R24 ACADEMIC REGULATIONS COURSE STRUCTURE AND SYLLABI

of

M.TECH. COMPUTER SCIENCE AND ENGINEERING

FOR

M.Tech. REGULAR TWO YEAR DEGREE PROGRAM

(For the batches admitted from 2024-25)

CHOICE BASED CREDIT SYSTEM



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SRI VENKATESWARA COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Affiliated to J.N.T. University Anantapur, Ananthapuramu, Accredited by NBA & NAAC "A")

Karakambadi Road, Tirupati - 517 507

Vision

To be a centre of excellence focusing on high quality technical education, research and technical services with global leadership competence to succeed in employment and higher education with ethical, social, entrepreneurial aspects updating to the real time requirements.

Mission

M 1: To impart high quality technical education by providing the state-of-the art infrastructure, core instruction.

M 2: Advanced research and technical consultancy services with qualified and senior faculty.

M 3: To prepare the students professionally deft and intellectually adept possessing excellent skill, knowledge and behavior with global competence.

Department of Computer Science and Engineering

Vision

To produce globally competent, dynamic and multi-talented young leaders with skill & knowledge in Computer science and Engineering to cater the contemporary demands of the software industry, thereby making them industry ready while at the institution and also to pursue higher education imbibing holistic approach.

Mission

M 1: To impart high quality technical education in Computer Science and Engineering by providing core values and well-equipped infrastructure.

M 2: To provide advanced research and technical consultancy services with qualified and senior faculty.

M 3: To prepare the learners professionally deft and intellectually adept possessing excellent skill, knowledge and behaviour.

M 4: To inculcate the leadership capabilities in learners to face the dynamic and challenging global work of the Computer Science and Engineering field.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Gain in-depth knowledge of advanced computational methods, to apply in relevant real-world issues within the context of a specific application domain.

PEO2: Design and develop innovative solutions making use of modern computing platforms by exhibiting commitment to ethical practices and lifelong learning.

PEO3: Understand and contribute to prevalent literature for pursuing research in the field of computer science and engineering.

PEO4: Exhibit technical and managerial skills in multidisciplinary domains and become competent professionals.

PROGRAM OUTCOMES

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over computer science and engineering for holistic professional development.

PO4: An ability to demonstrate understanding for designing and developing software for multidisciplinary problems.

PROGRAM SPECIFIC OUTCOMES

PSO1: Conduct research using knowledge gained to identify and Solve problems in multidisciplinary domains.

PSO2: Demonstrate critical thinking ability to propose efficient solutions to the real world computational problems taking into consideration environmental and societal issues.

PRELIMINARY DEFINITIONS AND NOMENCLATURE

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 Anantapur**).

Academic Autonomy: Means the freedom granted to an institute in all aspects of conducting its academic programs, as granted by the UGC, to promote excellence.

Academic Council: The Academic Council is the highest academic body of theinstitute 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 Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., one odd and one even.

Branch: Means specialization in a programme like M.Tech. degree programme in Computer Science and Engineering etc.

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 programmes offered by a department.

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

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

Choice Based Credit System: It 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.

Continuous Internal Evaluation: It is an examination conducted towards sessional assessment.

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

Course: A course is a subject offered by a department 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 hour of teaching (Lecture / Tutorial) or two hours of practical work / field work 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 overall 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 up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials and resources.

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 Semester: Student who does not obtain minimum prescribed attendance in a Semester shall be detained in that particular 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 examinations 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: Represents Sri Venkateswara College of Engineering, Tirupati unless indicated otherwise by the context.

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

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

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

Programme: Denotes PG degree programme: Master of Technology (M.Tech.).

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

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

Regulations: The regulations, common to all M.Tech. programmes offered by Institute, are designated as "SVCE R24" and are binding on all the stakeholders.

Semester: It is a period of study with a minimum of 90 instructional days per semester (including all examinations). Each academic year of study is divided into two semesters.

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

University: Represents Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu.

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1 General

1.1 About the College

Sri Venkateswara College of Engineering (SVCE) is part of the SV Colleges group established in the year 2007 with a vision to become a leader in providing quality educational services. College is affiliated to JNTUA & Approved by AICTE, recognized under sections 2(f) & 12(B) of UGC act 1956, Accredited by NAAC with 'A' Grade. Six B.Tech. Programmes CSE, ECE, EEE, IT, ME & CE are accredited by NBA, New Delhi. The College offers UG Programmes [CE, CSE, CSE (AI & ML), CSE (CS), CSE (DS), ECE, EEE, IT & ME], PG Programmes (VLSI Design, CSE, MCA & MBA). The Institution conferred 'Autonomy' by UGC, New Delhi in the year 2020.

The Campus is equipped with state of art laboratories of centre of excellence through advanced tools and technologies. Learning at Sri Venkateswara College of Engineering has a pragmatic approach with a clear focus, valuing individual vision, intellectual discipline, and a sense of teamwork. We aim at developing our students to their full potential, preparing them to take the next step towards career success.

Sri Venkateswara College of Engineering is committed to its role in creating leaders through its innovative programmes, outstanding faculty and thought leadership. Sri Venkateswara College of Engineering nurtures global leaders who can speak their minds and work well with others in a wide range of cultural contexts. It will develop their ability to manage a career successfully in the global economy.

Our teaching modes and methods of assessment vary between courses to ensure that you gain the most benefit from the interactive course content, faculty members, fellow students, and invited guests. Lectures comprise only a portion of course delivery, with the remaining taken up by discussions, seminars, case analysis, simulation, individual and group projects, and presentations.

Academic programmes of the College are governed by the rules and regulations as approved by the Academic Council, which is the highest academic body of the College. These academic rules and regulations are effective from the academic year 2024-25 for the students admitted into the two-year Post Graduate M.Tech. programme offered by the college.

1.2 Applicability

All the rules specified herein, approved by the Academic Council, shall be in force and applicable to students admitted from the academic year 2024–25 onwards. Any reference to 'College' in these rules and regulations stands for Sri Venkateswara College of Engineering.

1.3 Extent

All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. It shall be ratified by the Academic Council in theforthcoming meeting. As per the requirements of statutory bodies, Principal, Sri Venkateswara College of Engineering shall be the Chairman, Academic Council.

1.4 Programmes Offered

Following programmes are offered in various branches in Sri Venkateswara College of Engineering leading to the award of M.Tech. Degree:

S No	Branch	Specialization	Branch Code
1	Electronics and Communication Engineering	VLSI Design	57
2	Computer Science and Engineering	Computer Science and Engineering	58

1.5 Semester System and Structure

A student after securing admission shall complete the M.Tech. programme in a minimum period of two academic years (4 semesters), and a maximum period of four academic years (8 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in M.Tech. programme. Each semester shall normally consist of 90 instructional days having - Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), Choice Based Credit System (CBCS) and Credit Based Semester System(CBSS) as suggested by UGC and Curriculum/ Course Structure as suggested by AICTE/APSCHE are followed.

1.5.1 Semester Scheme

i. A Candidate after securing admission must pursue the M.Tech. programme of study for four semesters duration.
ii. Each Semester shall be of a minimum of 90 instructional days.
iii. A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.
iv. The medium of instruction of the programme shall be English only for all theory and practical courses, examinations, seminar, and project thesis/dissertation reports.

1.5.2 Course Classification

All courses offered for the post graduate programme in Engineering and Technology (M.Tech. degree programmes) are broadly classified as follows.

S. No.	Broad Course Classification	Course Group/ Category	Course Description	Credits
1	Core Courses	PC – Professional Core	Includes core courses related to the parent discipline/ department / branch of Engineering.	20
2	Elective Courses	PE – Professional Electives	Includes elective courses related to the parent discipline/ department / branch of Engineering.	18
3		OE – Open Electives	Elective courses which include interdisciplinary courses or courses in an area outside the parent discipline/ department/ branch of Engineering which are of importance in the context of special skill development.	
4	Research	Research Methodology and IPR	To understand importance and process of creation of patents through research	2
		TS - Technical Seminar	Seminar ensures preparedness of students to undertake major projects / dissertation, based on core contents related to parent discipline/ department/ branch of Engineering.	2
		Co-curricular Activities	Attending conferences, scientific presentations and other scholarly activities	2
		Project Work	M.Tech. Project Work or Major Project Work Phase - I and II	26
5	Mandatory Courses (MC)	Mandatory Non - Credit Courses	Covering courses of developing desired attitude and skills among the learners	NIL
6	Audit Courses (AC)	Audit Non - Credit Courses	Covering courses of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education etc. Any other course helpful for enhancing the employability of the students.	NIL
Total				**70**

- The college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- A faculty advisor/mentor shall be assigned to each specialization to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.
- Preferably 25% course work for the theory courses in every semester shall be conducted in the blended mode of learning.

1.6 Admissions

Admissions in to the first year of M.Tech. programme in Sri Venkateswara College of Engineering will be as per norms of Jawaharlal Nehru Technological University Anantapur, Ananthapuramu and Government of Andhra Pradesh.

Admissions shall be made either on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by A.P. State Government (APPGECET) for M.Tech. programmes/an entrance test conducted by University/on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

1.7 Award of M.Tech. Degree

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

1. Pursues a course of study for not less than two academic years and not more than four academic years.
2. Registers for 70 credits and secures all 70 credits.

Students, who fail to fulfil all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in M.Tech. programme and their admission stands cancelled.

