind, pleasing personality and determination.
III. Awaken wisdom in students.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1 Summarize steps to develop personality with stable mind, pleasing manners and determination.

CO 2 Identify day to day work and duties for developing peace and prosperity as depicted in Geeta.

CO 3 Formulate the daily life style by depicting the verses from Bhagavatgeetha.

CO 4 Outline the verses of Shrimad Bhagavad Geetha for holistic development.

CO 5 Demonstrates personality development by verses of Bhagavatgeetha.

IV. SYLLUBUS:
MODULE – I: HOLISTIC DEVELOPMENT
Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

MODULE – II: BHAGWAD GEETA
Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3- Verses 13, 21, 27, 35.

MODULE – III: BHAGWAD GEETA
Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

MODULE – IV: BASIC KNOWLEDGE
Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 - Verses 13, 14, 15, 16,17, 18

MODULE – V: ROLE MODEL
Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63

V. TEXT BOOKS:
1. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

VI. REFERENCE BOOKS:
1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata.

VII. WEB REFERENCES:
1. http://openlearningworld.com/section_personality_development.html

VIII. E-TEXT BOOKS:
1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf

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COURSE CONTENT

ADVANCED ALGORITHMS							

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSD13	Core	3	0	0	3	40	60	100

Contact Classes: 48	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 48

Prerequisites: Advanced Data Structures

I. COURSE OVERVIEW:

This course typically aims to equip students with a deep understanding of fundamental algorithmic techniques, their analysis, and their applications in solving complex computational problems. This course includes graph theory, flow networks, and linear programming. Gain an understanding of a wide range of advanced algorithmic problems, and their application to real-world problems.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The advanced methods of designing and analyzing algorithms.
II.   The student should be able to choose appropriate algorithms and use it for a specific problem.
III. Students should be able to understand different classes of problems concerning their computation difficulties.

III. COURSE OUTCOMES:

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

CO1   Analyze algorithm efficiency, including time complexity, and space complexity for problem solving techniques

CO2   Determine the appropriate data structure for solving a particular set of problems

CO3   Develop algorithms using advanced techniques such as graph algorithms, and flow algorithms

CO4   Apply substitution, recurrence-tree methods to solve recurrences

CO5   Gain an understanding of a wide range of advanced algorithmics, and their application to real-world problems

CO6   Explore the complexity theory, and the concept of NP-completeness, and be able to identify and classify problems within different complexity classes

IV. COURSE CONTENT:

MODULE-I: Role of algorithms in computing (10)

Role of algorithms in computing, Analyzing algorithms, Designing Algorithms,
Growth of Functions, Divide and Conquer- The maximum-subarray problem, Strassen's algorithms for matrix multiplication, The substitution method for solving recurrences, The recurrence-tree method for solving recurrence, The master method for solving recursions, Probabilistic analysis, and random analysis

MODULE-II: Review of Data Structures (10)

Review of Data Structures- Elementary Data Structures, Hash Tables, Binary Search Trees, and Red-Black Trees.

MODULE-III: Elements of dynamic programming (09)

Elements of dynamic programming, - Matrix-chain multiplication, Longest common subsequence,

Greedy Algorithms - Elements of the greedy strategy, Huffman codes, Amortized Analysis - Aggregate analysis, The accounting method, The potential method, Dynamic tables.

MODULE-IV: Flow – Networks (10)
Flow-Networks: Maxflow-min-cut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

MODULE-V: Shortest Path in Graphs (09)
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.
Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP-completeness: Examples, proof of NP-hardness and NP-completeness.

VI. TEXTBOOKS
1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms". The MIT Press, 4th edition, 2022.
2. Aho, Hopcroft, Ullman "The Design and Analysis of Computer Algorithms", Pearson Education, 7th edition, 2018.

VI. REFERENCE BOOKS:
1. Kleinberg and Tardos "Algorithm Design", Pearson Education, 2nd edition, 2016.

VII. WEB REFERENCES:
1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

VIII. E-TEXTBOOKS:
1. https://mitpress.mit.edu/9780262530910/
2. https://edutechlearners.com/download/Introduction_to_algorithms-3rd%20Edition.pdf
3. https://books.google.co.in/books/about/Introduction_To_Algorithms.html?id=NLngYyWFl_YC&redir_esc=y

COURSE CONTENT

ADVANCED COMPUTER ARCHITECTURE							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD14	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**			**Total Classes: 48**			
Prerequisite: Computer Organization and Architecture								

1. COURSE OVERVIEW:

This course is designed to provide students with in-depth knowledge of the design principles, organization, and performance evaluation of modern computer systems. It covers the concepts related to modern processor architectures, including pipelining, superscalar processors, out-of-order execution, speculation, and advanced instruction-level parallelism. Equip students for roles in computer engineering, hardware design, system optimization, research, and development in the ever-evolving field of computer systems and architecture.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concepts and principles of parallel and advanced computer architectures.
II. The design techniques of Scalable and multithreaded architectures.
III. The concepts and techniques of parallel and advanced computer architectures to design modern computer systems.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to

CO1	Categorize Parallel computer models, and program flow mechanisms to implement parallelism.
CO2	Summarize the challenges of realizing different kinds of parallelism and leverage them for performance advancement
CO 3	Apply the concept of memory hierarchy for efficient memory design and virtual memory to overcome the memory wall
CO 4	Explore the working of pipelining, and instruction-level parallelism using static, dynamic, and advanced techniques of scheduling
CO 5	Classify multiprocessors, and thread-level parallelism using shared, distributed, and directory-based memory models.
CO 6	Outline the principles and characteristics of vector processors, vector pipelines, SIMD execution, and vector instructions.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and multicomputers, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

MODULE-II: PRINCIPLES OF SCALABLE PERFORMANCE (09)

Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and

Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors.

MODULE-III: SHARED MEMORY ORGANIZATIONS (09)
Shared-memory organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

MODULE-IV: PARALLEL AND SCALABLE ARCHITECTURES (09)
Parallel and Scalable Architectures, Multiprocessors and multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputer, Message-passing Mechanisms, Multivector and SIMD computers.

MODULE-V: VECTOR PROCESSING PRINCIPLES (09)
Vector Processing Principles, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

V. TEXTBOOKS:
1. Kai Hwang "Advanced Computer Architecture" Third Edition, Tata McGraw-Hill, 2016,

VI. REFERENCE BOOKS:
1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor & Francis.
3. Introduction to High-Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ.Press.

VII. WEB REFERENCES:
1. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
2. https://www.academia.edu/7318769/Computer_Architecture_Recommended_Reference_Books
3. https://www.researchgate.net/publication/329076555_Advanced_Computer_Architectures

VIII. E-TEXTBOOKS:
1. https://onlinecourses.nptel.ac.in/noc21_cs47/preview
2. https://abit.edu.in/wp-content/uploads/2022/07/advanced-computer-architecture.pdf
3. https://www.academia.edu/7318769/Computer_Architecture_Recommended_Reference_Books

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COURSE CONTENT

CYBER SECURITY							

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSD15	Elective	3	0	0	3	40	60	100

Contact Classes: 48	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 48

Prerequisite: Computer Networks

I. COURSE OVERVIEW:

This course focuses on effectively applying analytical and critical thinking to plan and execute security measures to shield an organization's computer systems, networks, and network devices from infiltration and cyber-attacks. Cyber Security course covers topics such as an overview of cybercrimes, computer security, cryptography algorithms, internet hacking and cracking, web hacking, cybercrime investigation, digital forensics and certificates, securing databases, laws, and acts. Provide career opportunities as Cyber Security Analyst, Cyber Security Practitioner, Cyber Defense Analyst, and Information Security Engineer in leading IT and Governmental Organizations.

II. COURSE OBJECTIVES:
The students will try to learn:
    I.   Preventing, monitoring, and responding to data breaches and cyber-attacks.
    II.   The core information of assurance principles.
    III.   The key components of cyber security network architecture.
    IV.   The cyber security architecture principles

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to

CO1	Outline web security concepts to overcome cyber crimes
CO2	Make use of cryptography techniques for protecting systems from unauthorized access and information protection
CO 3	Demonstrate cybercrime investigation tools for detecting and recovering the loss in the web domain.
CO 4	Summarize digital security procedures and policies to manage organizational security risks.
CO 5	Outline cyber laws and Acts to offer legal electric communication

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)
A web security forensic lesson, web languages, introduction to different web attacks, overview of n-tier web applications.
Web servers: Apache, IIS, database servers, introduction and overview of cybercrime, nature and scope of cybercrime, types of cybercrime: social engineering, categories of cybercrime, property cybercrime.

