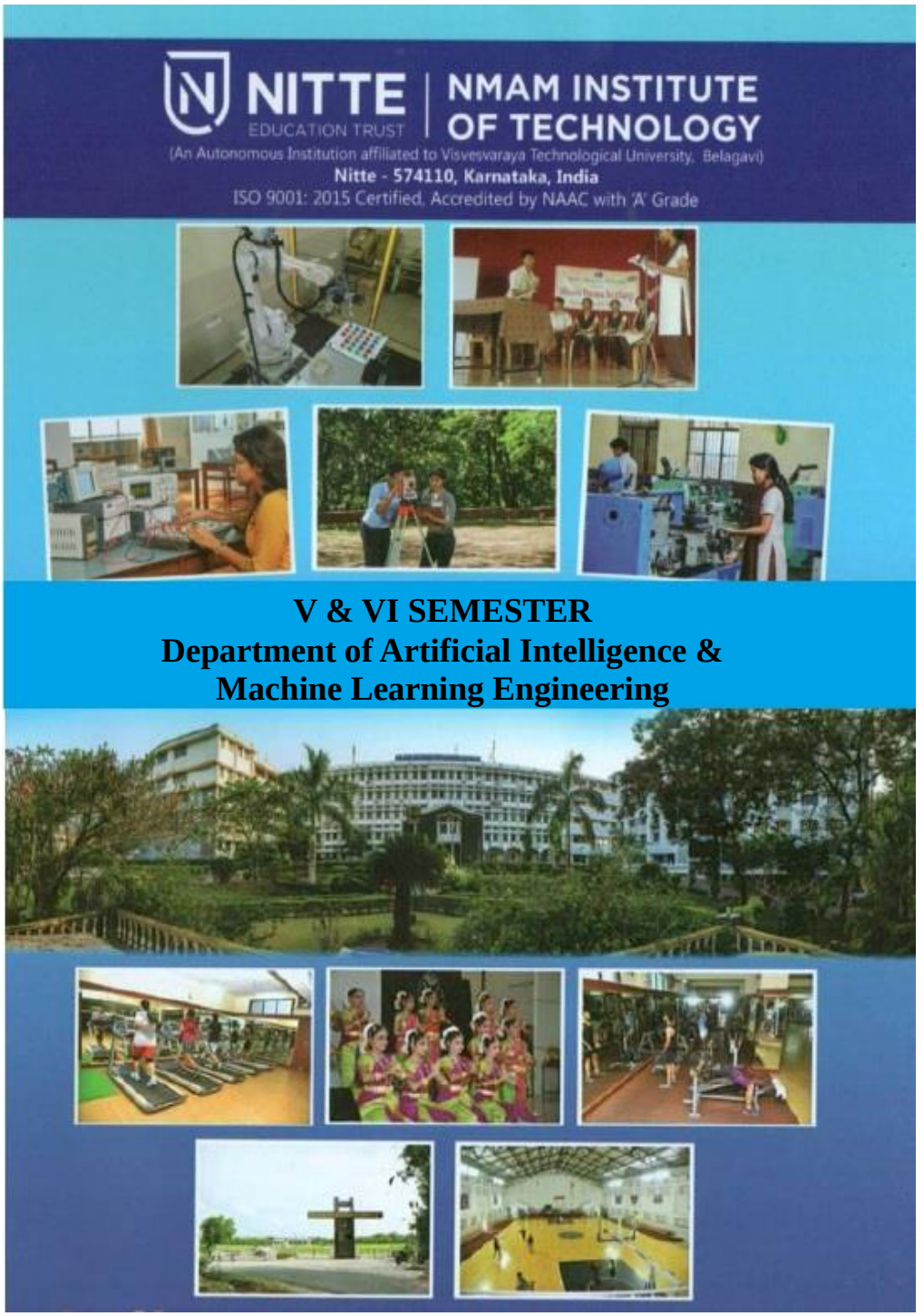
NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

College Calendar 2023-24

Department of Artificial Intelligence & Machine Learning Engineering

Syllabus of 3rd Year



College Calendar 2023-24

मातेव रक्षति पितेव हिते नियुङ्क्ते
कान्तेव चापि रमयत्यपनीय खेदम् ।
लक्ष्मीं तनोति वितनोति च दिक्षु कीर्तिं
किं किं न साधयति कल्पलतेव विद्या ॥

ಮಾತೇವ ರಕ್ಷತಿ ಪಿತೇವ ಹಿತೇ ನಿಯುಂಕ್ತೇ
ಕಾಂತೇವ ಚಾಪಿ ರಮಯತ್ಯಪನೀಯ ಖೇದಮ್ ।
ಲಕ್ಷ್ಮೀಂ ತನೋತಿ ವಿತನೋತಿ ಚ ದಿಕ್ಷು ಕೀರ್ತಿಂ
ಕಿಂ ಕಿಂ ನ ಸಾಧಯತಿ ಕಲ್ಪಲತೇವ ವಿದ್ಯಾ ॥

ತಾಯಿಯಂತೆ ರಕ್ಷಣೆಯನ್ನಿತ್ತು, ತಂದೆಯಂತೆ ಸನ್ಮಾರ್ಗದಲ್ಲಿ ತೊಡಗಿಸಿ ಪತ್ನಿಯಂತೆ ದುಃಖವನ್ನು ದೂರಮಾಡಿ ಮನಕ್ಕೆ ಮುದಕೊಡುತ್ತಾ, ಸಂಪತ್ತನ್ನು ವರ್ಧಿಸಿ ದಶದಿಕ್ಕುಗಳಲ್ಲಿ ಕೀರ್ತಿಯನ್ನು ಪಸರಿಸುವ 'ವಿದ್ಯೆ', ಕಲ್ಪಲತೆಯಂತೆ ನಾವು ಬಯಸಿದ್ದನ್ನು ಕೊಡುತ್ತಾಳೆ.

विद्या माता की तरह पालन करती है, बाप के तरह हितकर मार्ग में ही ले लेता है। पत्नी की तरह हमारा दुःख दूर करता है। मन को संतोष देता है, धन देती है, दिशाओं में कीर्ति फ़ैलाती है । कल्पवल्ली की तरह वह सब कामनाये पूरी करती है ।

Do you know in how many ways the 'Knowledge' serves his master? Like mother it protects, like father it teaches and guides, like wife, provides all kinds of happiness after destroying all sorrows, it brings wealth from every corner and spreads the fame in all direction. Like 'Kalpalatha' knowledge offers everything to human being whatever he wishes.

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

(An Autonomous Institution affiliated to VTU, Belgavi)
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India
ISO 9001:2015 Certified, Accredited by NAAC with "A" Grade

COLLEGE CALENDAR
2023-24
(V & VI Semester)

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

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Vision Statement

Pursuing Excellence, Empowering people, Partnering in CommUNITy Development

Mission Statement

To develop N.M.A.M. Institute of Technology, Nitte, as Centre of Excellence by imparting Quality Education to generate competent,
Skilled and Humane Manpower to face emerging Scientific, Technological, Managerial and Social Challenges
with Credibility, Integrity, Ethics and Social Concern.

In Memorium

Late Nitte Mahalinga Adyanthaya

Our Founder

Late Justice K. S. Hegde
1909-1990

SRI N. VINAYA HEGDE

President, Nitte Education Trust
Chancellor, Nitte (Deemed to be University), Mangaluru

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

Sl.No.	Name of the Faculty	Designation
1.	Dr. N. Niranjan Chiplunkar	Principal
2.	Mr. Yogeesh Hegde	Director(CM&D)
3.	Dr. Shrinivasa Rao B. R.	Vice Principal/Controller of Examinations/Professor
4.	Dr. I. Ramesh Mithanthaya	Vice Principal / Dean (Academic)/Professor
5.	Dr. Sudesh Bekal	Dean (R&D)/Professor
6.	Dr. Rajesh Shetty K.	Dean (Admissions)/Professor
7.	Dr. Rekha Bhandarkar	Deputy Registrar of Nitte Off-campus Centre, Nitte (DU)
8.	Dr. Subrahmanya Bhat K	Deputy COE of Nitte Off-campus Centre, Nitte (DU)
9.	Dr. Nagesh Prabhu	Director(Curriculum Development) Nitte (DU)
10.	Dr. Srinath Shetty K.	Resident Engineer/Professor
11.	Dr. Narasimha Bailkeri	Dean(Student Welfare)/Professor
12.	Dr. Rajalakshmi Samaga BL	PG Coordinator/Professor

HEADS OF DEPARTMENTS

1.	Dr. Arun Kumar Bhat	HoD, Civil Engg.
2.	Dr. Jyothi Shetty	HoD, Comp. Science & Engg
3.	Dr. Ashwini B	HoD, Information Science & Engg
4.	Dr. Ujwal P	HoD, Biotechnology
5.	Dr. KVSSSS Sairam	HoD, E&C Engg.
6.	Dr. Suryanarayana K	HoD, E&E Engg.
7.	Dr. Muralidhara	HoD, Robotics & Artificial Intelligence
8.	Dr. Kumudakshi	HoD, Mathematics
9.	Dr. Shobha R. Prabhu	HoD, Physics
10.	Dr. Shivaprasad Shetty M.	HoD, Chemistry
11.	Dr. Mamatha Balipa	HoD, MCA
12.	Dr. Vishwanatha	HoD, Humanities
13.	Dr. Udaya Kumar K Shenoy	HoD, Computer & Communication Engg
14.	Dr. Sharada Uday Shenoy	HoD, Artificial Intelligence & Machine Learning

15.	Dr. Srinivas Pai P	HoD, Mechanical Engg
16.	Dr. Venugopala PS	HoD, Artificial Intelligence & Data Science
17.	Mr. Bharath G Kumar	Head, Training & Placement Cell