2 Continuous Assessment

2.1 Attendance Requirement

i. A candidate shall be deemed to have eligibility to write Semester End Examinations if he/she has put in at least 75% of attendance on cumulative basis of all courses in the semester and 40% of minimum attendance should be maintained in each course.
ii. Condonation of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee, if a student puts an aggregate attendance of 65% and minimum 40% in each course.
iii. Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.
iv. A stipulated fee shall be payable towards condonation of shortage of attendance.
v. If the candidate does not satisfy the attendance requirement, he/she is detained for want of attendance and shall re-register for that semester. He/she shall not be promoted to the next semester. They may seek re-admission into that semester when offered next.
vi. If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

2.2 Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is introduced in line with UGC guidelines in order to promote:

i. Student centered learning
ii. Students to learn courses of their choice
iii. Interdisciplinary learning

A Student has a choice of registering for courses comprising programme core,professional electives, open electives, MOOC courses, and courses related to research.

2.3 Evaluation

The performance of a student in each semester shall be evaluated course wise (irrespective of credits assigned), for a maximum of 100 marks for theory course and 100 marks for practical course, on the basis of Continuous Internal Evaluation and Semester End Examination.

For theory/practical courses the distribution shall be 40 marks for Continuous Internal Evaluation and 60 marks for the Semester End Examination.

2.3.1 Theory Courses

2.3.1.1 Continuous Internal Evaluation

For theory courses, during the semester, there shall be two midterm examinations, one in the middle of the semester and the other immediately after the completion of instructional period. First midterm examination shall be conducted for I, II units of syllabus. The second midterm examination shall be conducted for III, IV and V units. Each midterm examination shall be evaluated for 40 marks of which 30 marks for subjective paper (2-hour duration) and 10 marks for assignments.

Subjective paper shall contain 3 questions covering all the units of respective syllabus, student has to answer all the 3 questions, each question carries 10 marks.

***Note 1**: Any fraction shall be rounded off to the next higher mark.

If the student is absent for the midterm examination, no re-exam shall be conducted and midterm examination marks for that examination shall be considered as zero.

Final midterm examination marks shall be arrived at by considering the marks secured by the student in both the midterm examinations with 80% weightage given to the better midterm exam and 20% to the other.

2.3.1.2 Semester End Examination

End examination of theory courses shall have the following pattern:

i. There shall be 5 questions and all questions are compulsory.
ii. In each of the questions, there shall be either or type questions of 12 marks each from every unit of the syllabus. Student shall answer any one of them.
iii. Each question may consist of one, two or more bits

2.3.2 Practical Courses

For practical courses, 60 marks shall be for the Semester End Examinations and 40 marks will be for Continuous Internal Evaluation based on the day-to-day performance. The internal evaluation based on the day-to-day work - 10 marks, record - 10 marks and the remaining 20 marks to be awarded by conducting a midterm examination at the end of the instruction period. The Semester End Examination shall be conducted by the examiners, with a breakup mark of Procedure – 10 Marks, Experimentation – 25 Marks, Results - 10 Marks, Viva Voce - 15 Marks.

The laboratory records and midterm examination answer scripts shall be preserved for a minimum period of 3 years in the institute as per the norms and shall be produced to the Committees of the University as and when the same are asked for.

2.3.3 Project Work

The Project work shall be initiated at the beginning of the III Semester and the duration of the Project is of two semesters. Evaluation of Project work is for 300 marks with 200 marks for Continuous Internal Evaluation and 100 marks for Semester End Examination. Continuous Internal Evaluation of the Project Work Phase – I & Project Work Phase – II in III & IV semesters respectively shall be for 100 marks each. Semester End Examination of final Project work viva voce in IV semester shall be for 100 marks.

A Project Evaluation Committee (PEC) shall be constituted with the Head of the Department, project supervisor, and project coordinator. The PEC is constituted by the Principal on the recommendations of the Head of the Department.

i. **Registration of Project Work**: A candidate is permitted to register for the Project Work in III Semester after satisfying the attendance requirement in all the courses, both theory and practical (in I & II semesters).
ii. The Project Work Phase – I shall be initiated in the third semester and the Project Work Phase – II will be continued in the final semester. The duration of the project work is for two semesters. The candidate can submit Project Thesis with the approval of PEC. The candidate has to pass all the theory, practical and other courses before submission of the Thesis.
iii. Project work shall be carried out under the supervision of teacher in the parent department concerned.

iv. A candidate shall be permitted to work on the project in an industry/research organization on the recommendation of the Head of the Department. In such cases, one of the faculty members from the department concerned would be the internal supervisor and an expert from the industry/ research organization concerned shall act as external supervisor. It is mandatory for the candidate to make full disclosure of all data/results on which they wish to base their Thesis. They cannot claim confidentiality simply because it would come into conflict with the Industry's or R&D laboratory's own interests. A certificate from the external supervisor is to be included in the Thesis.

v. Continuous Internal Evaluation of Project Work Phase - I and Project Work Phase – II in III & IV semesters respectively will be monitored by the PEC.

vi. The candidate shall submit status report by giving seminars in three different phases (two in III semester and one in IV semester) during the project work period. These seminar reports must be approved by the PEC before submission of the Project Thesis.

vii. After registration, a candidate must present in Project Work Review - I, in consultation with his Project Supervisor, the title, objective and plan of action of his Project work to the PEC for approval within four weeks from the commencement of III Semester. Only after obtaining the approval of the PEC can the student initiate the project work.

viii. The Project Work Review - II in III semester carries internal marks of 100. Evaluation should be done by the PEC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The PEC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work.

ix. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review - II. Only after successful completion of Project Work Review – II, candidate shall be permitted for Project Work Review – III in IV Semester. The unsuccessful students in Project Work Review - II shall reappear for it as and when supplementary examinations are conducted.

x. The Project Work Review - III in IV semester carries 100 internal marks. Evaluation should be done by the PEC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PEC will examine the overall progress of the Project Work and decide whether or not eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review - III. If he fails to obtain the required minimum marks, he has to reappear for Project Work Review - III after a month.

xi. For the approval of PEC the candidate shall submit the draft copy of Thesis to the Head of the Department and make an oral presentation before the PEC.

xii. After approval from the PEC, the students are required to submit a report showing that the plagiarism is within 30%. The Thesis report will be accepted only when the plagiarism is within 30%, which shall be submitted along with the Thesis report.

xiii. Research paper related to the Project Work shall be published in conference proceedings/UGC recognized journal. A copy of the published research paper shall be attached to the Thesis.

xiv. After successful plagiarism check and publication of research paper, three copies of the Thesis certified in the prescribed format given by the supervisor, shall be submitted to the HOD. One copy is to be forwarded to the controller of examinations and one copy to be sent to the external examiner.

xv. The HOD shall submit a panel of three experts for a maximum of **five** students at a time. However, the thesis will be adjudicated by one examiner nominated by the Principal.

xvi. If the report of the examiner is not satisfactory, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PEC. If report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the College.

xvii. If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva Voce exam.

xviii. The Project Viva Voce examinations shall be conducted by a board consisting of the Supervisor, Head of the Department and the External Examiner who has adjudicated the Thesis. For Thesis Evaluation (Viva Voce) in IV semester, there are external marks of 100 and it is evaluated by External Examiner. The candidate has to secure a minimum of 50% marks in Viva Voce exam.

xix. If he fails to fulfill the requirements as specified, he will reappear for the Project Viva Voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree.

2.3.4 Technical Seminar

There shall be a Technical Seminar for internal evaluation of 100 marks. A student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Seminar Evaluation Committee (SEC). Seminar Evaluation Committee shall be constituted with the Head of the Department, seminar supervisor, and seminar coordinator. The SEC is constituted by the Principal on the recommendations of the Head of the Department

The student has to secure a minimum of 50% of marks, to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same as and when supplementary examinations are conducted. The assessment of Technical seminar shall be conducted at the end of II semester instruction by SEC. There shall be no external examination for Technical Seminar.

2.3.5 Co-curricular Activities

The credits assigned for co-curricular activities shall be given by the Head of the Department and the same shall be submitted to the Principal. A Student shall earn 02 credits under the head of co-curricular activities, viz., attending Conference, Scientific Presentations and Other Scholarly Activities.

Following are the guidelines for awarding Credits for Co-curricular Activities

Name of the Activity	Maximum Credits/Activity
Participation in National level Seminar/Conference/ Workshops/ Training programs (Related to Specialization of the Student)	1
Participation in International Level Seminar / Conference / Workshop / Training programs (related to the specialization of the student)	2
Academic Award/Research Award from State Level/National Agencies	1
Academic Award/Research Award from International Agencies	2
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	1
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	2

Note:

(i) Credit shall be awarded only for the first author. Certificate of attendance and participation in a Conference/Seminar is to be submitted for awarding credit.

(ii) Certificate of attendance and participation in workshops and training programs (Internal or External) is to be submitted for awarding credit. The total duration should be at least one week.

(iii) Participation in any activity shall be permitted only once for acquiring required credits under co-curricular activities.

2.3.6 Mandatory Courses

A candidate has to undergo 2 mandatory courses, which carries zero credits.

i. One mandatory course should be a theory course identified by the department, which will be evaluated for 40 marks of Continuous Internal Evaluation. A candidate has to secure a minimum of 50% of marks in the Continuous Internal Evaluation. A re-examination shall be conducted for failed students in the consecutive semester. There shall be no Semester End Examination. However, attendance in mandatory course shall be considered while calculating aggregate attendance in that semester.

ii. Another mandatory course is a MOOCs course to be done by the candidate as suggested by the department. The department shall give a list of standard MOOCs providers among Edx, Udacity, Coursera, NPTEL or any other standard providers with a minimum duration of not less than 8 weeks.