MODULE-II: REVIEW OF COMPUTER SECURITY AND CYBERCRIME ISSUES (09)
Public key cryptography, RSA, online shopping, payment gateways, unauthorized access to computers, computer intrusions, white collar crimes, viruses, malicious code, internet hacking and cracking, virus attacks, pornography, software piracy, intellectual property, mail bombs, exploitation, stalking and obscenity in the internet, digital laws and legislation, law enforcement roles and responses.

MODULE-III: WEB HACKING BASICS AND INVESTIGATION (10)
Web hacking basics HTTP and HTTPS URL, web under the cover overview of java security reading the HTML source, applet security, servlets security, symmetric and asymmetric encryptions, network security basics, firewalls, and IDS.

Investigation: Introduction to cybercrime investigation, investigation tools, e-discovery, digital evidence collection, evidence preservation, e-mail investigation, e-mail tracking, IP tracking, e-mail recovery, hands-on case studies; Encryption and Decryption methods, search and seizure of computers, recovering deleted evidence, password cracking.

MODULE-IV: DIGITAL CERTIFICATES AND DIGITAL FORENSICS (10)
Digital certificates, hashing, message digest, and digital signatures. Digital forensics: Introduction to digital forensics, forensic software and hardware, analysis and advanced tools, forensic technology and practices, forensic ballistics and photography, face, iris, and fingerprint recognition, audio video analysis, windows system forensics, Linux system forensics, network forensics.

MODULE-V: SECURING DATABASES, LAWS AND ACTS (09)
Basics, secure JDBC, securing large applications, cyber graffiti; Laws and acts: Laws and ethics, digital evidence controls, evidence handling procedures, basics of Indian Evidence Act IPC and CrPC, electronic communication privacy act, legal policies.
.

V TEXTBOOKS:
1. Mc Clure, Stuart, Saumil Shah, Shreeraj Shah, "Web Hacking: Attacks and Defense", Addison-Wesley Professional, Illustrated Edition, 2003.
2. Garms, Jess, Daniel Somerfield, "Professional Java Security", Word Press, Illustrated Edition, 2001.

VII. REFERENCE BOOKS:
1. Nelson Phillips, Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi,2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", Tata McGraw Hill,2009.
3. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 1st Edition,2005.

VIII.WEB REFERENCES:
1. http://www.mail.nih.gov/user/faq/tlsssl.htm
2. http://www.openssl.org/
3. http://www.ntsecurity.net/

IX.E-TEXT BOOKS:
1. https://www.mitre.org/sites/.../pr-13-1028-mitre-10-strategies-cyber-ops-center.pdf
2. https://www.coursera.org/specializations/cyber-security
3. https://www.ccdcoe.org/publications/books/NationalCyberSecurityFrameworkManual.pdf

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COURSE CONTENT

DEEP LEARNING									
II Semester: CSE									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
BCSD16	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		3	-	-	3	40	60	100	
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**			
Prerequisite: Artificial Neural Networks									

I. COURSE OVERVIEW:

This course is designed to introduce students to the theoretical foundations, algorithms, and practical applications of deep learning techniques. Students will explore various neural network architectures, learn to build, and train models using popular frameworks, and apply these techniques to solve real-world problems in diverse domains.

II. COURSE OBJECTIVES:

The students will try to learn:
   I.   The principles of artificial neural networks and deep learning.
   II. The deep learning techniques to tasks including computer vision, natural language processing

III. COURSE OUTCOMES:

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

CO1	Summarize the basic principles of feedforward, recurrent, and convolutional neural network architectures
CO2	Comprehend the principles of Learning, training, testing, and validation of Deep Learning models
CO3	Apply deep learning techniques in domains such as computer vision, natural language processing
CO4	Outline domain-specific challenges and how deep learning can be adapted to solve them
CO5	Analyze the data using multilayer perceptron and backpropagation algorithms
CO6	Develop a model for domain-specific applications by applying various network models in deep learning.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)
Introduction: Historical Trends in Deep Learning - Learning algorithms: Supervised and Unsupervised Training - Linear Algebra for Machine Learning - Testing - Cross Validation - Dimensionality Reduction - Overfitting/Under Fitting - Hyperparameters and validation sets - Estimators – Bias – Variance - Loss Function- Regularization

MODULE-II: ARCHITECTURE (10)
Architecture: Biological Neuron – Idea of Computational units - Linear Perceptron - Perceptron Learning Algorithm - Convergence theorem for Perceptron Learning Algorithm - Linear Separability - Multilayer perceptron – Backpropagation.

MODULE-III: MODERN PRACTICES IN DEEP NETWORKS (09)
MODERN PRACTICES IN DEEP NETWORKS: Simple DNN - Platform for Deep Learning - Deep Learning Software Libraries - Deep Feedforward networks – Gradient-Based Learning - Architecture Design,

Various Activation Functions, ReLU, Sigmoid – Error Functions - Regularization methods. for Deep Learning - Early Stopping - Drop Out - Optimization methods for Neural Networks-Adagrad, Adam.

MODULE-IV: CONVOLUTIONAL NEURAL NETWORKS (CNNS) (09)
Convolutional Neural Networks (CNNs): CNN Fundamentals – Architectures – Pooling – Visualization – Sequence Modeling: Recurrent Neural Networks (RNN) - Long-Short Term Memory (LSTM) – Bidirectional LSTMs-Bidirectional RNNs -Deep Unsupervised Learning: Autoencoders – Auto Encoder Applications -Deep Boltzmann Machine (DBM).

MODULE-V: APPLICATIONS OF DEEP LEARNING TO COMPUTER VISION (09)
Applications of Deep Learning to Computer Vision: Image segmentation, object detection,
automatic image captioning, Image generation with Generative adversarial networks, video-to-text with LSTM models.
Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove,

V. TEXT BOOKS:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 4th edition, MIT Press,2016.

VI. REFERENCE BOOKS:
1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Michael A. Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013 Satish Kumar,

VII. WEB REFERENCES:
1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft_computing.html

VIII E-Text Books:
1. https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/DeepLearning-NowPublishing-Vol7-SIG-039.pdf
2. https://cours.etsmtl.ca/sys843/REFS/Books/ebook_Haykin09.pdf
3. https://www.programmer-books.com/applied-deep-learning/

COURSE CONTENT

COMPUTER VISION								
II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD17	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes:45	**Total Tutorials:Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Computer Organization and Architecture								

I. COURSE OVERVIEW:

This course introduces the principles, algorithms, and applications of computer vision. Students will learn how to extract meaningful information from images and videos, understand various computer vision tasks, and apply techniques to solve real-world problems.

II. COURSE OBJECTIVES:

The students will try to learn:
I. Both the theoretical and practical aspects of computing with images.
II. The foundation of image formation, measurement, and analysis.
III. The geometric relationships between 2D images and the 3D world.
IV. The principles of state-of-the-art deep neural networks.

III. COURSE OUTCOMES:

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

CO 1   Analyze image filtering operations to enhance image quality
CO 2   Explore the methods of recognition of objects and scenes and categorization from images
CO 3   Apply threshold techniques, morphological processes, and region-growing methods for edge detection in images
CO 4   Develop clustering-based segmentation solutions for image synthesis
CO 5   Synthesize and evaluate classification procedures for texture and feature analysis.
CO6   Select and apply appropriate techniques for object recognition and detection in computer vision-based applications.

IV.   COURSE CONTENT:

MODULE-I: INTRODUCTION AND IMAGE ENHANCEMENT (10)

The nature of the vision, Low-level vision – Gray scale versus color, Image processing operations; Basic image filtering operations – Gaussian smoothing, Median filters, Mode Filters, Rank Order Filters, Sharp and Unsharp masking.

MODULE-II: THRESHOLDING AND EDGE DETECTION (09)

Region-growing methods, Thresholding, Adaptive thresholding, Threshold selection – Variance-based thresholding, Entropy-based thresholding, Maximum likelihood thresholding; Global valley approach to thresholding; Edge Detection – Template Matching Approach, 3×3 Template Operators, Canny Operator, Laplacian Operator; Dilation and erosion in binary images – Properties of dilation and erosion operators, Closing and opening. Edge detection performance, Hough transform, corner detection.