INCHARGE OF INSTITUTION'S RESPONSIBILITIES

1.	Dr. Shashikanth Karinka	Co-ordinator MoUs
2.	Dr. Gururaj Upadhyaya	Workshop Suptd
3.	Dr. Joy Elvine Martis	1st year Coordinator
4.	Dr. Jnaneshwar Pai Maroor	Co-ordinator Alumni
5.	Dr. Venkatesh Kamath	Assistant CoE
6.	Dr. Janardhan Nayak	Co-ordinator – Red Cross UNIT
7.	Mr. Srinivas Nekkar	NCC Officer
8.	Mr. Krishnaraja Joisa	Public Relation Officer
9.	Mr. K. Sathish Nayak	Digital Media Executive
10.	Sri. Shekar Poojari	Student Welfare Officer

ENTREPRENEURSHIP DEVELOPMENT CELL

1.	Dr. Ramakrishna B	Professor/EDC- Incharge
2.	Mrs. Geetha Poojarthi	Co-ordinator

DEPARTMENT OF TRAINING & PLACEMENT

1.	Mr. Ankith S Kumar	Counsellor

DEPARTMENT OF MATHEMATICS

1.	Dr. Shashirekha B. Rai	Professor
2.	Dr. Kumudakshi	Asso. Professor/ HoD
3.	Dr. Sharad M. Hegde	Asst. Professor Gd III
4.	Dr. Vasanth K.R	Asst. Professor Gd III
5.	Dr. Ashwini Kumari	Asst. Professor Gd III
6.	Dr. Chaithra K.	Asst. Professor Gd III
7.	Dr. Prashanthi K S	Asst. Professor Gd III
8.	Dr. Girija K P	Asst. Professor Gd III
9.	Dr. Ganesh Kumar K	Asst. Professor Gd III

10.	Mrs. Ambika N.	Asst. Professor Gd I
11.	Mrs. Vinaya Acharya	Asst. Professor Gd I
12.	Mrs. Anitha D. Bayar	Asst. Professor
13.	Mrs. Bhavya K.	Asst. Professor
14.	Mrs. Bhavya. D.	Asst. Professor
15.	Mrs. Sharmila	Asst. Professor
16.	Mrs. Anjana Pai K	Asst. Professor
17.	Mrs. Soumya	Asst. Professor
18.	Mrs. Smitha G. V.	Asst. Professor

DEPARTMENT OF PHYSICS

1.	Dr. Manjunath K. B.	Professor
2.	Dr. Shobha R. Prabhu	Asso. Professor / HoD
3.	Dr. Sathyajith	Asso. Professor
4.	Dr. Raghavendra Bairy	Asso. Professor
5.	Dr. Nagaraja B.S.	Asst. Professor Gd III
6.	Dr. Shyam Prasad . K.	Asst. Professor Gd III
7.	Dr. Saritha Suvarna	Asst. Professor Gd III

DEPARTMENT OF CHEMISTRY

1.	Dr. Janardhana Nayak	Professor
2.	Dr. Ramesh Bhat	Asso. Professor
3.	Dr. Shivaprasad Shetty M.	Asso. Prof/HoD
4.	Dr. Aarti S. Bhat	Asst. Professor Gd III
5.	Dr. Subrahmanya Ishwar Bhat	Asst. Professor Gd III
6.	Dr. Sarvajith MS	Asst. Professor Gd III
7.	Dr. Ranjitha	Asst. Professor Gd III

DEPARTMENT OF HUMANITIES

1.	Dr. Ramakrishna B.	Professor
2.	Mrs. Rashmi D. Hegde	Asso. Professor
3.	Dr. Vishwanatha	Asso. Professor /HoD
4.	Dr. Jnaneshwar Pai Maroor	Asst. Professor Gd III

5.	Dr. Joy Elvine Martis	Asst. Professor Gd III
6.	Mrs. Shyla D Mendonca	Asst. Professor Gd II
7.	Ms. Sonia Lobo	Asst. Professor Gd I
8.	Ms. Akshatha Kumari J Shetty	Asst. Professor Gd I
9.	Mr. Srinivas Nekkar	Asst. Professor
10.	Mrs. Sudeeksha S. Pai	Asst. Professor
11.	Mrs. Shwetha	Asst. Professor

OFFICE SECTION HEADS

1.	Mr. Keshava Mugeraya	Sr. Suptd, Academic Section/ Purchase In -Charge
2.	Mrs. Suneetha R. Shetty	Sr. Suptd, Administrative Section
3.	Mr. Suresh Achar	Sr. Suptd, Stores
4.	Mrs. Jayashree	Sr. Programmer, Office Automation Cell
5.	Mrs. Shailaja V. Shetty	Suptd, Accounts Section
6.	Dr. Preetham Shetty KV	Librarian

SECURITY DEPARTMENT

1.	Mr. Hirianna Suvarna S	Security Supervisor

SPORTS DEPARTMENT

1.	Sri. Shyam Sundar M.	P.E.D
2.	Sri. Ganesh Poojary	P.E.D
3.	Ms. Sowjanya M.	P.E.I
4.	Mr. Ravi Prakash C. Anpur	Basket Ball Coach
5.	Mr. Clive Nolan Mascarenhas	Football Coach
6.	Mr. Rajesh Acharya	Cricket Coach

HOSTEL WARDENS

1.	Dr. Veena Devi S.V	Chief Warden, NET Ladies Hostels, Nitte
2.	Dr. Vishwanatha	Chief Warden, NET Gents Hostels, Nitte

HOSTEL SUPERINTENDENT / MANAGER

1.	Mr. John D'Souza	Sr. Manager, Gents Main Hostel
2.	Mr. Manjunatha Suvarna	Hostel Manager, Gents Main Hostel
3.	Mr. Rajesh Ballal	Manager, Gents PG Hostel
4.	Mrs. Gayathri Kamath	Manager, Ladies PG Hostel
5.	Mrs. Chethana Sharma	Manager, Ladies Main Hostel
6.	Mrs. Hema S. Hegde	Superintendent, Hostel Office

REGULATIONS

2023-24

(Applicable for admission batch 2021-22 onwards)

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

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REGULATIONS COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE PROGRAMMES OF NMAM INSTITUTE OF TECHNOLOGY, NITTE Karkala, Udupi Dist., Karnataka

1. INTRODUCTION

1.1 The general regulations are common to all B.E. (Credit System) Degree Programmes conducted at the NMAMIT, Nitte Campus and shall be called "NMAMIT Regulations".

1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting Instructions of course, conduct of the examination and evaluation and certification of student's performance and all amendments related to the said Degree programme(s).

1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the BE Degree program (of VTU) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. **This set of Regulations, may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time, and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.**

1.4 In order to guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.

1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of NMAMIT courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

1.6 The course shall be called **Bachelor of Engineering** course abbreviated as B.E. (Subject of specialization) – Credit System.

1.7 **DURATION OF THE COURSE**

(a) The course shall extend over a period of total duration of 4 years.

(b) Each year shall have the following schedule with **5** ½ days a week.
Suggested Break down of Academic Year into Semesters

1. No. of Semesters / Year	Three; Two being Main semesters (odd, even) and one being a supplementary semester; after 2 main semesters. (Note: Supplementary semester is primarily to assist weak and / or failed students through make up courses. However, Autonomous Colleges may use this semester to arrange Add-On courses for other students and / or for deputing them for practical training elsewhere.)
2. Semester Duration	Main semester (odd, even) each 19 Weeks; Supplementary Semester 8 Weeks
3. Academic Activities	Main Semester
(Weeks):	Registration of Courses & Course Work (16.0) Examination Preparation and Examination (3.0)

	Total (19) Supplementary Semester Registration of Courses & Course Work (5.0) Examination Preparation and Examination (3.0) Total (8) Declaration of results: 2 weeks from the date of last examination Inter- Semester Recess: After each Main Semester (2) Total Vacation: 10 weeks (for those who do not register for supplementary semester) and 4 weeks (for those who register for supplementary semester)

(Note: In each semester, there will be provision for students for Registration of courses at the beginning, dropping of courses in the middle and withdrawal from courses towards the end, under the advice of faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and also ensure their better monitoring by Faculty Advisors).

A candidate shall be allowed a maximum duration of eight years from the first semester of admission to become eligible for the award of Bachelor Degree.

The calendar of events in respect of the course shall be fixed by the Senate from time to time, but preferably in line with the academic calendar of the VTU.

2. DEGREE PROGRAMMES

2.1 Undergraduate B.E. Degree Programmes are offered in the following disciplines by the respective programme hosting departments listed below:

i)	**Biotechnology Engineering**	**(BT)**
ii)	**Civil Engineering**	**(CV)**
iii)	**Computer Science & Engineering**	**(CS)**
iv)	**Electronics & Communications Engineering**	**(EC)**
v)	**Electrical & Electronics Engineering**	**(EE)**
vi)	**Information Science & Engineering**	**(IS)**
vii)	**Mechanical Engineering**	**(ME)**
viii)	**Artificial Intelligence and Machine Learning Engg.**	**(AM)**
ix)	**Computer and communication Engineering**	**(CC)**

x) Robotics and Artificial Intelligence Engineering (RA)

Other teaching departments are –

i) Mathematics (MA)
ii) Physics (PH)
iii) Chemistry (CY)
iv) Humanities, Social Sciences and Management (HU)

2.2 The provisions of these Regulations shall be applicable to any new discipline* that may be introduced from time to time and appended to the above list.

3. REGISTRATION

3.1 Every student after consulting his Faculty Advisor in parent department shall register approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will have to pay a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the college at the end of each semester, like odd, even, supplementary and it forms the basis for determining the student's performance in that semester.