A student shall choose an online course (relevant to his/her programme of study)from the given list of MOOCs providers, with the approval of the HOD. If the student fails in completing the course with in the III semester, he/she must complete the course in the IV semester with the special permission from the Principal/Controller of Examinations.

2.3.7 Audit Courses

Audit courses carry "zero" credits. There shall be 1 audit course in II semester with no Continuous Internal Evaluation and Semester End Examination. However, attendance in audit courses shall be considered while calculating aggregate attendance in a semester. The student should study the audit course, and it shall be indicated in the grade sheet.

2.3.8 Summary - Distribution and Weightage of Marks

S No	Course	Marks	Examination and Evaluation		
1	Theory	60	Semester End Examination for 3 hours duration		
		40	30	Continuous Internal Evaluation (Two midterm examinations, each of 120 minutes duration)	
			10	Average of two assignments, one assignment per each midterm examination	
2	Laboratory	60	Semester End Examination for 3 hours duration		
		40	20	Regularity, viva, observation and record	
			20	Internal exam	
3	Project Work Phase - I and II	300	200	100	A report and presentation shall be made before PEC during Project Work Review - II in III semester of Project Work Phase - I.
				100	A report and presentation shall be made before PEC during Project Work Review - III in IV semester of Project Work Phase - II.
			100	In Project Work Phase - II, if the report of the examiner is favourable, Viva Voce examination shall be conducted by the board, consisting of the Supervisor, Head of the Department and the External Examiner who adjudicated the Thesis.	
4	Technical Seminar	100	A report and a presentation shall be made before a SEC.		
5	Mandatory Theory Course	40	Continuous Internal Evaluation shall be conducted and evaluated similar to theory courses. There shall be no Semester End Examination. However, attendance in mandatory course shall be considered		
	Mandatory MOOC Course	-	Student shall complete a certificate course offered by external agencies.		
6	Audit Courses	-	There shall be no Continuous Internal Evaluation and Semester End Examination. However, attendance in audit course shall be considered		

2.3.9 Re-Registration for Improvement of Continuous Internal Evaluation Marks

Following are the conditions to avail the benefit of improvement of Continuous Internal Evaluation Marks.

i. The candidate should have completed the course work and obtained examinations results for **I, II and III** semesters.
ii. He / She should have passed all the courses for which the Continuous Internal Evaluation marks secured are more than 50%.
iii. Out of the courses the candidate has failed in the examination due to Continuous Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory courses and for a maximum of **three** Theory courses for Improvement of Continuous Internal Evaluation marks.
iv. The candidate has to re-register for the chosen courses before the start of the semester in which re-registration is required and fulfil the academic requirements.
v. For each re-registered course, the candidate has to pay a prescribed fee.

vi. In the event of availing the Improvement of Continuous Internal Evaluation marks, the Continuous Internal Evaluation marks as well as the Semester End Examinations marks secured in the previous attempt(s) for the re-registered courses stand cancelled.

2.3.10 Recounting / Revaluation

Students shall be permitted to apply for Recounting / Revaluation of the Semester End Examination answer scripts against notification within a stipulated period, after payment of the prescribed fee. After completion of the process of Recounting / Revaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the student shall be intimated the same through a notice.

The Revaluation shall be carried out by an expert not less than Associate Professor cadre, as per the scheme of evaluation supplied by the examination branch in the presence of Principal / Controller of Examinations. Neither the students nor his parents shall be permitted to be present during the valuation.

2.3.11 Supplementary Examinations

In addition to the regular Semester End Examinations conducted, the college may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

2.3.12 Withholding of Results

In case of indiscipline or malpractice is pending against a candidate, the result of the candidate shall be withheld and he/she shall not be allowed/promoted to the next higher semester.

2.4 Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institution shall allow up to 40% of the total courses being offered in a particular Programme in a semester through the Online Learning courses through SWAYAM.

i. The institution shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.
ii. The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform.
iii. Student registration for the MOOCs shall be only through the department, it will be mandatory for the student to share necessary information with the department.
iv. The list of MOOCs shall be identified, approved and notified by the Head of the Department.
v. The department shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform department would essentially avoid the courses offered through the curriculum in the offline mode.
vi. The department shall notify at the beginning of semester; the list of the online learning courses eligible for credit transfer in the forthcoming semester.
vii. The department shall also ensure that the student has to complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester.
viii. The department shall designate a faculty member as a mentor for each course to guide the students from registration till completion of the credit course.
ix. The institution shall ensure no overlap of SWAYAM MOOC exams with that of the Semester End Examination schedule. In case of delay in SWAYAM results, the Institute will re-issue the marks sheet for such students.
x. Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
xi. The department shall submit the following to the examination section of the institution:
    a) List of students who have passed MOOC courses in the current semester along with the certificates of completion.
    b) Undertaking form filled by the students for credit transfer.
xii. The Institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and State government.

Note: Students shall also be permitted to register for MOOCs offered through online platforms other than SWAYAM NPTEL. In such cases, credit transfer shall be permitted only after seeking approval of the Institution at least three months prior to the commencement of the semester.

2.5 Student Transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

3 Grading System

3.1 Credits

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 hour of teaching (Lecture / Tutorial) or two hours of practical work / field work per week.

All courses are to be registered by the student in a semester to earn credits which shall be assigned to each course in an L T P C (Lecture Periods; Tutorial Periods; Practical Periods; Credits) structure based on the following general pattern.

Particulars	No. of Credits
1 Hour Lecture (L) per week	1
1 Hour Tutorial (T) per week	1
1 Hour Practical (P) per week	0.5
2 Hours Practical (P) per week	1
Technical Seminar	2
Dissertation / Project Work	26
Mandatory Courses/Audit Courses	0

3.1.1 Total Credits

The curriculum is designed for M.Tech. programme so that the total credits will be 70. To become eligible for the award of degree, every student shall earn all the credits of 70 specified in the curriculum of the programme.

3.2 Award of Grades

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

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Range in which the Marks in the Course fall	Grade	Grade points Assigned
≥ 90	S(Superior)	10
≥ 80 < 90	A (Excellent)	9
≥ 70 < 80	B (Very Good)	8
≥ 60 < 70	C (Good)	7
≥ 50 < 60	D (Average)	6
< 50	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade 'F' or Grade 'Ab' in a course shall be considered failed and will be required to reappear for that course when it is offered in the next supplementary examination.

3.2.1 Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses takenby a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \sum_{i=1}^{n}(C_i \times G_i) \Big/ \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course, G_i is the grade point scored by the student in the i^{th} course and n is the number of courses.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student in all the semesters of aprogramme, i.e.

$$CGPA = \sum_{i=1}^{n}(C_i \times S_i) \Big/ \sum_{i=1}^{n} C_i$$

Where S_i is the SGPA of the i^{th} semester, C_i is the total number of credits up to that semester and n is the number of semesters.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the SGPA, the courses in which the student is awarded Zero gradepoints will also be included.

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

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, and F.

3.3 Award of Degree and Class

A candidate shall be eligible for the award of M.Tech. degree if he/she satisfies the minimum academic requirements prescribed for the completion of the programme, he/she shall be placed in one of the following three classes, based on overall CGPA obtained.

Class Awarded	CGPA Secured
First class with Distinction	≥8
First class	<8 and ≥7
Pass class	<7 and ≥6

4. Exit Policy

The student shall be permitted to exit with a PG Diploma based on his/her request to the institution through the department at the end of first year subject to passing all the courses in first year.

The institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review the policy in the light of periodic changes brought by UGC, AICTE and State government.

5. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent courses as and when courses are offered, subject to Section 1.6 and they will follow the academic regulations into which they are readmitted.

6. General Instructions

i. The academic regulations should be read as a whole for purpose of any interpretation.

ii. Rules for disciplinary action for malpractice / improper conduct in examinations are appended.

iii. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers", respectively.

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

7. Amendments to Regulations

The Academic Council of Sri Venkateswara College of Engineering (Autonomous) reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy, depending on the relevant needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies. The amendments shall be made applicable to all the students on rolls with effect from the dates notified by the institution.

NOTE: FAILURE TO READ AND UNDERSTAND THE RULES & REGULATIONS IS NOT AN EXCUSE

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8 RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS

	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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course 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 course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the notice of Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four 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. The performance of the original candidate who has been impersonated, shall be cancelled in all the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all Semester End Examinations if his involvement is established. Otherwise, the candidate is 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.

	Nature of Malpractices / Improper conduct	**Punishment**
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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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 course only.
6	Refuses to obey the orders of the Chief Superintendent /Assistant - Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. If the candidate physically assaults the invigilator / officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

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

Note: Whenever the performance of a student is cancelled in any course(s) due to Malpractice, he/she has to register again for Semester End Examinations in that course(s) consequently and has to fulfill all the norms required for the award of Degree.