MODULE-III: SEGMENTATION BY CLUSTERING (10)
Grouping and gestalt, Important applications – Background subtraction, Shot boundary detection,
Interactive segmentation, Forming imaging regions; Image segmentation by clustering pixels,
Segmentation, clustering and graphs – Terminology and facts for graphs, Agglomerative clustering with a
graph, Divisive clustering with a graph, Normalized cuts.

MODULE-IV: FEATURE EXTRACTION (09)
Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature
vectors, distance /similarity measures, and data pre-processing.

MODULE-V: PATTERN ANALYSIS (10)
Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant
Function, Supervised, Un-supervised, Semi-supervised
Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-
parametric methods.

V. TEXTBOOKS:
1. David A. Forsyth, Jean Ponce, Computer Vision: A Modern Approach, Pearson, 2nd edition, 2012.
2. E. R. Davies, Computer and Machine Vision: Theory, Algorithms, Practicalities, Elsevier, 5th
   edition, 2017.

VI. REFERENCE BOOKS:
1. Richard Szeliski. "Computer Vision: Algorithms and Applications" 5nd edition, 2012.
2. Fisher, "Dictionary of Computer Vision and Image Processing, 4nd edition, 2015.

VII. WEB REFERENCES:
1. https://slideplayer.com/slide/5158896/
2. www.scs.carleton.ca/~c_shu/Courses/comp4900d/notes/PPT/lect1_intro.ppt

VIII. E-Text Books:
1. https://www.intechopen.com/books/3765
2. https://vdoc.pub/download/computer-vision-a-modern-approach-712q6l0ut2s0
3. https://www.e-booksdirectory.com/details.php?ebook=10885

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COURSE CONTENT

DIGITAL FORENSICS							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD18	**Elective**	3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Computer Networks, Information Security								

I. COURSE OVERVIEW:
Digital forensics course focuses on the investigation and analysis of digital devices, networks, and electronic data to uncover evidence for legal or investigative purposes. It involves the application of specialized techniques and tools to collect, preserve, analyze, and present evidence found in digital devices.

II. COURSE OBJECTIVES:
The students will try to learn:
I. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
II. combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
III. knowledge of digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, and e-discovery tools.

III. COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- CO 1   Apply ethical hacking in the Information Communication Technology (ICT) world.
- CO 2   Underline the need for digital forensics and the role of digital evidence
- CO 3   Understand incident response and security issues in the ICT world, and identify digital forensic tools for data collection.
- CO 4   Apply digital forensic duplication and tools for analysis to achieve adequate perspectives of digital forensic investigation.
- CO 5   Apply the knowledge of Intrusion Detection System to protect the network and perform router and network analysis
- CO6   List the techniques to generate legal evidence and supporting investigation reports

IV. COURSE CONTENT:
MODULE-I: INTRODUCTION OF CYBERCRIME (10)
Types of cybercrime, categories of cybercrime, Computers' roles in crimes, Prevention from Cybercrime, Hackers, Crackers, Phreakers.
Digital Forensic: Rules for Digital Forensic The Need for Digital Forensics, Types of Digital Forensics, Ethics in Digital Forensics.
Digital Evidence: Types and characteristics and challenges for Evidence Handling

MODULE-II: ETHICAL HACKING (10)
Difference between Hacking and Ethical hacking: Steps of Ethical Hacking, Exploring some tools for ethical hacking: scanning tools.
Introduction to Computer Security Incident: Goals of Incident response, Incident Response Methodology, Formulating Response Strategy.
IR Process – Initial Response, Investigation, Remediation, Tracking of Significant, Investigative Information.

MODULE-III: LIVE DATA COLLECTION (09)
Live Data Collection on Microsoft Windows Systems: Live Data Collection on Unix-Based Systems

Forensic Duplication: Forensic Image Formats, Traditional Duplication, Live System Duplication, Forensic Duplication tools.

MODULE-IV: FILE SYSTEMS (10)
Various Types of File Systems, Introduction to Storage Layers, Forensic Analysis of File Systems
Data Analysis: Analysis Methodology Investigating Windows systems, Investigating UNIX systems, Investigating Applications, Web Browsers, Email, Malware Handling: Static and Dynamic Analysis

MODULE-V: NETWORK FORENSICS (09)
Technical Exploits and Password Cracking, Introduction to Intrusion Detection systems, Types of IDS Understanding Network intrusion and attacks, Analyzing Network Traffic, Collecting Network evidence, Evidence Handling. Investigating Routers, Using Routers as Response Tools.
Report: Goals of Report, Layout of an Investigative Report, Guidelines for Writing a Report.

V. TEXT BOOKS:
1. Nilakshi Jain, Dhananjay Kalbande, "Digital Forensic: The fascinating world of Digital Evidence" Wiley India Pvt Ltd 2017.

VI.   REFERENCE BOOKS:
1. Jason Luttgens, Matthew Pepe, Kevin Mandia, "Incident Response and computer forensics", Tata McGraw Hill, 3rd edition 2014.
2. Cory Altheide, Harlan Carvey, "Digital forensics with open source tools", Syngress Publishing, Inc. 2011.
3. Clint P Garrison "Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data", Syngress Publishing, Inc. 2010.

VII. WEB REFERENCES:

1. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section---references

VIII E-Text Books:
1. https://www.oreilly.com/library/view/digital-forensics/9781119262381/
2. https://uou.ac.in/sites/default/files/slm/MIT(CS)-202.pdf
3. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/2a54509d-b6bb-43d8-8250-eae26782c392/FORC%20Book%201.pdf

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I A R E
EDUCATION FOR LIBERATION

COURSE CONTENT

GPU COMPUTING							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	Category	L	T	P	C	CIA	SEE	Total
BCSD19	**Elective**	3	-	-	3	40	60	100

Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 48**
Prerequisite: Computer Organization and Architecture			

I. COURSE OVERVIEW:

The GPU accelerates applications running on the CPU by offloading some of the compute-intensive and time-consuming portions of the code. This course includes memory hierarchy, consistency, and debugging GPU programs.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The concepts of parallel programming in problem solving.
II.   The Debugging and profiling of parallel programs.
III. The GPU synchronizations.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:
CO 1   Define terminology commonly used in parallel computing, such as efficiency and speedup.
CO 2   Explain common GPU architectures and programming models
CO 3   Identify efficient algorithms for common application kernels, such as matrix multiplication.
CO 4   Develop an efficient parallel algorithm to solve it.
CO 5   Identify an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (13)

History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL / Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.

MODULE-II: MEMORY (09)

Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

MODULE-III: SYNCHRONIZATION (09)

Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction.

Programs for concurrent Data Structures such as Work lists, Linked-lists.

Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

MODULE-IV: SUPPORT AND STREAMS (09)
Debugging GPU Programs. Profiling, Profile tools, Performance aspects Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

MODULE-V: CASE STUDIES (08)
Image Processing, Graph algorithms, Simulations, Deep Learning.

V. TEXTBOOKS:
1. David Kirk, Wen-meiHwu, Morgan Kaufman, "Programming Massively Parallel Processors: A Hands- on Approach", 2010 (ISBN:978-0123814722).
2. Shane Cook, Morgan Kaufman "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", 2012 (ISBN:978-0124159334).

VI.REFERENCE BOOKS:

1. Dr Brian Tuomanen, "Hands-On GPU Programming with Python and CUDA", Packt, 2014.

VII. WEB REFERENCES:
1. http://www.sctie.iitkgp.ernet.in/
2. http://www.rkala.in/softcomputingvideos.php
3. http://www.sharbani.org/home2/soft-computing-1
4. http://www.myreaders.info/html/soft_computing.html

VIII E-Text Books:
1. https://www.books.google.co.in/books?id=bVbj9nhvHd4C
2. https://www.books.google.co.in/books?id=GrZHPgAACAAJ&dq=1.+J.S.R.Jang,+C.T.Sun+and+E
3. Mizutani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.

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COURSE CONTENT

MINING MASSIVE DATASETS							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD20	**Elective**	3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Data Science, Data Mining								

I. COURSE OVERVIEW:

This course is based on text mining of massive data sets and their applications. Topics include map reduce and the new software stack, applications of similarity search, implementation of stream data, link analysis, handling large data sets, clustering, issues in online advertising, recommendation systems and mining social network graphs.

II. COURSE OBJECTIVES:

The students will try to learn:
 I.   This course will cover practical algorithms for solving key problems in mining of massive datasets.
 II. This course focuses on parallel algorithmic techniques that are used for large datasets.
 III. This course will cover stream processing algorithms for data streams that arrive constantly, page ranking algorithms for web search, and online advertisement systems that are studied in detail.