3.2 Lower and Upper Limits for Course Credits Registered in a Semester Course Credit Assignment

All courses comprise of specific Lecture/Tutorial/Practical (L-T-P) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

i) One hour Lecture per week is assigned one Credit.

ii) 2-hour Tutorial session per week is assigned 1.0 Credit.

iii) 2-hour Lab. session per week is assigned 1.0 credit.

For example, a theory course with L-T-P schedule of 3-2-0 hours will be assigned 4.0 credits.

A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0 credit.

Calculation of Contact Hours / Week – A Typical Example

A student must register, as advised by Faculty Advisor, between a minimum of 15 credits and up to a Maximum of 25 credits.

3.3 Mandatory Pre-Registration for higher semester

In order to facilitate proper planning of the academic activities of the Semester, it is necessary for the students to declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks prior to the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions -

i) satisfied all the academic requirements to continue with the programme of studies without termination

ii) cleared all Institute, hostel and library dues and fines, if any, of the previous semester

iii) paid all required advance payments of the Institute and the hostel for the current semester

iv) has not been debarred from registering on any specific grounds by the Institute.

4. ADD / DROP / AUDIT options

4.1 Registration of courses

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with subject teacher and under faculty advice. The permissible course load to be either average credits (=20) or to be within the limits of minimum (=15) and maximum (=25) credits.

4.2 DROP-option

During a specified period at the middle of a semester student's performance in CIE is reviewed by the faculty advisor. Following poor performance by a student he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses to be re-registered by these students and taken up for study at a later time.

4.3 Withdrawal from courses

During a specific period specified towards the end of the semester, student's performance in CIE is reviewed by the Faculty advisors. Following poor performance by a student in identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with mention in the Grade card (Grade 'W'). Such courses to be re-registered by these students and taken up for study at a later time.

4.4 AUDIT-option

A student can register for courses for audit only, with a view to supplement his/her knowledge and/or skills. The student's grades in such course(s) will have to be reflected in the grade card. However, CORE courses shall not be made available for audit. But these shall not be taken into account in determining the student's academic performance in the semester. 'U" grade is awarded to such courses on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses.

5. COURSE STRUCTURE:

5.1 Typical Breakdown for the B.E. Degree Curriculum:

No.	Course Category	Credit Range
1.	Basic Science Courses	20-25
2.	Engineering Science Courses	18-22
3.	Humanity, Social Science and Management	8-12
4.	Ability Enhancement Courses	10-14
5.	Professional Core Courses (PCC)	40-45
6.	Professional Elective Courses (PEC)	8-12
7.	Open Elective Courses (OE)	8-12
8.	Skill Courses (Project Work / Internship / Seminar)	28-36
9.	Mandatory courses	2
Note:	**Student can register between 15 to 25 credits per semester** **Total Credits to be earned : 160**	

5.2 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components, the semester wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies(BOS). The BOS will consider the proposals from the departments and make recommendations to the senate for consideration and approval.

5.3 The earned Credit Requirement for the B.E. Degree is 160.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to student to plan their career.

5.4 Mandatory Learning Courses

These are courses that must be completed by the student at appropriate time or at his convenience. The 'PP' grade is awarded for a Pass in the course and 'NP' grade is awarded for a Fail in the course. In case 'NP' grade is awarded, the student has to re- register for the same course wherein he has no alternative options. However, he/she can opt for other courses if he/she has been provided with multiple options.

The 'PP' and 'NP' grades do not carry grade points and hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However such non-credit mandatory courses are required to be included in the students' performance record (transcript) with Pass or Fail (PP or NP).

Courses that come under this category are the following.

Moral and Ethical Values, Communication skills, Entrepreneurship Development Programme, Environmental issues, Proficiency in a Language etc.

Such courses will not carry any credits for the award of degree, but a pass in each of such course during the programme shall be a necessary requirement for the student to qualify for degree award.

5.5 PROJECT

i) Project work at 7^{th} semester shall be completed batch wise. The batch shall consist of a maximum of 4 students.

ii) Project viva-voce examination shall be conducted individually.

5.6 **ELECTIVES**

i) A candidate shall take electives in each semester from groups of electives, commencing from 6^{th} semester.

ii) The minimum number of students to be registered for any Elective offered shall not be less than ten.

iii) A candidate shall opt for his/her choice of electives and register for the same if pre-registration is not done, at the beginning of each of 6^{th} & 7^{th} semesters. The candidate is permitted to opt for change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

6. ATTENDANCE REQUIREMENT:

6.1 Each semester is considered as a UNIT and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops and paper presentation.

6.2 The basis for the calculation of the attendance shall be the period of term prescribed by the College by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course (as per CET/COMED-K or Management allotment).

6.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up the shortage.

6.4 A candidate having shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s).Such students will be awarded 'N' grade in these courses.

He/she shall have to repeat those course(s). Such students shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or supplementary semester.

6.5 **Attendance in CIE and SEE:** Attendance at all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

7. WITHDRAWAL FROM THE PROGRAMME

7.1 Temporary Withdrawal

a) A student who has been admitted to a degree programme of the college may be permitted once during the course to withdraw temporarily, for a period of one semester, on the grounds of prolonged illness or grave calamity in the family etc., provided –

i) The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.

ii) The College is satisfied about the genuineness of the case and that even by taking into account the expected period of withdrawal, the student has the possibility to complete the programme requirements (160 credits) within the time limits specified by the university.

iii) The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.

iv) A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the Student's roll list. The fees/charges once paid shall not be refunded.

v) A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

7.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

(a) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues if any.

(b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts.

(c) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

8. EVALUATION SYSTEM

8.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

8.2 The Letter grades S, A, B, C, D, E, F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

8.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid- semester examinations and one semester end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE)	:	50% (50 marks)
Continuous Internal Evaluation (CIE)	:	50% (50 marks)
i) Quizzes, Tutorials, Assignments, Seminars, mini projects, tutorials etc.	:	10 marks
ii) Mid-semester Examination	:	40 marks

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

8.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.

8.5 The course Instructor shall announce in the class and/or display at the Faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

8.6 Passing standards

Evaluation Method	Passing Standard
Sessional (CIE)	Score: ≥40% (≥20 marks)
Terminal (SEE)	Score: ≥40% (≥20 marks)

i) Project work evaluation: The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a Department committee constituted for this purpose. Seminar presentation, project report and final oral examination conducted by project evaluation committee at the department level shall form the SEE of the project work.

ii) In the case of other requirements, such as, seminar, industrial internship, field work, comprehensive viva voce, if any, the assessment shall be made as laid down by the Academic council.

iii) **There shall be no re-examination for any course in the credit system.**

However, students

- who have abstained from attending CIE or SEE without valid reasons ('N' grade), or
- who have failed ('F' grade) to meet the minimum passing standards prescribed for CIE and/or SEE, or
- who have been detained for want of attendance, or
- who have withdrawn ('W' grade),
- who have dropped any course

shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than E in each case. While such students should re-register for same course(s) if core, they can re-register for alternative course(s) from among the elective courses, as the case may be. The re- registration shall be possible when the particular course is offered again either in a main (Odd/Even) or a supplementary semester.

8.7

i) Grade point scale for absolute grading

Level	Out Standing	Excellent	Very Good	Good	Average	Poor	Fail
Grade	S	A	B	C	D	E	F
Grade Points	10	09	08	07	06	04	00
Score (Marks) Range(%)	≥ 90	< 90 - ≥80	< 80- ≥70	< 70- ≥60	< 60 - ≥50	< 50 - ≥40	< 40

ii) The grade points given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in arriving at the credit index of the student for that semester, as it is the sum total of all the credit points earned by the student for all the courses registered in that semester.

8.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range S-E. Letter grade 'F' in any course implies failure of the student in that course and no credits earned.

8.9 The Transitional Grades 'I', 'W' and 'X' would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (S-F) after the student completes the course requirements.

- Grade 'I': To a student having satisfactory attendance at classes and meeting the passing standard at CIE, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

i) Illness or accident, which disabled him/her from attending SEE;
ii) A calamity in the family at the time of SEE, which required the student to be away from the College;

- Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of

that particular examination for which he or she is absent, failing which they will not be given permission. This is admissible only for students who have more than 45 CIE marks.

- Grade 'W': To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice
- Grade 'X': To a student having attendance ≥85% and CIE rating (90%), in a course but SEE performance observed to be poor, which could result in a F grade in the course. **(No 'F' grade awarded in this case but student's performance record maintained separately).**

8.10 Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students performance like SGPA and CGPA and the courses taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

8.11 The Make Up Examination

The Make Up Examination facility would be available to students who may have missed to attend the SEE of one or more course(s) in a semester for valid reasons and given the 'I' grade; Also, students having the 'X' grade shall be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be same as the regular SEE for the course(s).

a) All the 'I' and 'X' grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any

outstanding 'I' and 'X' grades after the last scheduled make-up examinations shall be automatically converted to 'F' grade.

b) All the 'W' grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ supplementary semester and fulfill the passing standards for their CIE and (CIE+SEE).

9. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices: SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

$$SGPA = \frac{\sum [\textit{(course credit) X (Grade point)}] \textit{ (for all courses in that semester)}}{\sum[\textit{(course credits)}]}$$

CGPA is computed as follows:

$$CGPA = \frac{\sum[\textit{(course credits)X (Grade points)}] \textit{ (for all courses excluding those with F grades until that semester)}}{\sum\textit{(course credits)}] \textit{ (for all courses excluding those with F grades until that semester)}}$$

10. COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitate the declaration of academic performance of a student at the end of a semester and at the end of successive semesters. Both of them would be normally calculated to the second decimal position.

11. VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

11.1 There shall be no restriction for promotion from an odd semester to the next even semester, provided the student has fulfilled the attendance requirement.

11.2 A Student shall be declared fail if he / she

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements.