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COURSE STRUCTURE

I Semester

S. No	Course Code	Course Name	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	CS24DPC101	Advanced Data Structures and Algorithms	3	0	0	3	3	40	60	100
2	CS24DPC102	Advanced Operating Systems	3	0	0	3	3	40	60	100
3	CS24DPE101 CS24DPE102 CS24DPE103	**Program Elective Course - I** Machine Learning Object Oriented Software Engineering Digital Image and Video Processing	3	0	0	3	3	40	60	100
4	CS24DPE104 CS24DPE105 CS24DPE106	**Program Elective Course - II** Data Science Design Patterns Information Security	3	0	0	3	3	40	60	100
5	CS24DPC103	Advanced Data Structures and Algorithms Lab	0	0	4	4	2	40	60	100
6	CS24DPC104	Advanced Operating Systems Lab	0	0	4	4	2	40	60	100
7	EC24DRM101	Research Methodology and IPR	2	0	0	2	2	40	60	100
8	EC24DMC101	**Mandatory Course** Entrepreneurship and Incubation	2	0	0	2	0	40	--	40
Total			**14**	**0**	**8**	**22**	**18**	**320**	**420**	**740**

II Semester

S. No	Course Code	Course Name	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	CS24DPC201	Advanced Computer Networks	3	0	0	3	3	40	60	100
2	CS24DPC202	Internet of Things	3	0	0	3	3	40	60	100
3	CS24DPE201 CS24DPE202 CS24DPE203	**Program Elective Course – III** Deep Learning Service Oriented Architecture Computer Vision	3	0	0	3	3	40	60	100
4	CS24DPE204 CS24DPE205 CS24DPE206	**Program Elective Course - IV** Data Visualization Techniques Distributed Systems Privacy Preserving Data Publishing	3	0	0	3	3	40	60	100
5	CS24DPC203	Advanced Computer Networks Lab	0	0	4	4	2	40	60	100
6	CS24DPC204	Internet of Things Lab	0	0	4	4	2	40	60	100
7	CS24DTS201	Technical Seminar	0	0	4	4	2	100	--	100
8	BA24DAC201	**Audit Course** Yoga for Stress Management	2	0	0	2	0	--	--	--
Total			**14**	**0**	**12**	**26**	**18**	**340**	**360**	**700**

III Semester

S. No	Course Code	Course Name	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	CS24DPE301 CS24DPE302 CS24DPE303	**Program Elective Course – V** Software Defined Networks Reinforcement Learning Data Analytics	3	0	0	3	3	40	60	100
2	ME24DOE301 BA24DOE301 MA24DOE301	**Open Elective** Industrial Safety Business Analytics Optimization Techniques	3	0	0	3	3	40	60	100
3	CS24DPR301	Project Work Phase - I	0	0	20	20	10	100	--	100
4	CS24DCA301	Co-curricular Activities	-	-	-	-	2	--	--	--
5	CS24DMC301	MOOCs (Mandatory Course)	-	-	-	-	0	--	--	--
Total			**6**	**0**	**20**	**26**	**18**	**180**	**120**	**300**

IV Semester

S. No	Course Code	Course Name	Contact Periods per Week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
1	CS24DPR401	Project Work Phase - II	0	0	32	32	16	100	100	200
Total			**0**	**0**	**32**	**32**	**16**	**100**	**100**	**200**

M.Tech. – I Semester

L	T	P	C
3	0	0	3

(CS24DPC101) ADVANCED DATA STRUCTURES AND ALGORITHMS

COURSE OBJECTIVES:

The objective of this course are to

- Understand concepts of dictionaries and hash tables.
- Implement lists and trees.
- Analyze usage of B trees, Splay trees and 2-3 trees.
- Understand the importance of text processing and computational Geometry.

COURSE OUTCOMES:

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

CO 1: Understand the implementation of symbol table using hashing techniques
CO 2: Apply advanced abstract data type (ADT) and data structures in solving real world problem
CO 3: Effectively combine the fundamental data structures and algorithmic techniques in building a solution to a given problem
CO 4: Develop algorithms for text processing applications
CO 5: Develop algorithms for advanced tree applications

UNIT I: (9 periods)

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries, Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT II: (9 periods)

Trees: Binary Search Trees (BST), AVL Trees, Red Black Trees: Height of a Red Black Tree, Red Black Trees Bottom-Up Insertion, Top-Down Red Black Trees, Top-Down Deletion in Red Black Trees, Analysis of Operations.

UNIT III: (9 periods)

2-3 Trees , Advantage of 2-3 trees over Binary Search Trees, Search and Update Operations on 2-3 Trees, Analysis of Operations, B-Trees: Advantage of B- trees over BSTs, Height of B-Tree, Search and Update Operations on 2-3 Trees, Analysis of Operations

UNIT IV: (9 periods)

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm

UNIT V: (9 periods)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

Total Periods: 45

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, second Edition, Pearson, 2004.
2. T.H. Cormen, C.E. Leiserson, R.L.Rivest, Introduction to Algorithms, Third Edition Prentice Hall, 2009

REFERENCES:

1. Michael T. Goodrich, Roberto Tamassia, Algorithm Design, First Edition, Wiley, 2006.

M.Tech. – I Semester

L	T	P	C
3	0	0	3

(CS24DPC102) ADVANCED OPERATING SYSTEMS

COURSE OBJECTIVES:

The objective of this course are to

- Read and understand sample open source programs and header files.
- System calls which explore networking and security Applications.
- Acquire the knowledge in the implementation of inter process communication.

COURSE OUTCOMES:

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

CO 1: To explain the functionality of a large software system by reading its source.
CO 2: To revise any algorithm present in a system.
CO 3: Inter process communication mechanism
CO 4: Android mobiles inner process system
CO 5: Build emulators for android applications

UNIT I: **(9 periods)**

Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types - Inodes - Access Rights - System Calls - Overview of Unix Kernels -Model - Implementation - Reentrant Kernels - Address Space - Synchronization - Interprocess Communication - Process Management – Memory Management - Device Drivers.

UNIT II: **(9 periods)**

Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls – Kernel Threads - Destroying Processes -Termination - Removal.

UNIT III: **(9 periods)**

The Virtual File System (VFS) - Role - File Model -System Calls - Data Structures - Super Block, Inode, File, dentry Objects - dentry Cache - Files Associated with a Process - Filesystem Types - Special Files systems – Filesystem Type Registration – Filesystem Handling - Namespaces – Mounting – Unmounting - Implementation of VFS System Calls.

UNIT IV: **(9 periods)**

Windows Operating system - versions, Concepts and tools, Windows internals, System Architecture, Requirements and design goals, Operating system model, Architecture overview. Key system components. System mechanisms - Trap dispatching, object manager, Synchronization, System worker threads, Windows global flags, Local procedural calls, Kernelevent tracing.

UNIT V: **(9 periods)**

What is android, basic building blocks – activities, services, broadcast receivers & content, ui components- views & notifications, components for communication -intents & intent filters, android api levels launching emulator editing emulator settings emulator shortcuts log cat usage, Applications of Android.

Total Periods: 45

TEXT BOOKS:

1. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O'Reilly Publications, 2005.
2. Harold Abelson, Gerald Jay Sussman and Julie Sussman, -Structure and Interpretation of Computer Programs‖, Second Edition, Universities Press, 2013.

REFERENCES:

1. Mark E. Russinovich and David A. Solomon, Microsoft Windows Internals, 4th Edition, Microsoft Press, 2004.

M.Tech. – I Semester

L	T	P	C
3	0	0	3

(CS24DPE101) MACHINE LEARNING

COURSE OBJECTIVES:

The objective of this course are to:

- Understand various key paradigms for machine learning approaches.
- Familiarize with the mathematical and statistical techniques used in machine learning.
- Understand and differentiate among various machine learning techniques.

COURSE OUTCOMES:

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

CO 1: Formulate a machine learning problem.
CO 2: Select an appropriate pattern analysis tool for analysing data in a given feature space.
CO 3: Apply pattern recognition and machine learning techniques such as classification and feature selection to practical applications and detect patterns in the data.
CO 4: Apply clustering algorithms on real time data
CO 5: Apply neural network algorithms

UNIT I: (9 periods)

Introduction: Definitions, Datasets for Machine Learning, Different Paradigms of Machine Learning, Data Normalization, Hypothesis Evaluation, VC-Dimensions and Distribution, Bias-Variance Tradeoff, Regression.

UNIT II: (9 periods)

Bayes Decision Theory: Bayes decision rule, Minimum error rate classification, Normal density and discriminant functions. Parameter Estimation: Maximum Likelihood and Bayesian Parameter Estimation

UNIT III: (9 periods)

Discriminative Methods: Distance-based methods, Linear Discriminant Functions, Decision Tree, Random Decision Forest and Boosting Feature Selection and Dimensionality Reduction: PCA, LDA, ICA, SFFS, SBFS

UNIT IV: (9 periods)

Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labelled and unlabelled data.

UNIT V: (9 periods)

Kernel Machines: Kernel Tricks, SVMs (primal and dual forms), K-SVR, K-PCA Artificial Neural Networks: MLP, Backprop, and RBF-Net

Total Periods: 45

TEXT BOOKS:

1. Shalev-Shwartz,S., Ben-David,S., (2014), Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press.
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition.

REFERENCES:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William WHsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995

M.Tech. – I Semester

L	T	P	C
3	0	0	3

(CS24DPE102) OBJECT ORIENTED SOFTWARE ENGINEERING

COURSE OBJECTIVES:

The objective of this course are to:

- Learn and understand various O-O concepts along with their applicability contexts.
- Give a problem, identify domain objects, their properties, and relationships among them.
- Identify and model/represent domain constraints on the objects and (or) on their relationships
- Learn various modeling techniques to model different perspectives of object-oriented software design (UML)

COURSE OUTCOMES:

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

CO 1: Discuss about software development process models
CO 2: Identify the contemporary issues and discuss about coding standards
CO 3: Recognize the knowledge about testing methods and comparison of various testing techniques.
CO 4: Use the concept and standards of quality and getting knowledge about software quality assurance group.
CO 5: Use software testing methods in project development

UNIT I: **(9 periods)**

Introduction to Software Engineering - Software Development process models – Agile Development - Project & Process - Project management - Process& Project metrics - Object Oriented concepts, Principles & Methodologies.