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:
 CO 1   Apply MapReduce for massive data analysis
 CO 2   Develop and implement algorithms for massive data sets and methodologies in the context of data mining.
 CO 3   Understand the algorithms for extracting models and information from large datasets
 CO 4   Understand the model of recommendation systems and its applications
 CO 5   Gain experience in matching various algorithms for particular classes of problems.

IV. COURSE CONTENT:

MODULE-I: DATA MINING (10)

Introduction-Definition of Data Mining-Statistical Limits on Data Mining. Map Reduce and the New Software Stack-Distributed File Systems, Map Reduce, Algorithms Using Map Reduce.

MODULE-II: SIMILARITY SEARCH (10)

Finding Similar Items-Applications of Near-Neighbor Search, Shingling of Documents, Similarity Preserving Summaries of Sets, and Distance Measures.
Streaming Data: Mining Data Streams-The Stream Data Model, Sampling Data in a Stream, Filtering Streams.

MODULE-III: LINK ANALYSIS (09)
Page Rank, Efficient Computation of Page Rank, Link Spam.
Frequent Item sets- Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting
Frequent Items in a Stream.
Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and
Parallelism..

MODULE-IV: ADVERTISING ON THE WEB (09)
Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The Adwords Problem,
AdWords Implementation.
Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations,
Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge.

MODULE-V: MINING SOCIAL-NETWORK GRAPHS (10)
Mining Social-Network Graphs - Social Networks as Graphs, Clustering of Social-Network Graphs,
Partitioning of Graphs, Sim rank, Counting Triangles.

V. TEXT BOOKS:
1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd edition, 2010.

VI. REFERENCE BOOKS:
1. Jiawei Han & Micheline Kamber, "Data Mining Concepts and Techniques", 3rd edition Elsevier.
2. Margaret H Dunham, "Data Mining Introductory and Advanced Topics", PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques,
   Morgan Kaufmann.

VII. WEB REFERENCES:
1. http://www.mmds.org/
2. https://web.stanford.edu/class/cs246/

VIII E-Text Books:
1. http://infolab.stanford.edu/~ullman/mmds/book.pdf
2. https://www.e-booksdirectory.com/details.php?ebook=5300
3. https://www.kdnuggets.com/2010/12/book-mining-massive-datasets.html

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COURSE CONTENT

NATURAL LANGUAGE PROCESSING							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD21	**Elective**	3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Data structures and Algorithms, Machine learning								

I. COURSE OVERVIEW:

This course provides students with a fundamental understanding of the key concepts and techniques in natural language processing, including syntax, semantics, morphology, and pragmatics, methods for representing and preprocessing text data, including techniques like tokenization, stemming, lemmatization, and vectorization. These concepts equip students with the knowledge and skills needed to understand, implement, and contribute to the field of natural language processing.

II. COURSE OBJECTIVES:

The students will try to learn:
- I. The problems and solutions of NLP and their relation to linguistics and statistics
- II. The techniques for extracting semantic information from text and understanding discourse structures.
- III. The discourse processing and structure modeling

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:
- CO 1   Understand the morphological models and find the structure of documents
- CO 2   Apply parsing techniques for syntax analysis and represents syntactic structure
- CO 3   Summarize the semantic parsing in natural language parsing and understand system paradigm
- CO 4   Analyze NLP algorithms Able to design different language modeling Techniques.
- CO 5   Analyze the structure language modeling and understand the dis course processing.

IV. COURSE CONTENT:

MODULE-I: FINDING THE STRUCTURE OF WORDS (10)
Words and Their Components, Issues and Challenges, Morphological Models. Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

MODULE-II: SYNTAX ANALYSIS (10)
Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

MODULE-III: SEMANTIC PARSING (09)
Introduction, Semantic Interpretation, System Paradigms

Word Sense Systems, Software.

MODULE-IV: PREDICTATE ARGUMENT STRUCTURE (10)
Predicate-argument structure, Meaning Representation Systems, Software.

MODULE-V: DISCOURSE PROCESSING (09)
Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross-Lingual Language Modeling.

V. TEXTBOOKS:
1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd edition, 2014.

VI.   REFERENCE BOOKS:
1.   Speech and Natural Language Processing - Daniel Jura sky & James H Martin, Pearson Publications.

VII. WEB REFERENCES:
1.   https://link.springer.com/book/10.1007/978-981-99-1999-4
2.   https://freecomputerbooks.com/Natural-Language-Processing-Succinctly.html

VIII E-Text Books:
1.   https://www.ai-startups.org/books/natural_language_processing/
2.   https://tjzhifei.github.io/resources/NLTK.pdf
3.   http://languagetechnologies.uohyd.ac.in/knm-publications/nlp-book.pdf

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COURSE CONTENT

ADVANCED ALGORITHMS LABORATORY							

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSD23	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	40	60	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42	Total Classes:42

Prerequisites: Advanced data structures

I. COURSE OVERVIEW:

Advanced Algorithms Laboratory typically focuses on ensuring that students acquire practical skills in designing, analyzing, and implementing advanced algorithms. Students should demonstrate a comprehensive understanding of various advanced algorithms, including but not limited to dynamic programming, greedy algorithms, graph algorithms, and divide and conquer**.**

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The various designing techniques and methods for algorithms.
II.   The performance analysis of Algorithms using asymptotic and empirical approaches

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:
CO1   Make use of the greedy method to design algorithms for complex problems and analyze their performance.
CO2   Apply hash, Red Block and binary search tree data structures to various problems.
CO3   Make use of the divide and conquer method to design algorithms for complex problems and analyze their performance.
CO4   Apply dynamic programming for complex problems and analyze their performance.
CO5   Analyze the flow concepts of Min-Max algorithms.
CO6   Apply substitution, recurrence-tree methods to solve recurrences.

IV. COURSE CONTENT:

Week 1:

Design and implement an algorithm to solve the maximum-subarray problem with improved time complexity.

Week 2:

Develop an efficient implementation of Strassen's algorithm for matrix multiplication. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity.

Week 3:

Develop an efficient implementation of the Substitution Method for Solving Recurrences. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

Week 4:

Develop an efficient implementation of the recurrence-tree method for Solving Recurrences. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

Week 5:
Design and implement Red-Black Trees that optimize dynamic operations such as insertions and deletions. Investigate scenarios where the standard Red-Black Tree operations might be suboptimal and propose enhancements to minimize the time complexity of these dynamic operations.

Week 6:
Design and implement binary search Trees that optimize dynamic operations such as insertions and deletions. Investigate scenarios where the standard binary search Tree operations might be suboptimal and propose enhancements to minimize the time complexity of these dynamic operations.

Week 7:
Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses the Hash function H: K * L as H(K)=K mod m (remainder method) and implement a hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Week 8:
Develop an efficient implementation of the matrix chain multiplication using dynamic programming. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

Week 9:
Develop an efficient implementation of the Huffman codes using **a** greedy strategy. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

Week 10:
Implement the Bellman-Ford Algorithm for solving the single-source shortest path algorithm. Write codes to input the graph as a linked list. Here node of the graph should also contain a field to store cost. Check the output for negative cost edges/negative cycles.

Week 11:
Implement of Ford-Fulkerson algorithm for solving the maximum flow problem in a network. Write code to input the network as a directed graph as a linked list. Compute the minimum capacity of the cut in the network. Compare the maximum flow with the capacity of the minimum cut.

Week 12:
Implement of Edmond- Karp maximum-flow algorithm for solving the maximum flow problem in a network.

Week 13:
Develop an efficient implementation of the Floyd-Warshall algorithm using dynamic programming. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

Week 14:
Develop an efficient implementation of the greedy selection criteria for the Knapsack Problem. Investigate techniques to optimize the algorithm's performance in terms of both time and space complexity

V. TEXT BOOKS:
1. Cormen, T.H., Leiserson,C.E., Rivest, R.L. Stein,C. "Introduction to Algorithms" Prentice-Hall of India Learning Pvt. Ltd, 4th edition, 2022.

VII. REFERENCE BOOKS:
1. Ellis Horowitz, Satraj Sahni and Rajasekharan "Fundamentals of Computer Algorithms", Universities Press, 2008.
2. Aho, Hopcroft, Ullman "The Design and Analysis of Computer Algorithms", Pearson Education, 2nd edition, 2018.
3. Kleinberg and Tardos "Algorithm Design", Pearson Education, 2nd edition, 2016.