11.3 (A) Vertical Progression in case of students admitted to First year:

(a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.

(a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.

(a.2) Students who have earned all the prescribed credits of I year, and having not more than four grades in the four semesters of II and III year shall be eligible to move to IV year.

(B) Vertical Progression in case of Diploma students admitted to Second year (lateral entry):

(a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year.

(a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The mandatory non-credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E/B.Tech. Programmes shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.

(b.1) In case, any student fails to satisfy the attendance requirement of the Courses Additional Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree.

(C) Vertical Progression in case of B.Sc students admitted to Second year (Lateral entry):

(a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III year.

(a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The prescribed mandatory non-credit Courses Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B. Sc holders admitted to III semester of B.E/B. Tech Programmes, shall attend the classes during the respective semesters to complete CIE and attendance requirements and to appear for the University examinations.

(b.1) In case, any student fails to satisfy the attendance requirement of the above said Courses; he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.

The Principal of each college shall make suitable arrangements in the timetable to facilitate the B. Sc students to attend the above mentioned courses to satisfy the CIE and attendance requirements and to appear for the University examinations.

11.4 Termination from the programme

A student shall be required to withdraw (discontinue) from the programme and leave the college on the following grounds.

i) **Failure to secure a CGPA = 5.0 on three consecutive occasions.**

ii) **Failure to earn a credit of 160 (120 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of**

absence).

iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.

iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

12. AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen from the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks	Class
≥ 7.75	≥ 70%	Distinction
≥ 6.75	≥ 60%	First Class
< 6.75	< 60%	Second Class

Percentage = (GPA - 0.75) x 10

13. APPEAL FOR REVIEW OF GRADES

a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

14. AWARD OF DEGREE

14.1 (1) B.E. Degree

a) Students shall be declared to have completed the Programme of B.E./B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (160 credits for regular students registered for 4 year degree programmes & 120 for lateral entry students).

b) For the award of degree, a CGPA≥5.00 at the end of Programme shall be mandatory.

c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.

d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc. graduates.

e) (i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/Autonomous colleges under VTU to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eight semester Grade Card.

(ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(2) B.E. (Honors) Degree

VTU, Belagavi has framed the guidelines for applying for the award of Bachelor of Engineering (Honors) degree.

These Regulations are applicable for the following students:

1. Admitted to **I semester** / I year from the academic year **2018-19** (i.e. USN XXX18XXXXX)

2. Admitted to **III semester** / II year from the academic year **2019-20** (i.e. USN XXX19XX4XX)
3. These Regulations are uniformly applicable to Affiliated, Autonomous and Constituent Colleges under VTU.

Eligibility criterion

(i) Students have to earn 18 or more additional credits through MOOCs.
(ii) Students shall register for this course from fifth semester onwards.
(iii) Students shall obtain a grade $\geq$ D in all the courses in first attempt only in all the semesters till 5th.
(iv) Students shall obtain CGPA of 8.5 and above at the end of fourth semester.
(v) For Diploma students, they shall complete Additional Mathematics I and II during 3rd and 4th semesters in first attempt only.

Requirements:

(i) Students shall maintain a grade $\geq$D in all courses from 5thto 8thsemester in 'first attempt' only.
(ii) Students not having CGPA greater than or equal to 8.5 at the end of the B.E. programme shall not be eligible for the award of Honors degree, even if they have satisfied the requirement of additional credits.
(iii) Students shall take up additional course work, other than the regular courses prescribed by the University from 5thto 8thsemester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %) before closure of eighth semester as per the academic calendar.
(iv) Students shall be permitted to drop the registered course work (s) and select alternative course work (s) in case they cannot give proctored examination.
(v) Students have to take courses from the list of MOOCs approved by the University, which can be from NPTEL / SWAYAM / other platforms.
(vi) Students shall select courses in consultation with their Class Advisor, such that the content / syllabus of them are not similar to that of the core courses, professional electives or open electives, which the students may chose in the program.

(vii) Students shall earn the additional credits for these courses through MOOCs, by only appearing in person to the proctored examinations conducted by NPTEL / SWAYAM / other platform. The method of assessment shall be as per NPTEL online platform.

(viii) The Credit equivalence shall be as follows - 4 weeks of online course duration – 1 credit, 8 weeks of online course duration – 2 credits and 12 weeks of online course duration – 3 credits.

Registration:

(i) Any student meeting the eligibility criteria and interested to register for Honors degree qualification shall apply to the University through the Principal in the prescribed form along with the prescribed application fees within 15 working days after notification by the University.

(ii) The Registrar shall notify the registration of the student and it will be notified to the student and the student shall pay a one-time, non-refundable registration fees as prescribed by the University to confirm the registration.

Award of Honors Qualification:

(i) Students who successfully complete the MOOCs prescribed by the University and submit their E-certificates to the University through the Principal against the notification issued by the Registrar in time before the closure of eighth semester, as per the academic calendar shall be eligible for B.E. (Honors) degree. If a student does not submit the certificates in time on or before the last date, their request shall not be considered, even if they have earned the requisite number of credits.

(ii) The Honors degree shall be awarded only if the CGPA at the end of the B.E. programme is equal to or greater than 8.5.

(iii) A student who has earned the requisite number of credits and who has submitted the certificates in time and has been accepted by the University will get B.E. degree with Honors suffixed indicating recognition of higher achievement by the student concerned.

(iv) Further students fulfilling all the above requirements shall be entitled to receive their transcripts indicating both the achievement of the student concerned.

(v) The award of the Honors degree shall be recommended by the Academic Senate and approved by the Executive Council of the University.

14.2 (1) Noncompliance of CGPA ≥ 5.00 at the end of the Programme

(a) Students, who have completed all the courses of the Programme but not having a CGPA ≥ 5.00 at the end of the Programme, shall not be eligible for the award of the degree.

(b) In the cases of 14.2 (1) a, students shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Main), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

(c) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 14.2 (1) b

(d) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥5.00, the students shall become eligible for the award of the degree. If CGPA<5.00, the students shall follow the procedure laid in 14.2 (1) b

(e) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is≥5.00, the students shall become eligible for the award of the degree. If CGPA <5.00, the students shall follow the procedure laid in 14.2 (1) b

(f) In case, the students fail (i.e., earns F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 14.2 (1) b

(g) Students shall obtain written permission from the Registrar (Evaluation) to reappear in SEE to make up the CGPA equal to or greater than 5.00.

(2) Noncompliance of Mini-project

(a) The mini-project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to

complete the same during subsequent University examinations after satisfying the Mini-project requirements. Also, mini-project shall be considered for eligibility to VII semester.

(3) Noncompliance of Internship

(a) All the students of B.E/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation. A University examination shall be conducted during VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfy the internship requirements.

14.3 The maximum duration for a student for complying to the Degree requirements is 16 – semesters from the date of first registration for his first semester (8 years from the date of admission to first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

15 GRADUATION REQUIREMENTS AND CONVOCATION

15.1 A student shall be declared to be eligible for the award of the degree if he/she has

a) **Fulfilled "Award of Degree" Requirements**
b) **No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centres**
c) **No disciplinary action pending against him/her.**

15.2 The award of the degree must be recommended by the Senate

15.3 Convocation

Degree will be awarded for the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer 'Award of Degree') within the specified date in order to arrange for the award of the degree during convocation.

16 AWARD OF PRIZES, MEDALS, CLASS & RANKS

For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the College for such awards.

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class as described in 12.

17 CONDUCT AND DISCIPLINE

17.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

17.2 **As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.**

17.3 The following acts of omission/ or commission shall constitute gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

a) Ragging.
b) Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.
c) Willful damage or stealthy removal of any property/belongings of the College/Hostel or of fellow students/citizens.
d) Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
e) Mutilation or unauthorized possession of Library books.
f) Noisy and unseemly behaviour, disturbing studies of fellow students.
g) Hacking in computer systems (such as entering into other Person's area without prior permission, manipulation and/or Damage of computer hardware and software or any other Cyber crime etc.).

h) Plagiarism of any nature.

i) Any other act of gross indiscipline as decided by the Senate from time to time.

j) Use of Mobile in the college Academic area.

k) Smoking in College Campus and supari chewing.

l) Unauthorized fund raising and promoting sales.

Commensurate with the gravity of offence the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

17.4 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

17.5 All cases involving punishment other than reprimand shall be reported to the Principal.

17.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE

18.1 As per VTU guidelines, every students entering 4 year degree programme should earn 100 activity points & every students entering 4 year degree programme through Lateral Entry should earn 75 activity points for the award of the Engineering Degree.

18.2 The Activity Points earned will be reflected on the student's eighth semester Grade Card.

18.3 The activities can be spread over the years (duration of the programme) any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.

18.4 Activity Points (non-credit) have no effect on SGPA/CGPA point.

18.5 In case students fail to earn the prescribed Activity Points, Eighth semester Grade Card shall be issued only after earning the required Activity Points.

Note: Students are required to be inside the examination hall 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

LIST OF MAJOR SCHOLARSHIPS

Applicable to	*Types of scholarship*	*Method*	*Website*
For SC/ST Students	*Income : Below Rs.2,50,000/-*	*Online application*	SSP
	Income : Above Rs.2,50,000/- to Rs.10,00,000/-		
For Others	*Category I : Income Below Rs.2,50,000/-*	*Online application*	
	Category 2A, 3A, 3B Income Below Rs.1,00,000/-	*Online application*	
	GSB & Brahmins EWS Certificate upto Rs.8,00,000/-	*Online application*	
	Minority students Income Below Rs.2,50,000/-	*Online application*	*NSP & SSP*
Parents must have Beedi Id. Card	*Beedi Scholarship*	*Online application*	scholarships.gov.in or nsp.gov.in

1. Scholarship details will be published in the notice board near College Academic Section. Students must see the notice board and submit the application before due dates.