UNIT II: **(9 periods)**

Software Requirements Specification, Software prototyping - Software project planning - Scope - Resources - Software Estimation - Empirical Estimation Models – Planning - Risk Management - Software Project Scheduling - Object Oriented Estimation & Scheduling.

UNIT III: **(9 periods)**

Analysis Modelling - Data Modelling - Functional Modelling& Information Flow - BehaviouralModelling- Structured Analysis - Object Oriented Analysis - Domain Analysis-Object oriented Analysis process - Object Relationship Model - Object Behaviour Model, Design modelling with UML.

UNIT IV: **(9 periods)**

Design Concepts & Principles - Design Process - Design Concepts - Modular Design - Design Effective Modularity - Introduction to Software Architecture - Data Design - Transform Mapping - Transaction Mapping - Object Oriented Design - System design process- Object design process - Design Patterns.

UNIT V: **(9 periods)**

Top - Down, Bottom-Up, object oriented product Implementation & Integration. Software Testing methods- White Box, Basis Path-Control Structure - Black Box - Unit Testing - Integration testing - Validation & System testing - Testing Tools – Software Maintenance &Reengineering.

Total Periods: 45

TEXT BOOKS:

1. Fairley R, "Software Engineering Concepts", second edition, Tata McGraw Hill, New Delhi, 2003.

2. Jalote P, "An Integrated Approach to Software Engineering", third edition, NarosaPublishers, New Delhi, 2013.

REFERENCES:

1. Grady Booch, James Rumbaugh, Ivar Jacobson - "the Unified Modeling Language User Guide" - Addison Wesley, 1999.
2. Ali Bahrami, "Object Oriented Systems Development" 1st Edition, The McGraw-Hill Company, 1999

M.Tech. – I Semester

L	T	P	C
3	0	0	3

(CS24DPE103) DIGITAL IMAGE AND VIDEO PROCESSING

COURSE OBJECTIVES:

The objective of this course are to:

- Study the image fundamentals and mathematical transforms necessary for image Processing.
- Study the image enhancement techniques
- Study image restoration procedures.
- Study the image compression procedures

COURSE OUTCOMES:

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

CO 1: Review the fundamental concepts of a digital image processing system.
CO 2: Analyse images in the frequency domain using various transforms.
CO 3: Evaluate the techniques for image enhancement and image restoration.
CO 4: Categorize various compression techniques.
CO 5: Apply video encoding techniques

UNIT I: (9 periods)

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing. Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform,
Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms

UNIT II: (9 periods)

Spatial Domain Methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.
Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind de-convolution.

UNIT III: (9 periods)

Image Segmentation: Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour Image Compression: Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.

UNIT IV: (9 periods)

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT V: (9 periods)

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform

based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Total Periods: 45

TEXT BOOKS:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang.1st Ed., PH Int.

REFERENCES:

1. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata Mc Graw Hill publishers, 2009

M.Tech. – I Semester

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(CS24DPE104) DATA SCIENCE

COURSE OBJECTIVES:

The objective of this course are to:

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
- Produce Python code to statistically analyse a dataset;
- Critically evaluate data visualizations based on their design and use for communicating stories from data

COURSE OUTCOMES:

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

CO 1: Explain how data is collected, managed and stored for data science;
CO 2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
CO 3: Implement data collection and management scripts using MongoDB
CO 4: Use data visualization techniques
CO 5: Apply data science techniques in real time

UNIT I: (9 periods)

Introduction to Core Concepts and Technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

UNIT II: (9 periods)

Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

UNIT III: (9 periods)

Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes

UNIT IV: (9 periods)

Data Visualization: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings

UNIT V: (9 periods)

Applications of Data Science, Technologies for visualisation, Bokeh (Python) Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Total Periods: 45

TEXT BOOKS:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press

REFERENCES:

1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press, 2013.
2. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. O'Reilly, 2013.

3. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. Springer, 2009.
4. Avrim Blum, John Hopcroft and RavindranKannan. Foundations of Data Science.2018.
5. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press, 2014.
6. Jiawei Han, MichelineKamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. Morgan Kaufmann, 2011.

M.Tech. – I Semester

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(CS24DPE105) DESIGN PATTERNS

COURSE OBJECTIVES:

The objective of this course are to:

- Understand the concept of Design patterns and its importance.
- Understand the behavioural knowledge of the problem and solutions.
- Relate the Creational, Structural, behavioural Design patterns.
- Apply the suitable design patterns to refine the basic design for given context

COURSE OUTCOMES:

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

CO 1: Identify the appropriate design patterns to solve object oriented design problems.
CO 2: Develop design solutions using creational patterns.
CO 3: Apply structural patterns to solve design problems.
CO 4: Construct design solutions by using structural patterns.
CO 5: Construct design solutions by using behavioral patterns

UNIT I: **(9 periods)**

Introduction: What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT II: **(9 periods)**

A Case Study: Designing a Document Editor : Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary

UNIT III: **(9 periods)**

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Pattern Part-I : Adapter, Bridge, Composite.

UNIT IV: **(9 periods)**

Structural Pattern: Decorator, Façade, Flyweight, Proxy.Behavioural Patterns Part-I : Chain of Responsibility, Command, Interpreter, Iterator.

UNIT V: **(9 periods)**

Behavioral Patterns: Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

Total Periods: 45

TEXT BOOKS:

1. Design Patterns by Erich Gamma, Pearson Education

REFERENCES:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides , Grady Booch Design Patterns: Elements of Reusable Object-Oriented Software

M.Tech. – I Semester

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(CS24DPE106) INFORMATION SECURITY

COURSE OBJECTIVES:

The objective of this course are to:

- Understand basics of Cryptography and Network Security.
- Secure a message over insecure channel by various means.
- Learn about how to maintain the Confidentiality, Integrity and Availability of a Data
- Understand various protocols for network security to protect against the threats in the networks.

COURSE OUTCOMES:

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

CO 1: Provide security of the data over the network.
CO 2: Do research in the emerging areas of cryptography and network security.
CO 3: Implement various networking protocols.
CO 4: Protect any network from the threats in the world
CO 5: Use web security mechanisms in real time projects

UNIT I: (9 periods)

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

UNIT II: (9 periods)

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

UNIT III: (9 periods)

Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

UNIT IV: (9 periods)

Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT V: (9 periods)

Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats.

Total Periods: 45

TEXT BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn IdoDubrawsky, Steve W.Manzuik and Ryan Permeh, wiley Dreamtech,
3. Cryptography and network Security, Third edition, Stallings, PHI/Pearson

REFERENCES:

1. Network Security and Cryptography‖, Bernard Menezes, Cengage Learning.
2. Cryptography and Security‖, C.K. Shymala, N. Harini and Dr.T.R. Padmanabhan, Wiley-India.
3. Applied Cryptography, Bruce Schiener, 2nd edition, John Wiley & Sons.
4. Cryptography and Network Security‖, AtulKahate, TMH.
5. Introduction to Cryptography‖, Buchmann, Springer.
6. N umber Theory in the Spirit of Ramanujan‖, Bruce C.Berndt, University Press
7. Introduction to Analytic Number Theory‖, Tom M.Apostol, University Press

M.Tech. – I Semester

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(CS24DPC103) ADVANCED DATA STRUCTURES AND ALGORITHMS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Implement linear and non linear data structures.
- Analyze various algorithms based on their time complexity.
- Choose appropriate data structure and algorithm design method for a specific application.
- Identify suitable data structure to solve various computing problems.

COURSE OUTCOMES:

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

CO 1: Implement divide and conquer techniques to solve a given problem.

CO 2: Implement hashing techniques like linear probing, quadratic probing, random probing and double hashing/rehashing.

CO 3: Perform Stack operations to convert infix expression into post fix expression and evaluate the post fix expression.

CO 4: Differentiate graph traversal techniques Like Depth First Search, Breadth First Search. Identify shortest path to other vertices using various algorithms.

LIST OF EXPERIMENTS:

- To implement functions of Dictionary using Hashing (division method, Multiplication method, Universal hashing).
- To perform various operations i.e., insertions and deletions on AVL trees.
- To perform various operations i.e., insertions and deletions on 2-3 trees.
- To implement operations on binary heap.
- To implement operations on graphs.
- To implement Depth First Search for a graph non-recursively.
- To implement Breadth First Search for a graph non-recursively.
- To implement Prim's algorithm to generate a min-cost spanning tree.
- To implement Krushkal's algorithm to generate a min-cost spanning tree.
- To implement Dijkstra's algorithm to find shortest path in the graph.

M.Tech. – I Semester

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(CS24DPC104) ADVANCED OPERATING SYSTEMS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Study Linux memory management data structures and algorithms.
- Acquire the knowledge in the implementation of interprocess communication.
- Understand how program execution happens in Linux.

COURSE OUTCOMES:

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

CO 1: Revise any algorithm present in a system.

CO 2: Design a new algorithm to replace an existing one.

CO 3: Appropriately modify and use the data structures of the linux kernel for a different software system

LIST OF EXPERIMENTS:

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Developing Application using Inter Process communication (using shared memory, pipes or message queues)
7. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).