VIII. WEB REFERENCES:
1. https://www.scribd.com/document/445971276/Advanced-Algorithms-Lab-Manual
2. https://people.iitism.ac.in/~download/lab%20manuals/mathandcomp/Advanced%20Data%20Structures%20And%20Algorithms.pdf

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COURSE CONTENT

CYBER SECURITY LABORATORY							

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSD24	Core	0	0	4	2	40	60	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 42	Total Classes:42

Prerequisites: Computer Networks

I. COURSE OVERVIEW:

This course typically aims to equip students with the knowledge and skills necessary to protect information and information systems from various threats. This course covers public key crypto systems, Kerberos, and firewall mechanisms. The students can gain expertise in information security and contribute to the protection of valuable organizational assets

II. COURSE OBJECTIVES:

The students will try to learn:
I.   How to implement the cryptographic algorithms.
II. How to identify, analyze, and remediate computer security breaches.
III. The importance of digital signature algorithms

III. COURSE OUTCOMES:

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

CO1   Implement cryptography techniques and attack detection for providing security solutions.
CO2   Analyze the impact of public key cryptosystems for secure exchange of information and web transactions.
CO3   Experiment with a signature scheme using the Digital signature standard.
CO4   Make Use of hashing and authentication for implementing data integrity and develop Kerberos.
CO5   Design a firewall for restricting user activities over the network.
CO6   Apply random number generation techniques for cryptosystems.

IV.   COURSE CONTENT:

Week 1: CIPHER ALGORITHM

Implement the encryption and decryption of symmetric cipher algorithm (AES and RC4)

Week 2: RANDOM NUMBER GENERATION

a) Design and implement a Random number generation algorithm using a subset of digits and alphabets.
b) Design and implement a Random number generation algorithm using a Subset-sum of numbers

Week 3: RSA ALGORITHM

a) Implement RSA algorithm for encryption and decryption in C
b) In an RSA System, the public key of a given user is e=31, n=3599.
   Write a program to find the private key of the User.

Week 4: HASH ALGORITHMS
Calculate the message digest of a text using the SHA-1 and MD-5 algorithm

Week 5: WEB TRANSACTIONS
Implement a trusted secure web transaction

Week 6: DIGITAL SIGNATURE ALGORITHM
Implement the SIGNATURE SCHEME – Digital Signature Standard.

Week 7: DIFFIE-HELLMAN ALGORITHM
Implement the Diffie-Hellman Key Exchange algorithm

Week 8: CRYPTOSYSTEM
Implement of EIGAMAL cryptosystem.

Week-9: PUBLIC KEY SYSTEM
Implement of Goldwasser-Micali probabilistic public key system

Week 10: CRYPTOSYSTEM
Implement of Rabin Cryptosystem

Week 11: KERBEROS
Implementation of Kerberos cryptosystem

Week 12: FIREWALL IMPLEMENTATION
Configure a firewall to block the following for 5 minutes and verify the correctness of this system using the configured parameters:
    (a) Two neighborhood IP addresses on your LAN
    (b) All ICMP requests
    (c) All TCP SYN Packets.

Week 13: WIRESHARK
Install and analyze the network packets using Wireshark.

Week 14: PROBE ATTACKS
Write an algorithm to detect probe attacks in network flows.

V. REFERENCE BOOKS:
1. William Stallings "Network Security Essentials (Applications and Standards)" Pearson Education 6th edition, 2017.
2. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", Cengage Learning, 2011.

VI. WEB REFERENCES:
1. https://www.iiitm.ac.in/index.php/en/information-security-lab
2. https://omscs.gatech.edu/cs-6265-information-security-lab
3. https://www.iitr.ac.in/departments/CSE/pages/Facilities+Information_Security_Lab.html
4. https://isec.unige.ch/

COURSE CONTENT

<table>
<tr><td colspan="10" align="center">**BLOCKCHAIN TECHNOLOGIES**</td></tr>
<tr><td colspan="10">**II Semester:** CSE</td></tr>
<tr><td rowspan="2" align="center">**Course Code**</td><td rowspan="2" align="center">**Category**</td><td colspan="3" align="center">**Hours / Week**</td><td align="center">**Credits**</td><td colspan="3" align="center">**Maximum Marks**</td></tr>
<tr><td align="center">**L**</td><td align="center">**T**</td><td align="center">**P**</td><td align="center">**C**</td><td align="center">**CIA**</td><td align="center">**SEE**</td><td align="center">**Total**</td></tr>
<tr><td rowspan="2" align="center">**BCSD26**</td><td rowspan="2" align="center">**Core**</td><td align="center">0</td><td align="center">0</td><td align="center">4</td><td align="center">2</td><td align="center">40</td><td align="center">60</td><td align="center">100</td></tr>
<tr><td align="center"></td><td align="center"></td><td align="center"></td><td align="center"></td><td align="center"></td><td align="center"></td><td align="center"></td></tr>
<tr><td colspan="2">**Contact Classes: Nil**</td><td colspan="3">**Tutorial Classes: Nil**</td><td colspan="2">**Practical Classes: 42**</td><td colspan="3">**Total Classes:42**</td></tr>
<tr><td colspan="10">**Prerequisites: Cryptography and Network Security**</td></tr>
</table>

I. COURSE OVERVIEW:

The course on Blockchain Technology typically covers topics related to the fundamentals, applications, and implementation of blockchain. Blockchain technology is an attractive option for industries looking to enhance security, efficiency, and transparency in their operations.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The fundamentals of blockchain and various types of blockchain and consensus mechanisms.
II.   The public blockchain system, Private blockchain system, and consortium blockchain.
III.   The security issues of blockchain technology in the area of algorithmic design.

III. COURSE OUTCOMES:

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

CO1   Summarize the concepts of blockchain technology.

CO2   Apply the blockchain for business applications.

CO3   Apply the blockchain for technology, legal, and governance applications.

CO4   Analyze the various available private blockchain platforms.

CO5   Evaluate various blockchain challenges for real-world applications.

CO6   Analyze the security and privacy challenges of blockchain and Hyperledger fabric

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION (10)

Introduction to Blockchain, Types of Blockchain - Public Blockchains, Consortium Blockchains, Private Blockchains. Blockchain Implementations -Bitcoin, Name coin, Ripple, Ethereum, Blockchain Collaborative Implementations - Hyperledger, Corda, Categories of Blockchain, Private Blockchain Use Cases, Private Blockchain Technology, Alpha Point Distributed Ledger Platform, Chain Core, Corda, Domus Tower, The Elements Project, Hydra Chain, Hyper ledger, Stellar

MODULE-II: BLOCKCHAIN BUSINESS USE CASES (09)

Currency and Tokens, Cryptocurrency, Digital Tokens, Financial Services Use Cases viz. Know Your Customer (KYC) Use Case, Asset Management Settlement Use Case, Insurance Claims Processing Use Case, Trade Finance (Supply Chain) Use Case, Global Payments Use Case, Smart Property, Smart Contracts on the Blockchain.

MODULE-III: PRIVATE BLOCKCHAIN SYSTEM (10)

Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

MODULE-IV: SECURITY IN BLOCKCHAIN (09)

Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

MODULE-V: APPLICATIONS OF BLOCKCHAIN (10)

Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real Estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain
Compliance, regulations, and legal considerations in the blockchain space. Impact of blockchain on industries and existing legal frameworks.

V. TEXTBOOKS:

1. Chandramouli Subramanian, Asha A. George, Abhilash K A and Meena Karthikeyan "Blockchain Technology", Universities Press, 2018.
2. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", VPT Books, 2017.

VI. REFERENCE BOOKS:

1. Joseph J. Bambara and Paul R. Allen "Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions" , McGraw-Hill Education, 2017.
2. Hands-On Blockchain with Hyperledger, Nitin Gaur et al., Packt Publishing.