2. All SC/ST and Category I students who have not paid any fee in CET must apply for Fee concession or Scholarship. Otherwise they must pay the tuition fee and college fee.

3. The students, who are applying for any of the above scholarship through online, must submit the hardcopy with supporting documents (with attestation) to the academic section in time.

B. E. SYLLABUS

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING ENGINEERING

V & VI SEMESTER

With

Scheme of Teaching

& Examination

Faculty

Sl. No.	Faculty Name	Qualification	Designation
1.	Dr. Sharada Udaya Shenoy	B.E, M.Tech., Ph.D	Professor & HOD
2.	Mr. Sudesh Rao	B.E, M.Tech., (Ph.D)	Asst. Prof Gd II
3.	Mrs. Disha D N	B.E, M.Tech., (Ph.D)	Asst. Prof Gd II
4.	Mr. Mahesh B L	B.E, M.Tech (Ph.D).	Asst. Prof Gd II
5.	Mrs. Swathi Pai	B.E, M.Tech., (Ph.D)	Asst. Prof Gd II
6.	Mrs. Rakshitha	B.E, M.Tech., (Ph.D)	Asst. Prof Gd I
7.	Mrs. Sneha Shetty R	B.E, M.Tech., (Ph.D)	Asst. Prof Gd I
8.	Mr. Anirudhan Adukkathayar C	B.E, M.Tech., (Ph.D)	Asst. Prof Gd I

VISION

To be a center of excellence in Artificial Intelligence and Machine Learning Engineering education and research, to produce comprehensively trained, technically skilled, ethically strong, innovative engineers to excel globally, take future challenges and contribute to social welfare.

MISSION:

- To provide excellent academic environment to students for continuous improvement in Computer Science, Artificial Intelligence and Machine learning specialization by imparting education with innovation, skills, and positive attitude to make them competent engineers and leaders to solve the real-world problems to inculcate values of professional ethics, leadership qualities and lifelong learning.
- To strengthen the industry partnership for collaborative work and prepare graduates in cutting edge Artificial Intelligence technologies in par with industrial standards by undertaking collaborative projects which offer opportUNITies for long term interaction between academia and industry.
- To inculcate research, ethical values, professionalism, lifelong learning to make them globally competent and socially committed.
- To provide resources that contribute to congenial learning environment and encourage students to pursue higher education and take competitive exams.

Program Educational Objectives (PEOs)

After few years of graduation, the graduates of B. E in **Artificial Intelligence & Machine Learning** will:

1. Demonstrate technical skills, competency in computer science, artificial intelligence and machine learning and exhibit team management capability with effective communication and responsibility in their career.
2. Emerge as engineering professionals, innovators or entrepreneurs engaged in technology deployment and support the growth of economy of a country with a lifelong learning attitude.
3. Use basic science and engineering ideas to carry out research, pursue higher studies in the multidisciplinary areas to address the basic needs of the society.

Program Outcomes (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

Program Specific Outcomes (PSOs)

1. Gain both theoretical and practical knowledge of human cognition, Artificial Intelligence, Machine Learning, Deep learning and data engineering for designing intelligent systems.
2. Apply computational knowledge, tools, techniques and project development skills to provide innovative solutions for social wellbeing.

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B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examination 2023-24

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

V SEMESTER

SN	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Mini project Component	Duration	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	21AM501	Neural Network and Deep Learning	AME	3	-	2	-	3	50	50	100	4
2	PCC	21AM502	Computer Network and Data Communication	AME	3	-	-	-	3	50	50	100	3
3	PCC	21AM503	Artificial Intelligence	AME	3	-	-	-	3	50	50	100	3
4	PCC	21AM504	Computer Vision	AME	3	-	-	-	3	50	50	100	3
5	PCC	21AM505	Artificial Intelligence and Computer Vision Lab	AME	-	-	2	✓	3	50	50	100	1
6	AEC	21HU511	Research Methodology & Intellectual Property Rights	CV/ME	2	-	-	-	3	50	50	100	2
7	HSMC	21CV512	Environmental Studies	CV	1	-	-	-	1	50	50	100	1
8	AEC	21AMA5X	Ability Enhancement Course - V	AME	1	-	-	✓	1	50	50	100	1
TOTAL					**16**	**-**	**4**	**2**	**-**	**400**	**400**	**800**	**18**

Note: PCC: Professional Core, PEC: Professional Elective, BS: Basic Science, HSMC: Humanities, OE: Open Elective

Ability Enhancement Course – V	
21AMA51	Data Visualization Techniques and Tools
21AMA52	Mobile Application Development

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B.E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examination 2023-24

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

VI SEMESTER

SN	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Mini project Compo	Duration	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	21AM601	Internet of Things	AME	3	-	2	✓	3	50	50	100	4
2	PCC	21AM602	Natural Language Processing	AME	3	-	-	-	3	50	50	100	3
3	HSMC	21AM603/ 21CC603	Management & Entrepreneurship (Common with CCE)	AME	3	-	-	-	3	50	50	100	3
4	PEC	21AMEXX	Professional Elective Course - 1	AME	3	-	-	-	3	50	50	100	3
5	OEC	21ZZ8XYY	Open Elective Course - 1	AME	3	-	-	-	3	50	50	100	3
6	PCC	21AM604	Natural Language Processing Lab	AME	-	-	2	✓	3	50	50	100	1
7	PROJ	21AM605	Mini Project	AME	-	-	2	✓	-	100	-	100	1
8	INT	21INT61	Innovation/Entrepreneurship/Social based Internship (4 Weeks)	AME	-	-	-	-	-	100	-	100	3
TOTAL					**15**	**0**	**6**	**3**	**-**	**500**	**300**	**800**	**21**

Note: PCC: Professional Core, PEC: Professional Elective, BS: Basic Science, HSMC: Humanities, OE: Open Elective

Value Added Course												
PCC	21AMV02	Software Engineering and Testing	AME	0	0	2	✓	03	50	50	100	0

Professional Electives

Professional Elective Course - 1 (Group 1)				
Course Code	**Course Title**		**Course Code**	**Course Title**
21AME101	Angular and ReactJS		21AME121	Graphics and Animation
21AME102	Artificial Intelligence and Machine Learning in Healthcare		21AME122	High Performance Computing
21AME103	Artificial Intelligence in Agriculture		21AME123	Human Computer Interaction
21AME104	Augmented and Virtual Reality		21AME124	Introduction to Data Science
21AME105	Autonomous Systems		21AME125	Introduction to Drones
21AME106	Big Data Analytics		21AME126	Micro controllers and embedded systems
21AME107	Bio Informatics		21AME127	Mobile Application Development with Flutter
21AME108	Blockchain Technology		21AME128	Operation Research
21AME109	Business Intelligence		21AME129	Pattern Recognition
21AME110	Cloud Computing		21AME130	Prompt Engineering
21AME111	Compiler Design		21AME131	Semantic Web
21AME112	Computer Vision with Embedded Machine Learning		21AME132	Social and Web Analytics
21AME113	Cryptography and Cyber Security		21AME133	Soft Computing
21AME114	Cyber Forensics		21AME134	Solve Business Problems with AI
21AME115	Data and Visual Analytics in AI		21AME135	Speech processing
21AME116	Data mining and Data Warehousing		21AME136	System Modelling and Simulation
21AME117	Distributed Systems		21AME137	Text Mining
21AME118	Full Stack Development		21AME138	UNIX System Programming
21AME119	Fundamentals of Image Processing		21AME139	Web Applications using ML
21AME120	Game Theory and Applications		21AME140	Wireless Sensor Networks

NEURAL NETWORKS AND DEEP LEARNING

Course Code	21AM501	**CIE Marks**	50
Number of Contact Hours/Week	3:0:2	**SEE Marks**	50
Total Number of Contact Hours	39 _26	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Understand the neural network and artificial neurons
2. Learn about how to train neural networks with different optimizers
3. Describe the operation of deep convolutional neural networks
4. Outline the concepts Recurrent neuralnetworks
5. Learn about performance metric and different applications of neural networks

UNIT – I	Contact Hours
Introduction to artificial neural networks: From biological to artificial neurons, the perceptron, Multilayer perceptron, Activation Functions and types, Feed forward neural networks, Back propagation algorithm, Fine tuning neural network hyperparameters: Number of hidden layers, number of neurons per hidden layer, learning rate, batch size and other hyperparameters **Optimizers:** Gradient descent, stochastic gradient descent, mini-batch stochastic gradient descent, AdaGrade optimizers, AdaDelta optimizers, learning rate scheduling, avoiding overfitting through regularization, L1 and L2 regularization, Drop-out layers **Training deep neural networks:** Vanishing Gradient problems Exploding gradient problem, Glorot and He Initialization, Batch normalization, Gradient clipping	15
UNIT – II	
Convolutional Neural Networks: The convolution operation, motivation, Padding in convolution network, Operation of CNN, Max pooling in CNN, Data augmentation, Variants of the basic convolution function, Structured Outputs, Data types, Efficient convolution algorithms **Sequence modeling: Recurrent and Recursive Nets:** Unfolding computational graphs, Recurrent neural networks, Bidirectional RNNS, Encoder-Decoder	15

Sequence to Sequence Architecture, Deep Recurrent networks, Recursive neural networks, LSTM Recurrent neural network, optimization for long term dependencies learning in CNN	
UNIT - III	
Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, **Applications:** Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications	9

Course Outcomes:

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

1. Describe the concepts of perceptron, neurons, back propagation algorithm
2. Implement neural networks with different optimizers and loss function calculation
3. Analyze the operations involved in deep convolution neural networks
4. Apply the concepts sequence modeling using Recurrent neural networks
5. Describe the performance metric and different applications of neural networks

TEXTBOOKS:

1. Hands-on-machine learning with Scikit-Learn, Keras and Tensorflow Concepts, tools and Techniques to build Intelligent Systems, Aurélien Géron, 2nd edition, 2019.
2. Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow, YoshuaBengio, Aaron Couville-2016

REFERENCE BOOKS:

1. Introduction to Artificial Neural Systems, Zurada and Jacek M, 1992, West PublishingCompany, ISBN: 9780534954604
2. Neural Networks Design, M T Hagan, H B Demoth, M Beale, 2002, Thomson Learning,ISBN-10: 0-9717321-1-6/ ISBN-13: 978-0-9717321-1-7

E Books / MOOCs/ NPTEL

1. deeplearning.net
2. deeplearning.stanford.edu
3. deeplearning.cs.toronto.edu
4. https://www.coursera.org/specializations/deep-learning
5. Deep Learning, Self-Taught Learning and Unsupervised Feature Learning by AndrewNg

Table 1: Mapping Levels of COs to POs											
COs	**Program Objectives (POs)**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	3	2	2		2						
CO2	3	2	2		2						
CO3	3	2	2		2						
CO4	3	2	2		2						
CO5	3	2	2		2						

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indica
CO1	PO1, PO2, PO3, PO5, PO12	1.1.1, 1.2.2, 1.2.3, 3.2.1, 3. 12.1.1
CO2	PO1, PO2, PO3, PO5, PO12	1.1.1, 1.2.2, 1.2.3, 3.2.1, 3. 12.1.1
CO3	PO1, PO2, PO3, PO5, PO12	1.1.1, 1.2.2, 1.2.3, 3.2.1, 3. 12.1.1
CO4	PO1, PO2, PO3, PO5, PO12	1.1.1, 1.2.2, 1.2.3, 3.2.1, 3. 12.1.1
CO5	PO1, PO2, PO3, PO5, PO12	1.1.1, 1.2.2, 1.2.3, 3.2.1, 3. 12.1.1

NEURAL NETWORKS AND DEEP LEARNING LAB		
Course Code	21AM501	**CIE Marks**
Number of Contact Hours/Week	0:0:2	**SEE Marks**
Total Number of Contact Hours	26	**Exam Hours**
Credits – 1		

Course Learning Objectives:

1) Learn about different healthcare applications
2) Implement different machine learning algorithms applicable in healthcare
3) Implement different deep learning algorithms applicable in healthcare
4) Understand and analyze the performance of the models on various datasets
5) Understand and apply CNN models for the analysis of medical images

PART A

1. Train a Deep learning model to classify a given image using pre trained model
2. Object detection using Convolution Neural Network
3. Recommendation system from sales data using Deep Learning
4. Improve the Deep learning model by tuning hyper parameters
5. Perform Sentiment Analysis in network graph using RNN Image generation using G
6. build a MLP s (feed-forward neural networks) and apply it to the MNIST dataset.
7. Implementation: Implement a simple feed-forward neural network

Mini Projects:

1. Feedforward Networks for Handwritten Digit Recognition
2. Sequence Labelling with Deep Recurrent Networks
3. Image Classification with Deep Convolutional Networks

PART B

1. Perform the survival analysis on cancer dataset using any suitable model
2. Perform the medical diagnosis to predict the covid 19 on chest X-Ray dataset using a suitable deep learning model
3. Classification of medical images of pathology using suitable deep learning model
4. Perform the image segmentation on any given images using threshold-based segmentation algorithms

5. Perform the image segmentation on any given images using edge-based image segmentation algorithms
6. Analysis of survival functions and estimation of survival model on The Veterans' Administration Lung Cancer Trial for survival function by treatment
7. Malaria detection using machine learning algorithms
8. Parkinson disease prediction using deep learning models
9. Melanoma skin cancer detection using image classification techniques
10. Leukaemia blood cancer detection using CNN model

Course Outcomes:

1) Implement image processing and segmentation algorithms in healthcare
2) Implement different machine learning algorithms applicable in healthcare
3) Implement different deep learning algorithms applicable in healthcare
4) Understand and analyze the performance of the models on various datasets
5) Understand and apply CNN models for the analysis of medical images

Table 1: Mapping Levels of COs to POs

Cos	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3		2							2	3	
CO2	3	3	3		2							2	3	
CO3	3	3	3		2							2	3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3
CO2	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3
CO3	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3

COMPUTER NETWORK AND DATA COMMUNICATION			
Course Code	21AM502	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives

The primary Course Learning Objective is to introduce the

This course will enable students to:

1. Outline the concepts of basic data communications and networking.
2. Get the idea of signal transmission.
3. Understand the basic of data link layer functionalities and protocols.
4. Study the importance of network layer and differentiate various routing algorithms
5. Acquire the knowledge of working of transport layer, its protocols and some application layer protocols.

UNIT - I	**Contact Hours**
I**ntroduction to data communications**: Components, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, The OSI Model. (Chapter 1) **Physical Layer**: Signals, Signal Impairment, Digital Transmission, Analog Transmission, Multiplexing. (Chapter 2) **Data-Link Layer**: **Data-link control:** Framing, Error Control. **Media Access Protocols:** Carrier Sense Multiple Access, CSMA/CD. Link-Layer Addressing: Three Types of Addresses (Chapter 3) **Local Area Networks:** Ethernet, Standard Ethernet Frame Format. (Chapter 4) **Tutorials:** Create Simple network using Packet tracer, Basic Switch Setup using Packet tracer, Basic Router Setup using Packet tracer.	15
UNIT - II	
Network Layer: Data Transfer: Services, Packet Switching, Performance, IPv4: IPv4 Addressing, Main and Auxiliary Protocols.	15

IPv6: IPv6 Addressing, The IPv6 Protocol. (Chapter 7) **Network Layer: Routing of Packets**: General Idea, Least-Cost Routing, Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, OSPF, BGP4, Multicast Routing: Unicasting, Multicasting, Distance Vector Multicast Routing Protocol. IGMP. (Chapter 8) **Tutorials:** Demonstrate OSPF, RIP protocol working using packet tracer, Simulate Simple network using wireshark, Simulate the transmission of ping messages over a network topology consisting of 3 nodes n0, n1 and n2, where node n0 and n1 are the pingers. Analyze the working of ping using wireshark.	
UNIT - III	
Transport Layer: Transport-Layer Services, Transport-Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). (Chapter 9) **Application Layer**: Introduction, Client/Server Paradigm, Standard Applications. (Chapter 10) **Tutorials:** Demonstration of HTTP request and HTTP response in real time client server communication.	9

Course Outcomes (COs):

Upon completion of this course, students will be able to:

1. Describe the basics of Data Communication and understand the working of signals in physical layer.
2. Understand the working of data link layer, the protocols and differentiate the types of LAN.
3. Comprehend the basic data transfer in network layer.
4. Distinguish between various routing algorithms.
5. Portray the transport layer protocols and the list some of the services in application layer.

TEXTBOOKS:

1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, 6th Edition, 2022, McGraw Hill, ISBN 978-1-26-436335-3

REFERENCE BOOKS:

1. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education.
2. Data Communication and Networking by Behrouz A. Forouzan (Fifth Edition), Tata McGraw Hill.
3. Computer Networking. A Top-down Approach, James F. Kurose, Keith W. Ross, Pearson, ISBN: 1292153598, 2017.
4. Data and Computer Communications, 10th Edition, William Stallings, Pearson Education, 2013, ISBN: 0133506487,9780133506488.
5. Data and Computer Communication, 8th Edition, William Stallings, Prentice Hall, 0132433109, 2007.
6. An Introduction to Computer Networks, Peter L Dordal, Open Book, http://intronetworks.cs.luc.edu/ 2020.
7. William A. Shay, "Understanding Data Communications and Networks", 2nd Edition, Thomson.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2												2
CO2	2	2												2
CO3	3	2												2
CO4	2	2												2
CO5	3	3												2

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2	1.3.1, 1.4.1, 2.1.3	L2
CO2	1,2	1.4.1, 2.1.3, 2.3.1, 2.2.1, 2.2.2	L2, L4
CO3	1,2	1.4.1, 2.1.2, 2.1.3, 2.4.1, 2.3.2	L2
CO4	1,2	1.3.1, 1.4.1, 2.1.3	L2, L3
CO5	1,2	1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.4.1	L2, L3

ARTIFICIAL INTELLIGENCE			
Course code	**21AM503**	**CIE Marks**	**50**
Total number of Contact hours/Week	3:0:0	**SEE Marks**	**50**
Total Number of Contact Hours	**39**	**Exam Hours**	**03**
Credits-3			

Course Learning Objectives:

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

1. Understanding history of Artificial Intelligence (AI) and its foundation.
2. Learn basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning
3. Analyze various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Identify and explain the proficiency developing applications of AI language, expert system shell, or data mining tool.
5. Determine an ability to share in discussions of AI, its current scope and limitations.