M.Tech. – I Semester

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(EC24DRM101) RESEARCH METHODOLOGY AND IPR

COURSE OBJECTIVES:

The objective of this course are to:

- Understand the purpose and significance of research in academic and professional contexts
- Understand the components of a research proposal
- Understand the importance of selecting appropriate tools and techniques for data collection.
- Understand the process of publishing research in academic journals
- Understand the concept and importance of intellectual property (IP) in research and innovation.

COURSE OUTCOMES:

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

CO 1: Understand research problem formulation.
CO 2: Analyze research related information and Follow research ethics
CO 3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO 4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth & social benefits.

UNIT I: (5 periods)

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 and Necessary instrumentations.

UNIT II: (5 periods)

Effective literature study approaches, analysis Plagiarism, and Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III: (5 periods)

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.

UNIT IV: (5 periods)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V: (5 periods)

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.

Total Periods: 30

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

REFERENCES:

1. Mayall , "Industrial Design", McGraw Hill, 1992.
2. Niebel , "Product Design", McGraw Hill, 1974.
3. Asimov , "Introduction to Design", Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

M.Tech. – II Semester

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(CS24DPC201) ADVANCED COMPUTER NETWORKS

COURSE OBJECTIVES:

The objective of this course are to:

- Understand computer network architectures, protocols, and interfaces.
- Refer the OSI model and the Internet architecture network applications.
- Expose students to the concepts of traditional as well as modern day
- Computer networks - wireless and mobile, multimedia-based.
- Understand the key concepts and practices employed in modern computer networking

COURSE OUTCOMES:

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

CO 1: Analyze computer network architectures and estimate quality of service
CO 2: Design application-level protocols for emerging networks
CO 3: Analyze TCP and UDP traffic in data networks
CO 4: Design and analyze medium access methods, routing algorithms and IPv6 protocol for data networks
CO 5: Analyze Data Center Networks and Optical Networks

UNIT I: (9 periods)

Network Architecture, Performance: Bandwidth and Latency, High Speed Networks, Network- Centric View, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks, Overlay Networks: Routing Overlays, Peer-to-Peer Networks and Content Distribution Networks, Client-Server Networks, Delay- Tolerant Networks,

UNIT II: (9 periods)

Switching: Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Message- Switched Networks, Asynchronous Transfer Mode: Evolution, Benefits, Concepts, Exploring Broadband Integrated Services Digital Network, Layer and Adaptation Layer, IPv4: Address Space, Notations, Classful, Classless, Network Address Translation, Datagram

UNIT III: (9 periods)

Fragmentation and Checksum IPv6 Addresses: Structure, Address Space, Packet Format and Extension Headers, ICMP, IGMP, ARP, RARP, Congestion Control and Resource Allocation: Problem, Issues, Queuing, TCP Congestion Control, Congestion-Avoidance Mechanisms and Quality of Service,

UNIT IV: (9 periods)

Internetworking: Intra-Domain and Inter-Domain Routings, Unicast Routing Protocols: RIP, OSPF and BGP, Multicast Routing Protocols: DVMRP, PIM-DM, PIM-SM, CBT, MSDP and MOSPF, Spanning Tree Algorithm, Optical Networking: SONET/SDH Standards, Traffic Engineering: Requirement, Traffic Sizing, Characteristics, Protocols, Time and Delay Considerations, Connectivity, Availability, Reliability and Maintainability and Throughput.

UNIT V: (9 periods)

Multimedia Over Internet: Transmission, IP Multicasting and VoIP, Domain Name System: Name Space, Domain Name Space, Distribution, Domains, Resolutions and Dynamic Domain Name System, SNMP, Security: IPSec, SSL/TLS, PGP and Firewalls, Datacenter Design and Interconnection Networks.

Total Periods: 45

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. Davie, Computer Networks: A System Approach, Fifth Edition, Morgan Kaufmann, Elsevier, 2012.

2. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, Fifth Edition, 2017.
3. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber Security, CRC press, Taylor & Francis Group, 2014
4. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Pearson, 5th Edition, 2014.

REFERENCES:

1. Satish Jain Advanced Computer Networking: Concepts and Applications

M.Tech. – II Semester

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(CS24DPC202) INTERNET OF THINGS

COURSE OBJECTIVES:

The objective of this course are to:

- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

COURSE OUTCOMES:

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

CO 1: Choose the sensors and actuators for an IoT application
CO 2: Select protocols for a specific IoT application
CO 3: Utilize the cloud platform and APIs for IoT applications
CO 4: Experiment with embedded boards for creating IoT prototypes
CO 5: Design a solution for a given IoT application

UNIT I: (9 periods)

Overview of IoT: The Internet of Things: An Overview, The Flavor of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.
Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

UNIT II: (9 periods)

Embedded Devices: Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

UNIT III: (9 periods)

Communication in the IoT: Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols
Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

UNIT IV: (9 periods)

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups.
Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

UNIT V: (9 periods)

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software.
Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Total Periods: 45

TEXT BOOKS:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

REFERENCES:

1. Haider Raad Fundamentals of IoT and Wearable Technology Design, Wiley Publications 2020.
2. KashishAraShakil, Samiya Khan, Internet of Things (IoT) Concepts and Applications,Springer Publications 2020.

M.Tech. – II Semester

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(CS24DPE201) DEEP LEARNING

COURSE OBJECTIVES:

The objective of this course are to:

- Present the mathematical, statistical and computational challenges of building neural networks.
- Teach the concepts of deep learning.
- Introduce dimensionality reduction techniques.
- Enable the students to know deep learning techniques to support real-time applications.
- Explain the case studies of deep learning techniques.

COURSE OUTCOMES:

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

CO 1: Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO 2: Implement deep learning algorithms and solve real-world problems.
CO 3: Apply dimensionality reduction techniques
CO 4: Apply neural networks algorithms
CO 5: Use deep learning case studies in real world

UNIT I: (9 periods)

Introduction: Introduction to machine learning- Linear models (SVMs and Perceptron's, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT II: (9 periods)

Deep Networks: History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets- Deep Vs Shallow Networks Convolutional Networks - Generative Adversarial Networks (GAN), Semi- supervised Learning.

UNIT III: (9 periods)

Dimensionality Reduction: Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

UNIT IV: (9 periods)

Optimization and Generalization: Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT V: (9 periods)

Case Study and Applications: Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

Total Periods: 45

TEXT BOOKS:

1. Deep Learning", Ian Goodfellow, YoshuaBengio , Aaron Courville, MIT Press 2016.

REFERENCES:

1. "Neural Networks and Deep Learning A Text Book", Charu C Aggarwal, Springer International Publishing AG, Part of Springer Nature 2018.

M.Tech. – II Semester

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(CS24DPE202) SERVICE ORIENTED ARCHITECTURE

COURSE OBJECTIVES:

The objective of this course are to:

- Understand SOA and evolution of SOA.
- Understand web services and primitive, contemporary SOA.
- Understand various service layers.
- Understand service-oriented analysis and design based on guidelines.

COURSE OUTCOMES:

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

CO 1: Comprehend the need for SOA and its systematic evolution
CO 2: Apply SOA technologies to enterprise domain
CO 3: Design and analyse various SOA patterns and techniques
CO 4: Compare and evaluate best strategies and practices of SOA
CO 5: Apply service oriented design techniques

UNIT I: (9 periods)

Introducing SOA: Fundamental SOA, Common Characteristics of Contempo rary SOA, Common, Tangible Benefits of SOA, Common Pitfalls of Adopting SOA.
The Evolution of SOA: An SOA Timeline, The Continuing Evolution of SOA, The Roots of SOA.

UNIT II: (9 periods)

Web Services and Primitive SOA: The Web Services Frame Work, Services, Service Descriptions, Messaging.
Web Services and Contemporary SOA (Part I-Activity management and Composition): Message Exchange Patterns, Service Activity, Coordination, Atomic Transactions, Orchestration, and Choreography.
Web Services and Contemporary SOA (Part-II-Advanced Messaging, Metadata and Security): Addressing, Reliable Messaging, Correlation, Policies, Metadata exchange, Security.

UNIT III: (9 periods)

Principles of Service-Orientation: Service–Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service–Orientation, Interrelation between Principles of Service-Orientation, Service Orientation and Object Orientation, Native Web Services Support for Principles of Service - Orientation.
Service Layers: Service-Orientation and Contemporary SOA, Service Layer abstraction, Application, Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service, Layer Configuration Scenarios.

UNIT IV: (9 periods)

SOA Delivery Strategies: SOA Delivery Lifecycle Phases, The Top-Down Strategy, The Bottom-up Strategy, The Agile Strategy.
Service Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business Centric SOA, Deriving Business Services.
Service Oriented Analysis (Part-II-Service Modelling): Service Modelling, Service Modelling Guidelines, Classifying Service Model Logic, Contrasting Service Modelling Approaches.
Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL Related XML Schema Language Basics, WSDL Language Basics, Service Interface Design Tools.
Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing Steps, Considerations for Choosing Service Layers, Considerations for Positioning Core SOA Standards, Considerations for Choosing SOA Extensions.

UNIT V: **(9 periods)**

Service Oriented Design (Part III- Service Design): Service Design Overview, Entity-Centric Business Service Design, Application Service Design, Task-Centric Business Service Design, Service Design Guidelines.

Service Oriented Design (Part IV-Business Process Design): WS-BPEL Language Basics, WS - Coordination Overview, Service Oriented Business Process Design.