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/106105184/
2. https://medium.com/moatcoin/part-6-blockchain-simplified-notes-nptel-892f13875555
3. http://www.hands-on-books-series.com/assets/Bahga-Madisetti-Blockchain-Book-Code.zip

VIII. E-TEXTBOOKS:

1. https://www.researchgate.net/publication/345045424_BLOCKCHAIN_FUNDAMENTALS_TEXT_BOOK_Fundamentals_of_Blockchain
2. https://www.blockchainexpert.uk/book/blockchain-book.pdf
3. https://users.cs.fiu.edu/~prabakar/cen5079/Common/textbooks/Mastering_Blockchain_2nd_Edition.pdf

COURSE CONTENT

MALWARE ANALYSIS AND REVERSE ENGINEERING

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSD27	**Elective**	3	0	0	3	40	60	100

Contact Classes:45	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 45

Prerequisites: Computer Networks, Information security

I. COURSE OVERVIEW:

This course typically aims to provide students or participants with a comprehensive understanding of malicious software, how it operates, and techniques to analyze and reverse engineer it.

II. COURSE OBJECTIVES:

The students will try to learn:

I   The fundamentals of malware analysis
II   The malware taxonomy and malware analysis tools.
III   The malware samples using static, dynamic analysis, and reverse engineering techniques.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to

CO1   apply the skills to carry out static and dynamic malware analysis on various malware samples.
CO2   Comprehend reverse-engineering of malware analysis techniques.
CO 3   Apply techniques and concepts to unpack, extract, and decrypt malware
CO 4   Summarize the executable formats, Windows internals, and APIs and conduct malware forensics
CO 5   Apply reverse engineering to dissect malware, understand its code, and reconstruct its logic to comprehend how it works

IV. COURSE CONTENT:

MODULE-I: MALWARE TAXONOMY (10)

Malware taxonomy - Malware analysis techniques – Packed and Obfuscated Malware -Portable Executable File Format: Headers and Sections, Malware Analysis in Virtual Machines - Malware Analysis Tools: ProcMon/ ProcExplore, BinText, FileAlyzer, OllyDbg.

MODULE-II: MALWARE FORENSICS (09)

Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plu-gins: Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

MODULE-III: STATIC ANALYSIS (10)

File signature analysis and Identifying file dependencies -Database of file hashes. String analysis - Local and online malware sandboxing - Levels of Abstraction - x86 Architecture -x86/x86_64 Assembly - Static Analysis Tools: PeiD, Dependency Walker, Resource Hacker.

MODULE-IV: DYNAMIC ANALYSIS (09)

Source level vs. Assembly level Debuggers - Kernel vs. User-Mode Debugging –Exceptions - Modifying

Execution with a Debugger - Modifying Program Execution in Practice - DLL analysis - Dynamic Analysis Tools: Virustotal, Malware Sandbox, Windows Sysinternals

MODULE-V: REVERSE ENGINEERING (10)
Reverse engineering malicious code - Identifying malware passwords – Bypassing authentication - Advanced malware analysis: Virus, Trojan and APK Analysis – Reverse Engineering Tools: IDA Pro and OLLYDBG.

V TEXT BOOKS:
1. Abhijit Mohanta, Anoop Saldanha, "Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware", Apress publications, 1st edition, 2020,

VI. REFERENCE BOOKS:
1. Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" publisher Williampollock.
2. Monnappa K A, Learning Malware Analysis- Explore the concepts, tools, and techniques to analyze and investigate Windows malware, 2018, 1st edition, Packt Publishing,

VII. WEB REFERENCES:
1. https://github.com/CyberSecurityUP/Awesome-Malware-and-Reverse-Engineering
2. https://www.eccouncil.org/cybersecurity-exchange/ethical-hacking/malware-reverse-engineering/
3. https://www.eccouncil.org/cybersecurity-exchange/ethical-hacking/malware-reverse-engineering/

VIII. E-TEXTBOOKS:
1. https://ccdcoe.org/uploads/2020/07/Malware_Reverse_Engineering_Handbook.pdf
2. https://doc.lagout.org/security/Malware%20%26%20Forensics/Practical%20Malware%20Analysis.pdf
3. https://www.foo.be/cours/dess-20122013/b/Eldad_Eilam-Reversing__Secrets_of_Reverse_Engineering-Wiley(2005).pdf

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COURSE CONTENT

AUGMENTED REALITY AND VIRTUAL REALITY							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	Category	L	T	P	C	CIA	SEE	Total
BCSD28	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Computer Vision								

I. COURSE OVERVIEW:

An Augmented Reality (AR) and Virtual Reality (VR) course aims to cover various aspects of these immersive technologies, providing students or participants with a comprehensive understanding of their concepts, applications, development, and implementation.

II. COURSE OBJECTIVES:
The students will try to learn:
I.   the fundamentals of sensation, perception, and perceptual training.
II.   the scientific, technical, and engineering aspects of augmented and virtual reality systems.
III. The technology of augmented reality and its implementation

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to
CO1   Identify, examine, and use the software that reflects fundamental techniques for the design and deployment of VR and AR experience.
CO2   Describe how VR and AR systems work.
CO3   Choose, develop, explain, and defend the use of particular designs for AR and VR experiences.
CO4   Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body
CO5   Identify and examine state-of-the-art AR and VR design problems and solutions

IV. COURSE CONTENT:
MODULE-I: INTRODUCTION (10)
Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.
Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.

MODULE-II: VISUAL COMPUTATION IN VIRTUAL REALITY (10)
Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

MODULE-III: INTERACTIVE TECHNIQUES IN VIRTUAL REALITY (09)
Body Track, Hand Gesture, 3D Manus, Object Grasp. **Development Tools and Frameworks in Virtual Reality**: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.

MODULE-IV: APPLICATION OF VR IN DIGITAL ENTERTAINMENT (10)
VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games.
Demonstration of Digital Entertainment by VR.

MODULE-V: 3D INTERACTION TECHNIQUES (09)
 3D Manipulation Tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D
Manipulation.

V. TEXT BOOKS:
1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press,
    2003/2006.
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications,
    Morgan Kaufmann, 2013.

VI. REFERENCE BOOKS:
1. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications,
    Foundations of Effective Design", Morgan Kaufmann, 2009.

VII. WEB REFERENCES:
1. https://www.w3.org/WAI/APA/task-forces/research-
    questions/wiki/Virtual_Reality_and_Accessibility_References
2. https://nap.nationalacademies.org/read/4761/chapter/18
3. https://www.coursera.org/courses?query=augmented%20reality
4. https://www.udemy.com/topic/augmented-reality/

VIII. E-TEXT BOOKS:
1. https://www.researchgate.net/publication/322137851_Augmented_Reality_Books_An_Immersive_
    Approach_to_Learning
2. https://link.springer.com/book/10.1007/978-3-030-79062-2
3. https://link.springer.com/book/10.1007/978-3-030-79062-2

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COURSE CONTENT

QUANTUM COMPUTING

II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	**Category**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD29	**Elective**	3	-	-	3	40	60	100

Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**	**Total Classes: 48**

Prerequisites: Computer organization and Architecture, Advanced algorithms, Cryptography

I. COURSE OVERVIEW:

Quantum computing is an evolving and complex field that merges concepts from quantum mechanics, computer science, and mathematics. Provide insights into specific quantum algorithms, their advantages over classical algorithms, and their applications in various domains such as cryptography, optimization, and machine learning.

II. COURSE OBJECTIVES:

The students will try to learn:
  I.   The different quantum computing mechanics.
  II. The indepth of quantum computation theory.
  III. Quantum algorithms, and their advantages over classical algorithms.

III. COURSE OUTCOMES:

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

CO1	Analyze the performance of data transmission between the systems using quantum computing algorithms.
CO2	Identify suitable technique to minimize complexity of different computational problems.
CO3	Apply quantum search algorithms of find quantum information for speeding up the solutions of NP-complete problems.
CO4	Apply three-qubit phase flip code & shor code to discretize and correct the errors.
CO5	Identify suitable cryptography algorithms to provide security for quantum information
CO6	Classify various encryption techniques of quantum mechanics to secure and transmit data.

IV. COURSE CONTENT:
MODULE-I:
INTRODUCTION OF QUANTUM COMPUTING AND OVERVIEW (10)

History of quantum computation and quantum information, Quantum bits, Multiple qubits, Quantum computation, Single qubit gates, Multiple qubit gates, Measurements in bases other than the computational basis, Quantum circuits, Qubit copying circuit, Example: Bell states, Example: quantum teleportation. Quantum algorithms: Classical computations on a quantum computer, Quantum parallelism, Deutsch's algorithm, The Deutsch–Jozsa algorithm, and Quantum algorithms summarized.

MODULE-II: INTRODUCTION TO COMPUTER SCIENCE (09)

Models for computation, Turing machines, Circuits, The analysis of computational problems, How to quantify computational resources, Computational complexity, Decision problems and the complexity classes P and NP, A plethora of complexity classes, Energy and computation, and Perspectives on computer science.