UNIT - I	Contact Hours
Introduction: what is AI, Acting Humanly: The Turing Test approach, Thinking Humanly: The cognitive modelling approach, Thinking rationally: The laws of thought apprach, Acting Rationally: The rational agent approach. The state of art **Intelligent Agents:** Agents and Environments, Good behaviour: The concept of rationality, The nature of environments, properties of task environments, Structure of Agents: Agent Programs, Types of agent programs **Solving Problems by Searching:** Problem solving Agents, well defined problems and solutions, formulating problems, Example problems: Toy problems: Vacuum world, 8-Queen's problem, Real world problem: Airline Route finding problem	**10**

UNIT - II	
Searching for solutions: Infrastructure for search algorithms, measuring problem solving performance, Uninformed search strategies: Breadth first search, Cost search, Depth first search, Informed search strategies: Greedy best search, A* algorithms, Heuristic functions **Quantifying Uncertainty:** Acting under uncertainty, summarizing uncertainty, Uncertainty and rational decisions, Basic probability notation, what probabilities are about. The language of propositions in probability assertions, Inference using full joint distribution, Bayes' rule and its use, Applying Bayes' rule for simple use case **Probability Reasoning Over time:** Time and Uncertainty, States and observations, Transition and Sensor models, Inference in temporal models, Smoothing, Hidden Markov model, Simplified matrix algorithms, Hidden Markov model: Localization, Kalman Filter basics.	**12**
UNIT – III	
Reinforcement Learning: Introduction, Passive reinforcement learning, Generalization in reinforcement learning, Applications of reinforcement learning, **Q-Learning Intuition:** Plan of attack, Bellman Equation, The Plan, Markov Decision Process, Policy vs Plan, Adding Living penalty, Temporal Difference	**10**
Course Outcomes: At the end of the course student will be able to: 1. Explain the fundamental understanding of the history of Artificial Intelligence (AI) and its foundation. 2. Interpret the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning 3. Describe the awareness and fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models. 4. Identify and explain the proficiency developing applications of AI language, expert system shell, or data mining tool 5. Determine an ability to share in discussions of AI, its current	

scope and limitations.	
REFERENCE BOOKS: 1. Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017 2. Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier, 1997. 3. Artificial Intelligence by Luger, Pearson Education, 2002. 4. Artificial Intelligence by Padhy, Oxford Press, 2005.	
E Books / MOOCs/ NPTEL 1. https://www.edx.org/course/artificial-intelligence-ai 2. https://www.udemy.com/course/artificial-intelligence-az/	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2								3	
CO2	3	2	2		2								3	
CO3	3	2	2		2								3	
CO4	3	2	2		2								3	
CO5	3	2	2		2								3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3
CO2	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3
CO3	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 5.1.1	L3
CO4	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 5.1.1	L3
CO5	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3

COMPUTER VISION

Course Code	21AM504	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. To impart the knowledge on image processing measures, colors , shadows and filters.
2. To develop the ability to apprehend and implement various object identification techniques
3. Understand various texture analysis and synthesis on images.
4. Analyze various segmentation techniques.
5. To facilitate students to comprehend on various pattern and motion analysis schemes for machine vision applications.

UNIT - I	Contact Hours
Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases. **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models. **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color. **Linear Filters:** Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates.	15
UNIT – II **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges. **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture. **The Geometry of Multiple Views:** Two Views.	

Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras. **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.	15
UNIT - III	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Discover and understand enhancement, segmentation and morphological operations on images for further analysis.
2. Acquire the knowledge of various edge detection and analysis for better interpretation.
3. Experiment the various segmentation techniques on images.
4. Design and implement various probabilistic methods for images.
5. Analyze and explore various liner dynamic models

TEXTBOOKS:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCE BOOKS:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4th Edition, Cengage Learning, USA, 2014
3. Jurgen Beyerer, Fernando Puente Leon, Christian Frese,”Machine Vision Automated Visual Inspection: Theory, Practice and Applications”, 2016, Springer.
4. Oge Marques, Practical Image and Video Processing using MATLAB, IEEE Press, Wiley Publications, 2011
5. R. C. Gonzalez and R. E. Woods, “Digital Image Processing (4th Edition), 2018.
6. R. Szeliski, “Computer vision: algorithms and applications”, ISSN 1868-095X, 2nd Edition,Springer Nature Switzerland AG, 2022.

E Books / MOOCs/ NPTEL:

1) https://nptel.ac.in/courses/106105216

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2								3	
CO2	3	2	2		2								3	
CO3	3	2	2		2								3	
CO4	3	2	2		2								3	
CO5	3	2	2		2								3	

1: Low, 2: Medium, 3: High

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3
CO2	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3
CO3	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 5.1.1	L3
CO4	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 5.1.1	L3
CO5	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.3, 3.2.1, 5.1.1	L3

ARTIFICIAL INTELLIGENCE AND COMPUTER VISION LAB

Course Code	21AM505	**CIE Marks**	50
Number of Contact Hours/Week	0:0:2	**SEE Marks**	50
Total Number of Contact Hours	26	**Exam Hours**	03

Credits – 1

Course Learning Objectives:

This course will enable students to:

1. Implement and evaluate AI algorithms in Python programming language.
2. Apply the knowledge of AI and carry out a mini project on game design.
3. Demonstration of the Predicate logic/classification algorithms.
4. Design and implementation of image and video using open CV.
5. Evaluate different algorithms using given data set.

List of Experiments: the students must carry out minimum following experiments and not restricted to.
This lab contains a mini project.

PART-A

1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2. Implement and Demonstrate Best First Search Algorithm on any AI problem
3. Implement AO* Search algorithm.
4. Solve 8-Queens Problem with suitable assumptions
5. Implementation of TSP using heuristic approach
6. Implementation of the problem-solving strategies: either using Forward Chaining or Backward Chaining
7. Implement resolution principle on FOPL related problems
8. Implement K- means algorithm.
9. Implement K- nearest neighbour algorithm
10. Implement SVM

PART-B

1. Write a program in python to demonstrate working with images and videos using OpenCV.

2. Write a program in python to demonstrate Bitwise Operations on Binary

Images using OpenCV.

3. Write a program in python to Draw different geometric shapes and to write text on images using OpenCV.
4. Write a program in python to perform different Morphological operations on images based on OpenCV
5. Implement different Thresholding techniques, Edge detection and Contour detection on images using openCV.
6. Demonstrate Haar feature-based cascade classifiers for Face and Eye Detection on images and videos.
7. Develop a classification model using YOLO object detection algorithm using OpenCV.
8. Write a program in python to demonstrate Handwritten Digit Recognition on MNIST dataset.
9. Develop a classification model to detect dogs and cat from a given dataset

Course Outcomes: The student should be able to:

1. Implement and demonstrate AI algorithms for informed and uninformed searches.
2. Implementation of the problem-solving strategies.
3. Demonstration of the Predicate logic/classification algorithms.
4. Design and implementation of image and video using open CV.
5. Evaluate different algorithms using given data set.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3		2							2	3	
CO2	3	3	3		2							2	3	
CO3	3	3	3		2							2	3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3
CO2	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3
CO3	PO1, PO2, PO3, PO5, PO12	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 5.1.2, 12.1.1	L3

RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS

Course Code	**21HU511**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**25**	**Total Marks**	**100**
Credits	**2**	**Exam Hours**	**3**

Course Learning Objectives:

1. To explain the significance of carrying out research work,
2. To explain the Research Problem, Review the literature.
3. To understand Research Design, methodological way of execution.
4. To understand Data Collection, and Interpretation and Report Writing.
5. To appreciate the importance of Intellectual property rights protection.

UNIT - I

Research Methodology:

Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem:

Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique

Involved in Defining a Problem, An Illustration.

Reviewing the literature:

Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

UNIT - II

Research Design:

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Design of Sample Surveys:

Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Data Collection:

Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Interpretation and Report Writing:

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout.

Interpretation and Report Writing (continued):

of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Pedagogy	Chalk and talk, Power point presentation, Videos

UNIT - III

Intellectual Property:

The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration

of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.	
Pedagogy	Chalk and talk, Power point presentation, Videos

Course Outcomes (Course Skill Set)

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

CO1: Explain the significance of carrying out research work,

CO2: Explain the Research Problem, Review the literature.

CO3: Describe Research Design, methodological way of execution.

CO4: Execute Data Collection, and Interpretation and Report Writing.

CO5: Explain the importance of Intellectual property rights protection.

PO-CO mapping

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	**2**	1								3					**1**
CO 2	1	2	**1**												**1**
CO 3	2	2	**1**				1								**1**
CO 4	3	3	3			1									**1**
CO 5	1	1				3	2	2		3					**1**

1: Low 2: Medium 3: High

ENVIRONMENTAL STUDIES

Course Code:	21CV512	**Course Type**	**MNC**
Teaching Hours/Week (L: T: P)	**1:0:0**	**Credits**	**00**
Total Teaching Hours	**15+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Civil Engineering

Course Learning Objectives:

1. To raise consciousness about environmental conditions and to imbibe environmentally appropriate behaviour.
2. To equip the engineering undergraduates to identify the significance of environmental practice in their daily life and in the engineering practices.
3. To make them conscious of understanding the environment where we live and act up on.

UNIT - I

03 Hours

Environment

Definition, significance of environmental studies- current scenario, local, regional, national and global problems

Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere. Layers of atmosphere and its role.

Parts of Earth- lithosphere and its role; hydrological cycle

Eco system - Definition, ecology and environment, ecosystem components: biotic and abiotic components; ecological balance; elements of ecosystem: biotic, abiotic; producers, consumers and decomposers.

Habitat, range of life, Biome, balanced eco- system, food chain, food web and ecological pyramids

Human activities - The Anthropogenic System- human activities like growing food, building shelter and other activities for economy and social security. Soil erosion, water logging -definition. Organic farming- definition.

Natural resources **03 Hours**

Resources - Natural resources, water, minerals, Fossil fuels and energy

Water resources - Global water resources: distribution, uses of water for irrigation, domestic and industrial purposes in India.

Quality aspects - Water quality parameters, drinking water standards for turbidity, pH value, total hardness, iron, fluoride, lead, arsenic, nitrate

Mineral resources- Metallic minerals, non-metallic minerals Fossil fuels - Coal and petroleum

Forest Wealth - Components of the forest, key benefits of forests. Deforestation-

environmental effects of deforestation and remedies Sustainable development- definition, objectives

Material cycles - Carbon, Nitrogen, and Sulphur cycles.