Total Periods: 45

TEXT BOOKS:

1. Service-Oriented Architecture-Concepts, Technology, and Design, Thomas Erl, Pearson Education, 2006.
2. Understanding SOA with Web Services, Eric Newcomer, Greg Lomow, Pearson Education, 2005.

REFERENCES:

1. Thomas Erl; Service Oriented Architecture Concepts Technology & Design, Pearson Education Limited; 2015, ISBN-13: 9788131714904.
2. Guido Schmutz, Peter Welkenbach, Daniel Liebhart; Service Oriented Architecture An Integration Blueprint; Shroff Publishers & Distributors; 2010, ISBN-13: 9789350231081

M.Tech. – II Semester

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(CS24DPE203) COMPUTER VISION

COURSE OBJECTIVES:

The objective of this course are to:

- Be familiar with both the theoretical and practical aspects of computing with images.
- Have described the foundation of image formation, measurement, and analysis.
- Understand the geometric relationships between 2D images and the 3D world.
- Grasp the principles of state-of-the-art deep neural networks

COURSE OUTCOMES:

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

CO 1: Develop the practical skills necessary to build computer vision applications.
CO 2: To have gained exposure to object and scene recognition and categorization from images
CO 3: Apply segmentation techniques
CO 4: Use feature extraction techniques
CO 5: Apply classifiers in real world

UNIT I: **(9 periods)**

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis

UNIT II: **(9 periods)**

Edge detection, Edge detection performance, Hough transform, corner detection

UNIT III: **(9 periods)**

Segmentation, Morphological filtering, Fourier transform

UNIT IV: **(9 periods)**

Feature extraction, shape, histogram, colour, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing

UNIT V: **(9 periods)**

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.

Total Periods: 45

TEXT BOOKS:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.

REFERENCES:

1. Deep Learning, by Goodfellow, Bengio, and Courville.
2. Dictionary of Computer Vision and Image Processing, by Fisher et al.

M.Tech. – II Semester

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3	0	0	3

(CS24DPE204) DATA VISUALIZATION TECHNIQUES

COURSE OBJECTIVES:

The objective of this course are to:

- Develop skills to both design and critique visualizations.
- Introduce visual perception and core skills for visual analysis.
- Understand visualization for time-series analysis.
- Understand visualization for ranking analysis.
- Understand visualization for deviation analysis.

COURSE OUTCOMES:

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

CO 1: Explain principles of visual perception
CO 2: Apply core skills for visual analysis
CO 3: Apply visualization techniques for various data analysis tasks
CO 4: Design information dashboard
CO 5: Apply geo spatial data techniques

UNIT I: (9 periods)

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction analytical patterns – pattern examples.

UNIT II: (9 periods)

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis - multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

UNIT III: (9 periods)

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

UNIT IV: (9 periods)

Advantages of Graphics - Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together-Unveiling the dashboard.

UNIT V: (9 periods)

Plotting Geospatial Data: Introduction to Geoplotlib, Design Principles of Geoplotlib, Geospatial Visualizations, Plotting Geospatial Data on a Map Web-Based Visualizations: Concepts of Bokeh, Interfaces-Plotting and Model Interfaces, Output, Bokeh Server, Presentation, Integrating – HTML Document and Bokeh Applications.

Total Periods: 45

TEXT BOOKS:

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Mario Dobler, Tim Grobmann, "Data Visualization with Python", O'Reilly, First Edition, 2019

REFERENCES:

1. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.

M.Tech. – II Semester

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3	0	0	3

(CS24DPE205) DISTRIBUTED SYSTEMS

COURSE OBJECTIVES:

The objective of this course are to:

- Introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

COURSE OUTCOMES:

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

CO 1: Design trends in distributed systems.
CO 2: Apply network virtualization.
CO 3: Apply remote method invocation and objects
CO 4: Use reliability techniques in distributed systems
CO 5: Apply load balancing algorithms

UNIT I: **(9 periods)**

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

Distributed Database Management System Architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

UNIT II: **(9 periods)**

Distributed Database Design: Alternative design strategies; Distributed design issues; Fragmentation; Data Allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control

Query Processing Issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

UNIT III: **(9 periods)**

Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

Transaction Management: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

Concurrency Control: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

UNIT IV: **(9 periods)**

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

UNIT V: **(9 periods)**

Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing

Advanced Topics: Mobile Databases, Distributed Object Management, Multi-databases

Total Periods: 45

TEXT BOOKS:

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.

REFERENCES:

1. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

M.Tech. – II Semester

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(CS24DPE206) PRIVACY PRESERVING DATA PUBLISHING

COURSE OBJECTIVES:

The objective of this course are to:

- Decide, given an application, if it should be formulated as a data privacy problem. If yes, the students will be able to formally define the problem and state what properties can be guaranteed by applying differential privacy.
- Understanding of how (and why) randomness (or uncertainty) provides privacy protection.
- Analyse real-world privacy problems, identify which privacy-preserving methods are appropriate, and implement the private algorithms in code.
- Evaluate and compare privacy-preserving algorithms.

COURSE OUTCOMES:

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

CO 1: Apply anonymization methods for sensitive data protection
CO 2: Apply state-of-art techniques for data privacy protection
CO 3: Design privacy preserving algorithms for real-world applications
CO 4: Identify security and privacy issues in OLAP systems
CO 5: Apply information metrics for Maximizing the preservation of information in the anonymization process

UNIT I: **(9 periods)**

Fundamentals of defining privacy and developing efficient algorithms for enforcing privacy, challenges in developing privacy preserving algorithms in real-world applications, privacy issues, privacy models,

UNIT II: **(9 periods)**

Anonymization operations, information metrics, Anonymization methods for the transaction data, trajectory data, social networks data, and textual data, Collaborative Anonymization

UNIT III: **(9 periods)**

Access control of outsourced data, Use of Fragmentation and Encryption to Protect Data Privacy, Security and Privacy in OLAP systems.

UNIT IV: **(9 periods)**

Extended Data publishing Scenarios, Anonymization for Data Mining, publishing social science data,

UNIT V: **(9 periods)**

Continuous user activity monitoring (like in search logs, location traces, energy monitoring), social networks, recommendation engines and targeted advertising.

Total Periods: 45

TEXT BOOKS:

1. Benjamin C.M. Fung, Ke Wang, Ada Wai-Chee Fu and Philip S. Yu, Introduction to Privacy Preserving
2. Data Publishing: Concepts and Techniques, 1st Edition, Chapman & Hall/CRC, 2010.

REFERENCES:

1. Bee-Chung Chen, Daniel Kifer, Ashwin Machanavajjhala, Kristen LeFevre Privacy-Preserving Data Publishing ,Now Publishers Inc, 2009.

M.Tech. – II Semester

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(CS24DPC203) ADVANCED COMPUTER NETWORKS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

COURSE OUTCOMES:

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

CO 1: Develop programs for client-server applications
CO 2: Perform packet sniffing and analyze packets in network traffic.
CO 3: Implement error detecting and correcting codes
CO 4: Implement network security algorithms

LIST OF EXPERIMENTS:

1. Implementation of client server programs for different network applications
2. Study and analysis of the network using Wireshark network protocol analyser
3. Implementation of topology generation for network simulation
4. Implementation of queuing management
5. Implementation of MAC-layer protocols
6. Implementation of routing protocols
7. Implementation of transport-layer protocols
8. Implementation of network security mechanisms

M.Tech. – II Semester

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(CS24DPC204) INTERNET OF THINGS LAB

COURSE OBJECTIVES:

The objective of this course are to:

- Know the different real time sensors used to measure the different electrical parameters and to control the different devices from anywhere through IOT.

COURSE OUTCOMES:

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

CO 1: The students will be thorough about the technology behind the IoT and associated technologies

CO 2: The students will be able to use the IoT technologies in practical domains of society

CO 3: The students will be able to gain knowledge about the state of the art methodologies in IoT application domains.

LIST OF EXPERIMENTS:

1. Exercise on Eclipse IoT Project.
2. Experiments on few Eclipse IoT Projects.
3. Any Experiment on architecture of Iot Toolkit.
4. Exercise on smart object API Gateway service reference implementation in IoTToolkit.
5. Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit.
6. Experiment on Gate way as a service deployment in IoT Toolkit.
7. Experiment on application framework and embedded software agents for IoT Toolkit

M.Tech. – II Semester

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2	0	0	2

(BA24DAC201) YOGA FOR STRESS MANAGEMENT

COURSE OBJECTIVES:

The objective of this course are to:

- Achieve overall health of body and mind
- Overcome stress

COURSE OUTCOMES:

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

CO 1: Develop healthy mind in a healthy body thus improving social health also

CO 2: Improve efficiency

UNIT I: **(6 periods)**

Definitions of Eight parts of yog. (Ashtanga)

UNIT II: **(6 periods)**

Yam and Niyam.

UNIT III: **(6 periods)**

Do`s and Don't' sin life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV: **(6 periods)**

Asan and Pranayam

UNIT V: **(6 periods)**

i) Various yogposes and their benefits for mind &body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Total Periods: 30

TEXT BOOKS:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yoga bhyasi Mandal, Nagpur
2. "Rajayogaor conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

REFERENCES:

1. Bee-Chung Chen, Daniel Kifer, Ashwin Machanavajjhala, Kristen LeFevre Privacy-Preserving Data Publishing ,Now Publishers Inc, 2009.

M.Tech. – III Semester

L	T	P	C
3	0	0	3

(CS24DPE301) SOFTWARE DEFINED NETWORKS

COURSE OBJECTIVES:

The objective of this course are to:

- Introduce about software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network.