MODULE-III: QUANTUM SEARCH ALGORITHMS (10)

The quantum search algorithm, Quantum search as a quantum simulation, Quantum counting, Speeding up the solution of NP-complete problems, Quantum search of an unstructured database, Optimality of the search algorithm, Black box algorithm limits.

MODULE-IV: QUANTUM ERROR-CORRECTION (10)

The three-qubit bit flip code, the Three-qubit phase flip code, The Shor code, the Theory of quantum error correction Discretization of the errors, Independent error models, Degenerate codes, The quantum Hamming bound.

MODULE-V: QUANTUM CRYPTOGRAPHY (09)

Private key cryptography, Privacy amplification and information reconciliation, Quantum key distribution, Privacy, and coherent information, and security of quantum key distribution.

TEXT BOOKS:
1. Nielsen and Chuang, Quantum Computation and Quantum Information, 10th Anniversary Edition, Cambridge University Press, 2010.

REFERENCE BOOKS:
1. Scott Aaronson, "Quantum Computing since Democritus", Cambridge, 2013.
2. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd 2012.
3. V.K Sahni, Quantum Computing (with CD), TATA McGraw-Hill, 2007.

WEB REFERENCES:
1. https://fivebooks.com/best-books/quantum-computing-chris-bernhardt/
2. https://philpapers.org/browse/quantum-computation
3. https://link.springer.com/referenceworkentry/10.1007/978-1-4020-8265-8_1230

E-Text Books:
1. https://www.fi.muni.cz/usr/gruska/qbook1.pdf
2. https://library.oapen.org/handle/20.500.12657/48236
3. https://freecomputerbooks.com/Quantum-Computing-for-the-Quantum-Curious.html

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COURSE CONTENT

CYBER PHYICAL SYSTEMS

II Semester: CSE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSD30	**Elective**	3	-	-	3	40	60	100

Contact Classes:48	Total Tutorials: Nil	Total Practical Classes: Nil	Total Classes: 48

Prerequisites: Computer organization and Architecture, Advanced algorithms, Cryptography

I. COURSE OVERVIEW:

Cyber-physical systems, which consist of physical systems tightly integrated and/or controlled by software, are ubiquitous in many safety critical domains, including automotive, avionics, railways, healthcare, atomic energy, power, and industrial automation. The principles of design and implementation of cyber-physical systems are remarkably different from that of other embedded systems because of the tight integration of real valued and dense time real time systems with software based discrete automated control. The course aims to expose the student to real world problems in this domain and provide a walk through the design and validation problems for such systems. Applications for CPS research are far reaching and span medical devices, smart buildings, vehicle systems, and mobile computing. The application domain for this course will be cyber-physical vehicle systems though techniques are more broadly applicable. Current literature, techniques, theories, and methodologies will be reviewed and discussed.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The basic design, architecture and design principles of cyber physical systems.
II. The fundamental concepts of cryptography for ensuring security of cyber- physical systems
III. The sources of vulnerability in a cyber physical system systematically via attack surfaces.
IV. The various modeling formalisms for CPS, such as hybrid automata, state-space methods, etc.

III. COURSE OUTCOMES;
CO1 Analyze overall specifications of CPS and translate it to the different sub-systems design requirements.
CO2 Define embedded systems and cyber-physical systems (CPS) and give examples
CO3 Understand various modeling formalisms for CPS, such as hybrid automata, state-space methods, etc.
CO4 Apply modeling and associated tools for Hybrid system.
CO5 Analyze CPS by with holistic models of cyber and physical components.

IV. COURSE SYLLABUS:
MODULE – I: INTRODUCTION TO CYBER PHYCIAL SYSTEM (09)
Motivation and examples of CPS e.g. Energy, Medical and Transportation cyber physical systems; Key design drivers and quality attributes of CPS. Attributes of high confidence CPS.

MODULE – II: CYBER PHYSICAL SYSTEM DESIGN (10)
Continuous systems modeling; Discrete time system modeling; Finite state machine; Extended state machines; Hybrid system modeling; Classes of Hybrid Systems.

MODULE – III: ANALYSIS AND VERIFICATION (10)
Basic concepts of embedded systems; Embedded Processors; Input-outputs; Invariants and Temporal Logic; Linear Temporal Logic;

Equivalence and Refinement; Development of models from specifications; Reachability analysis and Model Checking.

MODULE - IV: CYBER PHYSICAL SYSTEM MODELLING (10)
Modeling experiments in continuous, discrete and hybrid system; Verification of model using different techniques; Sensitivity analysis of Models; Sensitivity analysis of Hybrid Models; Scheduling in embedded system.

MODULE – V: SECURITY IN CYBER PHYSICAL SYSTEMS (09)
Security issues of Industrial Control Systems; Integrity attacks on SCADA systems; Model based technique to detect integrity attacks on sensors; threat model and its effect on control scheme; countermeasure for detecting such attacks; watermarking scheme; Design of observers under sensor and actuator attacks; design of observer for distributed environment under different attacks; applications of swarms of UAVs; Control design with denial service attack; case studies

V. TEXT BOOKS:
1. R. Rajkumar, D. de. Niz and M. Klein, "Cyber Physical Systems", Addision-Wesely, 2017.
2. E.A.Lee and S AShesia, (2018), "Embedded System Design: A Cyber-Physical Approach", Second Edition, MIT Press.
3. A.Platzer, "Logical Foundations of Cyber Physical Systems", Springer, 2017.

VI. REFERENCE BOOKS:
1. F. Pasqualetti, F. Dörfler and F. Bullo, "Attack Detection and Identification in Cyber-Physical Systems", in IEEE Transactions on Automatic Control, vol. 58, no. 11, pp. 2715-2729, Nov. 2013.
2. H. Fawzi, P. Tabuada and S. Diggavi, "Secure Estimation and Control for Cyber-Physical Systems Under Adversarial Attacks", in IEEE Transactions on Automatic Control, vol. 59, no. 6, pp. 1454-1467, June 2014.
3. Yilin Mo, RohanChabukswar and Bruno Sinopoli, "Detecting Integrity Attacks on SCADA Systems" in IEEE Transactions on Control System Technology, Vol. 22, No. 4, 2014.
4. F. Pasqualetti, F. Dörfler and F. Bullo, "Control Theoretic methods for Cyber Physical Security", in IEEE Control System Magazine, pp. 110-127, Feb. 2015.

VII. WEB REFERENCES:
1. https://www.nist.gov/el/cyber-physical-systems
2. https://www.cs.cmu.edu/~aplatzer/course/fcps14/fcps14.pdf
3. https://www.eecs.umich.edu/courses/eecs571/lectures/lecture2-intro-of-CPS.pdf

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COURSE CONTENT

PARALLEL AND DISTRIBUTED COMPUTING							
II Semester: CSE							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD31	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Operating system, computer networking, and computer Organization								

I. COURSE OVERVIEW:
This course covers a broad range of topics related to parallel and distributed computing. It covers general introductory concepts in the design and implementation of parallel and distributed systems including parallel and distributed architectures and systems, parallel and distributed programming paradigms, parallel algorithms, and scientific and other applications of parallel and distributed computing.

II. COURSE OBJECTIVES:
The students will try to learn:
I.   The basic design, architecture and design principles of cyber physical systems.
II.   The fundamental concepts of cryptography for ensuring security of cyber- physical systems
III. The sources of vulnerability in a cyber physical system systematically via attack surfaces.
IV.   The various modeling formalisms for CPS, such as hybrid automata, state-space methods, etc.

III. COURSE OUTCOMES;
CO1   Apply the fundamentals of parallel and distributed computing including parallel architectures and paradigms
CO2   Analyze the various design principles of parallel algorithms
CO3   Learn the intricacies of parallel and distributed programming
CO4   Develop and execute basic parallel and distributed applications using basic programming models and tools.
CO5   Apply design, development, and performance analysis of parallel and distributed applications.