COURSE OUTCOMES:

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

- **CO 1:** Differentiate between traditional networks and software defined networks and understand the key benefits and use cases of SDN.
- **CO 2:** Interpret the SDN data plane devices and OpenFlow Protocols
- **CO 3:** Implement the operation of SDN control plane with different controllers
- **CO 4:** Apply techniques that enable applications to control the underlying network using SDN
- **CO 5:** Evaluate Network Functions Virtualization components and their roles in SDN

UNIT I: (9 periods)

Evolving Network Requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

UNIT II: (9 periods)

SDN Data Plane: Data plane Functions, Data plane protocols, Open flow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table-Open Flow Protocol.

UNIT III: (9 periods)

SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- OpenDaylight-REST- Cooperation and Coordination Among Controllers

UNIT IV: (9 periods)

SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring Security- Data Centre Networking- Mobility and Wireless.

UNIT V: (9 periods)

Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration

Total Periods: 45

TEXT BOOKS:

1. Paul Goransson Chuck Black Timothy Culver: Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, 2016.
2. Ken Gray Thomas Nadeau: Network Function Virtualization, Morgan Kaufmann, 2016.

REFERENCES:

1. Larry Peterson , Carmelo Cascone , Bruce Davie: Software-Defined Networks: A Systems Approach, Systems Approach, 2021

M.Tech. – III Semester

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(CS24DPE302) REINFORCEMENT LEARNING

COURSE OBJECTIVES:

The objective of this course are to:

- Statistical learning techniques where an agent explicitly takes actions and interacts with the world.

COURSE OUTCOMES:

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

CO 1: Formulate Reinforcement Learning problems
CO 2: Apply various Tabular Solution Methods to Markov Reward Process Problems
CO 3: Apply various Iterative Solution methods to Markov Decision Process Problems
CO 4: Apply temporal difference methods in real time
CO 5: Comprehend Function approximation methods

UNIT I: (9 periods)

Introduction: Introduction to Reinforcement Learning (RL) – Difference between RL and Supervised Learning, RL and Unsupervised Learning. Elements of RL, Markov property, Markov chains, Markov reward process (MRP).

UNIT II: (9 periods)

Evaluative Feedback - Multi-Arm Bandit Problem: An n-Armed Bandit Problem, Exploration vs Exploitation principles, Action value methods, Incremental Implementation, tracking a non- stationary problem, optimistic initial values, upper-confidence-bound action selection, Gradient Bandits. Introduction to and proof of Bellman equations for MRPs

UNIT III: (9 periods)

Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations. Dynamic Programming (DP): Overview of dynamic programming for MDP, principle of optimality, Policy Evaluation, Policy Improvement, policy iteration, value iteration, asynchronous DP , Generalized Policy Iteration

UNIT IV: (9 periods)

Monte Carlo Methods for Prediction and Control: Overview of Monte Carlo methods for model free RL, Monte Carlo Prediction, Monte Carlo estimation of action values, Monto Carlo Control, On policy and off policy learning, Importance sampling.
Temporal Difference Methods: TD Prediction, Optimality of TD(0), TD Control methods - SARSA, Q-Learning and their variants.

UNIT V: (9 periods)

Eligibility Traces: n-Step TD Prediction, Forward and Backward view of TD(λ), Equivalence of forward and backward view, Sarsa(λ), Watkins's Q(λ), Off policy eligibility traces using importance of sampling.
Function Approximation Methods: Value prediction with function approximation, gradient descent methods, Linear methods, control with function approximation.

Total Periods: 45

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction", 2nd Edition, The MIT Press.
2. CsabaSzepesvari – Algorithms for Reinforcement Learning – Morgan & Claypool, 2010.

REFERENCES:

1. Reinforcement Learning By Richard S. (University Of Alberta) Sutton,Andrew G. (Co- Director Autonomous Learning Laboratory) Barto

M.Tech. – III Semester

L	T	P	C
3	0	0	3

(CS24DPE303) DATA ANALYTICS

COURSE OBJECTIVES:

The objective of this course are to:

- Explore the fundamental concepts of data analytics.
- Learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- Understand the various search methods and visualization techniques.

COURSE OUTCOMES:

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

CO 1: Understand the ideas of statistical approaches to learning

CO 2: Understand the significance of exploratory data analysis (EDA) in data science and apply basic tools (plots, graphs, summary statistics) to perform EDA

CO 3: Apply basic machine learning algorithms (Linear Regression, k-Nearest Neighbors (k-NN), k-means, Naive Bayes) for predictive modeling. Explore the merits of Naive Bayes technique

CO 4: Recognize the characteristics of machine learning techniques that are useful to solve real-world problems

CO 5: Apply data visualization techniques

UNIT I: **(9 periods)**

Introduction: What is Data Science? Big Data and Data Science hype and getting past the hype, Why now?, Datafication, Current landscape of perspectives, Skill sets, Life cycle of Data Science, Different phases.

UNIT II: **(9 periods)**

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm), Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (k-NN), k-means.

UNIT III: **(9 periods)**

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web, Feature Generation and Feature Selection (Extracting Meaning From Data), Motivating application: user (customer) retention,

UNIT IV: **(9 periods)**

Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms: Filters; Wrappers; Decision Trees; Random Forests, Recommendation Systems: Building a User- Facing Data Product: Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

UNIT V: **(9 periods)**

Data Visualization: Basic principles, ideas and tools for data visualization, Case study on industry projects,

Exercise: create your own visualization of a complex dataset, Data Science and Ethical **Issues:** Discussions on privacy, security, ethics, A look back at Data Science, Next-generation data scientists.

Total Periods: 45

TEXT BOOKS:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly, 2014.
2. Jure Leskovek, AnandRajaraman and Jerey Ullman. Mining of Massive Datasets, Cambridge University Press, 2014.

REFERENCES:

1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press, 2013.
2. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. O'Reilly, 2013.
3. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. Springer, 2009.
4. Avrim Blum, John Hopcroft and RavindranKannan. Foundations of Data Science.2018.
5. Mohammed J. Zaki and Wagner Miera Jr. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press, 2014.
6. Jiawei Han, MichelineKamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition. Morgan Kaufmann, 2011.

M.Tech. – III Semester

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(ME24DOE301) INDUSTRIAL SAFETY

COURSE OBJECTIVES:

The objective of this course are to:

- Know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- Understand about fire and explosion, preventive methods, relief and its sizing methods
- Analyse industrial hazards and its risk assessment.

COURSE OUTCOMES:

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

CO 1: To list out important legislations related to health, Safety and Environment.
CO 2: To list out requirements mentioned in factories act for the prevention of accidents.
CO 3: To understand the health and welfare provisions given in factories act.

UNIT I: (9 periods)

Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II: (9 periods)

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III: (9 periods)

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants- types and applications, Lubrication methods, general sketch, working andapplications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV: (9 periods)

Fault Tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V: (9 periods)

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Total Periods: 45

TEXT BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

REFERENCES:

1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

M.Tech. – III Semester

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(BA24DOE301) BUSINESS ANALYTICS

COURSE OBJECTIVES:
The objective of this course are to:
- Give the student a comprehensive understanding of business analytics methods.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
- **CO 1:** Students will demonstrate knowledge of data analytics.
- **CO 2:** Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- **CO 3:** Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- **CO 4:** Students will demonstrate the ability to translate data into clear, actionable insights.
- **CO 5:** Apply business intelligence in real world

UNIT I: (9 periods)
Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

UNIT II: (9 periods)
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

UNIT III: (9 periods)
Forming Requirements: Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive
Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT IV: (9 periods)
Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

UNIT V: (9 periods)
Recent Trends: Embedded and colleborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

Total Periods: 45

TEXT BOOKS:
1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

REFERENCES:
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

M.Tech. – III Semester

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(MA24DOE301) OPTIMIZATION TECHNIQUES

COURSE OBJECTIVES:

The objective of this course are to:

- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
- Learn classical optimization techniques and numerical methods of optimization.
- Know the basics of different evolutionary algorithms.
- Explain Integer programming techniques and apply different optimization techniques to solve various models arising from engineering areas.

COURSE OUTCOMES:

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

CO 1: Explain the fundamental knowledge of Linear Programming and Dynamic Programming problems.
CO 2: Use classical optimization techniques and numerical methods of optimization.
CO 3: Describe the basics of different evolutionary algorithms.
CO 4: Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems arising from engineering areas
CO 5: Apply optimization in design and manufacturing systems

UNIT I: (9 periods)

Linear Programming (L.P): Revised Simplex Method, Duel simplex Method, Sensitivity Analysis

Dynamic Programming (D.P): Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.

UNIT II: (9 periods)

Classical Optimization Techniques: Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical Methods for Optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method

UNIT III: (9 periods)

Modern Methods of Optimization: GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators-reproduction, crossover, mutation

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA &GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems

UNIT IV: (9 periods)

Integer Programming: Graphical Representation, Gomory's Cutting Plane Method,Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method

UNIT V: (9 periods)

Applications of Optimization in Design and Manufacturing Systems: Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Total Periods: 45

TEXT BOOKS:

1. Engineering Optimization (4th Edition) by S.S.Rao, New Age International

REFERENCES:

1. Optimization for Engineering Design by Kalyanmoy Deb, PHI Publishers
2. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
3. Operations Research by Hillar and Liberman, TMH Publishers
4. Optimal design – JasbirArora, McGraw Hill (International) Publisher