IV. COURSE SYLLABUS:
MODULE – I: INTRODUCTION TO PARALLEL COMPUTING (09)
The Idea of Parallelism, Power and potential of parallelism, examining sequential and parallel programs, Scope and issues of parallel and distributed computing, Goals of parallelism, Parallelism and concurrency using multiple instructions streams

MODULE – II: PARALLEL ARCHITECTURE (09)
Pipeline architecture, Array processor, Multi processor architecture, Systolic architecture, Dataflow architecture, Architectural classification schemes, Memory access classification, Memory Issues : Shared vs. distributed, Symmetric multiprocessing (SMP), SIMD, Vector processing, GPU co-processing, Flynn's Taxonomy, Instruction Level support for parallel programming, Multiprocessor caches and Cache Coherence, Non-Uniform Memory Access (NUMA).

MODULE – III: PARALLEL ALGORITHM DESIGN PRINCIPLES AND PROGRAMMING (10)
Need for communication and coordination/synchronization, Scheduling and contention, Independence and partitioning, Task- Based Decomposition, Data Parallel Decomposition, Characteristics of task and interaction, Load balancing.

Data Management, parallel algorithm models, Sources of overhead in parallel programs, Performance metrics for parallel algorithm implementations, Parallel algorithmic patterns like divide and conquer, Map and Reduce, Specific algorithms like parallel Merge Sort, Parallel graph Algorithms.

MODULE - IV: INTRODUCTION TO DISTRIBUTED SYSTEMS (10)
Goals of the Distributed Systems, Relation to parallel systems, synchronous versus asynchronous execution, design issues and challenges, Types of Distributed Systems, Distributed System Models, Hardware and software concepts related to distributed systems, middleware models.

MODULE – V: DISTRIBUTED COMPUTING AND COMMUNICATION DESIGN PRINCIPLES (10)
A Model of distributed executions, Models of communication networks, Global state of distributed system, Models of process communication. Communication and Coordination: Shared Memory, Consistency, Atomicity, Message- Passing, Consensus, Conditional Actions, Critical Paths, Scalability, and cache coherence in multiprocessor systems, synchronization mechanism.

Parallel and Distributed Programming Frameworks:
Overview of CUDA, OpenMP, POSIX Threads, Apache Hadoop (DFS), and current trends in parallel and distributed computing

V. TEXT BOOKS:
1. Ananth Grama, Anshul Gupta, and George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Addition Wesley, 2nd edition 2012.
2. Arun Kulkarni, Nupur Prasasd Giri, Nikhilesh Joshi, "Parallel and Distributed Systems", 2nd edition, 2019.

VI. REFERENCE BOOKS:
1. Ian Foster, "Designing and Building Parallel Programs – Concepts and tools for Parallel Software Engineering", Pearson Publisher, 1st edition, 2019.
2. Michael J.Quinn, "Parallel Programming in C with MPI and OpenMP" McGrawHill Higher Education.

COURSE CONTENT

SOFTWARE PROJECT MANAGEMENT								
II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD32	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Computer organization and Architecture, Advanced algorithms, Cryptography								

I. COURSE OVERVIEW:

The main goal of software development projects is to create a software system with a predetermined functionality and quality in a given time frame and with given costs. For achieving this goal. models are required for determining target values and for continuously controlling these values. This course focuses on principles, techniques, methods & tools for model-based management of software projects. Assurance of product quality and process adherence (quality assurance), as well as experience-based creation & improvement of models (process management).

II. COURSE OBJECTIVES:

The students will try to learn:

I.   The specific roles within a software organization as related to project and process management
II. The basic infrastructure competences (e.g., process modeling and measurement).
III. The basic steps of project planning, project management. Quality assurance, and process management and their relationships.

III. COURSE OUTCOMES;

CO1   Outline process models, approaches and techniques of software economics.
CO2   Evaluate professional ethics in successful project development.
CO3   Elaborate the life cycle of project management
CO4   Analyze evaluation of organization and core metrics for project organization
CO5   Apply model based architectural concepts for building software.
CO6   Determine case study on future software project management practices in business context and scope of the project.

IV. COURSE SYLLABUS:

MODULE–I: CONVENTIONAL SOFTWARE MANAGEMENT (10)

The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics. Pragmatic software cost estimation.

MODULE–II: IMPROVING SOFTWARE ECONOMICS (10)

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 modem software management, transitioning to an iterative process.

MODULE– III: LIFE CYCLE PHASES (09)

Engineering and production stages, inception. Elaboration, construction, transition phases. Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts.

Model based software architectures: A Management perspective and technical perspective.

MODULE– IV: PROJECT ORGANIZATIONS (10)

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation the seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

MODULE– V: CASE STUDIES (09)

CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions

V. TEXT BOOKS:

1. Walker Royce, "Software Project Management", Pearson Education, 6th Edition, 2000.
2. Bob Hughes & Mike Cotterell, "Software Project Management", Tate McGraw H, 4th Edition, 2000.

VI. REFERENCE BOOKS:

1. Andrew SteIbian 8 Jennifer Greene, "Applied Software Project Management", O'Reilly. 2006.
2. Jennifer Greene & Andrew Steliman, "Head First PMP", O RoiHy, 2007.
3. Richard H. Thayer & Edward Yourdon, "Software Engineering Project Management", Wiley India, 2nd Edition, 2004.
4. Jim Highsniith, "Ale Project Management", Pearson Education, 2004.

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

MOBILE COMPUTING								
II Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSD33	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes:48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Computer organization and Architecture								

I. COURSE OVERVIEW:

This course will cover various topics of mobile computing, networking, and systems, including but not limited to: applications of smartphones, cellular networks, embedded sensor systems, localization systems, energy efficiency of mobile devices, wearable and vehicular mobile systems, mobile security, virtual reality and augmented reality. Students will gain knowledge of: the fundamental principles of mobile cloud computing, the major technologies that support mobile cloud computing, the current challenges and primary areas of research within the field of mobile cloud computing, and a basic understanding of the role of mobile cloud computing in the context of the everyday living.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The concept of wireless transmission Protocols.
II. The typical mobile networking infrastructure through a popular GSM protocol Architecture.
III. The various layers of mobile networks for location management.
IV. The database issues in mobile environments and data delivery models and also learn the platforms and protocols used in mobile environment.

III. COURSE OUTCOMES;

CO1   Define mobile technologies in terms of hardware, software, and communications
CO2   Analyze existing mobile computing frameworks and architectures.
CO3   Evaluate the effectiveness of different mobile computing frameworks.
CO4   Describe how mobile technology functions to enable other computing technologies.
CO5   Classify different types of mobile telecommunication systems
CO6   Demonstrate the Adhoc networks concepts and its routing protocols

IV. COURSE SYLLABUS:

MODULE–I: INTRODUCTION (10)

Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS.

MODULE–II: MEDIA ACCESS LAYER AND MOBILE NETWORK LAYER (10)

Motivation for a specialized MAC (Hidden and exposed terminals. Near and far terminals), SDMA, FDMA, TDMA, CDMA, wireless LAN (IEEE802.11) system and protocol architecture. Mobile network layer: Packet delivery and handover management, location management, registration, tunneling and encapsulation, route optimization, DHCP.

MODULE– III: MOBILE TRANSPORT LAYER (10)
Conventional TCP/IP protocols, indirect TCP, snooping TCP, mobile TCP, other transport layers protocols for mobile networks;

Database issues: Database hoarding & caching techniques, C-S computing and adaptation, transactional models, query processing, data recovery process and QoS issues.

MODULE– IV: DATA DISSEMINATION AND SYNCHRONIZATION (09)
Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods.

MODULE– V: MOBILE ADHOC NETWORKS(MANET'S) (09)
Introduction, applications and challenges of a MANET, routing, classification of routing algorithms, algorithms such as DSR, AODV, DSDV; Mobile Agents, Service Discovery.

V. TEXT BOOKS:
1. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, Illustrated, 2nd edition, 2012.

VI. REFERENCE BOOKS:
1. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005.
2. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, 2nd edition, 2003.
3. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley Dream Tech, 1st edition, 2003.

VII. WEB REFERENCES:
1. https://en.wikipedia.org/wiki/Mobile_computing
2. https://www.tutorialspoint.com/mobile_computing/mobile_computing_quick_guide.h
3. https://media.techtarget.com/searchMobileComputing/downloads/Mobile_and_pervasive_computing_Ch06pdf

UNDERTAKING BY STUDENT/PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms -- joining I Semester for the academic year 2023-2024 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean of Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 75% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus / Hostel / Residence and attend all the tests to secure more than the minimum prescribed Class / Sessional marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the concerned HOD / Principal.
11. I hereby acknowledge that I have received a copy of MT23 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

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ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date   **Signature of Parent with Date**
                                                                   Name & Address with Phone Number