UNIT – II

Environmental pollution: Definition, harmful effects related to public health	**03 Hours**

Water pollution:

Definition, types, and sources – agriculture (pesticides and fertilizers), industry, domestic and mining, harmful effects, water borne and water induced diseases- definition, common diseases and their causatives, Fluoride problem in drinking water

Land pollution:

Definition, sources_ agriculture, housing, industry, mining, transportation. Types of municipal Solid waste Disposal (Sanitary landfills, composting, incineration (in brief) and effects

Air Pollution:

Definition, types, and sources: industry, mining, agriculture, transportation, and effects

Noise pollution:

Definition, sources, mining, industries, rail-roads, aviation, effects and control measures

Energy	**02 Hours**

Different types of energy-

Non-renewable energy; fossil fuels- coal, oil, and natural gas- brief description only. Nuclear energy- nuclear power plants,

Renewable energy: solar energy- Photovoltaic systems for street and domestic lighting, solar water heating-brief description only

Wind energy- definition, merits and demerits, Hydro power- definition, merits, and demerits.

Biomass energy- definition, sources of bioenergy, biogas, biofuels, India's position in renewable energy

Hydrogen as an alternative future source of energy- brief scope, fuel cells.

UNIT – III

Current environmental issues of importance	**04 Hours**

Population growth- Definition, growth rate, effects, remedies Urbanization- Definition, environmental impacts and remedies Global warming and climate change-

Concept of greenhouse effect, sources of greenhouse gases, effects, and remedial measures of greenhouse gases

Acid rain: Definition, causes and effects, control measures. Ozone Depletion: Definition, causes, effects, and control measures.
Environmental Impact Assessment- EIA definition, objectives, and benefits of EIA.

Course Outcomes: At the end of the course student will be able to

1. Identify the significance of environmental practice in their daily life and in the Engineering practices.
2. Create awareness about environmental conditions.
3. Follow environmentally appropriate behaviour.
4. Understand the importance of their surroundings.
5. Understand Current environmental issues of importance

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes													1	2	3
CO1	-	2	-	-	-	-	-	2	-	-	-	-	1	-	-
CO2	-	-	-	1	-	-	-	-	-	1	-	-	1	-	-
CO3	1	-	-		1	-	-	-	-	-	-	-	1	-	-
CO4	1	-	-	1	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	3	-	-	-	-	-	-	-	3	-	1	-	-

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi, 2005.
2. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, London, 2005.

REFERENCE BOOKS:

1. Balasubramanya, N and Chatwal, Gurdeep R., "Environmental Studies", Himalaya Publishing House, Mumbai, 2007.
2. Barucha, E., "Environmental Studies", University Grants Commission, New Delhi, 2004.
3. Bhatia, S. C., "Environmental Chemistry", CBS Publishers, New Delhi, 2005.
4. De, A.K. and De, A. K., "Environmental Studies", 2006.
5. Keller, Edward A., "Environmental Geology", CBS Publishers and Distributors, Delhi, 1985.

ABILITY ENHANCEMENT COURSE-V

DATA VISUALIZATION TECHNIQUES AND TOOLS			
Course Code	21AMA51	**CIE Marks**	50
Number of Contact Hours/Week	**0:0:2**	**SEE Marks**	50
Total Number of Contact Hours	26	**Exam Hours**	03
Credits – 1			

Course Learning Objectives:

This Course will enable students to:

1) Comprehensive understanding of data visualization principles and techniques.
2) Familiar with popular data visualization tools and software, such as Tableau, Power BI, or Python libraries like Matplotlib and Seaborn.
3) Gain proficiency in using the tools to create interactive and visually appealing visualizations.
4) Understand the importance of data preparation and exploration in the context of data visualization.
5) Able to draw insights from the data and apply their knowledge and skills in real-world projects or case studies.

	Contact Hours
Introduction to Data Visualization using Tableau: • Getting familiar with the Tableau interface and terminologies. • Tableau Data Sources-Custom data view, Extracting data, Fields operations, Editing metadata, Data joining, Data blending. • Tableau Worksheets-operations. • Tableau Calculations • Tableau Sort & Filters • Visualizations in Tableau-bar charts, line charts, scatter plots, gantt chart, histogram, waterfall charts • Dashboard Design and Layout • Tableau Formatting and Forecasting	26

Introduction to Data Visualization using Power BI: • Overview, advantages • PowerBI desktop • PowerBI workspace • Transforming data-create column, remove column • Reports • Dashboards • PowerBI's Integration with R & Python • Saving and publishing.	
Course Outcomes: Upon completion of this course, students will be able to: 1. Apply knowledge of Tableau and PowerBI to real-world datasets. 2. Familiarize on data visualization tools and software, such as Tableau, Power BI, and Python libraries. 3. Design and customize different chart types, including bar charts, line charts, scatter plots, histograms, heat maps, and so on. 4. Perform various worksheet operations using different tools. 5. Create interactive dashboards, developing visualizations for specific business scenarios, or analyzing data for decision-making.	
TEXTBOOKS: 1. Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform Your Data, Kyran Dale, O'Reilly, 2016	

References:

https://www.tutorialspoint.com/tableau/index.htm
https://www.javatpoint.com/tableau
https://www.analyticsvidhya.com/blog/2021/04/from-scratch-to-a-story-introduction-to-tableau/
https://www.analyticsvidhya.com/blog/2021/10/step-by-step-guide-data-visualization-tableau/

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3		2								3	
CO2	3	2	3		2								3	
CO3	3	2	3		2								3	
CO4	3	2	3		2								3	
CO5	3	2	2		2								3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO2	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3

MOBILE APPLICATION DEVELOPMENT			
Course Code	21AMA52	**CIE Marks**	50
Number of Contact Hours/Week	0:0:2	**SEE Marks**	50
Total Number of Contact Hours	26	**Exam Hours**	03

Credits – 1

Course Learning Objectives:

This Course will enable students to:

1. Describe the architecture and overview of android.
2. Develop a mobile application on Android Platform using UI components and Android Components.
3. Develop applications supporting services and broadcast receivers.
4. Manage the data handling of the app using databases, shared preferences.
5. Support the application with the graphical features or animations and sensors.

UNIT – I	Contact Hours
INTRODUCTION AND OVERVIEW: Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android Platform, setting up the mobile app development environment along with an emulator in Android Studio, Hello World Example. **USER INTERFACE DESIGNING:** App user interface designing – mobile UI Layout (Layout, View) UI Control (TextView, EditText, Button, ImageButton, ToggleButton, RadioGroup, RadioButton, CheckBox, ProgressBar, Spinner, DayPicker, TimePicker), Draw-able, Menu(Option, Context, Popup). **Hands-on exercises:** • Design four checkboxes namely any four food items and one button. Find total amount of food items selected in Toast message after clicking the button. • Create an application which generates a random color on each click.	10

• Implement option menu concept in application to choose between two activities. • Implement context menu concept in application to change the background color.	
UNIT - II	
ANDROID APPLICATION COMPONENT: Activity –states and life cycle, interaction amongst activities. Services – state and lifecycle. Notifications, Broadcast Receivers, Content Provider, Fragments. **Intents**: Implicit and Explicit Intent **APP FUNCTIONALITY BEYOND USER INTERFACE**: Threads, Async task, Notification, Location Based Service, Telephony and SMS APIs, Text to Speech, Camera **Hands-on exercises:** 1. Write an application to send SMS using Intent class. 2. Implement phone call concept in application by passing number from the user. 3. Demonstrate the sending of an email with the help of a registered email client on your android phone. 4. Write an app to capture the image using camera and set it as background for your app.	10
UNIT - III	
DATA HANDLING: Shared preferences, mobile data bases such as SQLite and enterprise data access, Android multimedia**:** Multimedia-audio/video playback and record. Sensors**:** Location awareness and native hardware access (sensors such as accelerometer and gyroscope). Android Web Service, Android Google Maps, Android Bluetooth, Navigation. **Hands-on exercises:** 1. Write an application to insert the data entered by a user into a database and display all the values in database. 2. Write an application to search for a given USN from a student database and call to that student. 3. Write an application to toast your joining date and course selected for engineering using date picker and list view.	06

Course Outcomes:

Upon completion of this course, students will be able to:

1. Use the IT tool like Android Platform and Android Studio Environment to develop android application.
2. Design the user interface using the Android UI Components and Android Application Components.
3. Use the concepts like SQLite, shared preference, files, broadcast, notifications, and other APIs for developing the android applications.
4. Develop Application using Sensor telephony APIs.
5. Apply the google APIs for the app development.

TEXTBOOKS:

1. Anubhav Paradhan, Anil V Deshpande, "Mobileapps Development", First Edition, Wiley,2014.
2. Barry Burd , "Android Application Development All in one for Dummies", Second Edition Wiley,2015.
3. SAMS,"Teach Yourself Android Application Development in 24 Hours",FirstEdition,SamsPublishing,2010.

REFERENCE BOOKS:

1. Wei-Meng Lee, "Beginning Android Application Development", WroxPublication, 2011.
2. Reto Meier, "Professional Android 4 Application Development", WroxPublication,2012.

INTERNET OF THINGS			
Course Code	21AM601	**CIE Marks**	50
Number of Contact Hours/Week	3:0:2	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 4

Course Learning Objectives:

1. Assess the genesis and impact of IoT applications, architectures in real world.
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT.
4. Infer the role of Data Analytics and Security in IoT.
5. Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

UNIT - I	Contact Hours
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoTArchitecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks **Textbook 1: Ch.1, 2, 3**	15
UNIT - II	
Connecting Smart Objects, Communications Criteria, IoT Access Technologies (IEEE 802.15.4, LoRaWAN, NB-IoT and Other LTE Variations) IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	15

Textbook 1: Ch.4, 5, 6	
UNIT - III	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR **Textbook 1: Ch.7, 8**	9
Following are the Lab experiments can be carried in Internet of things Lab and not limited to. **This contains a mini project component.** 1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation. 2. Introduction of Arduino IDE. Demonstrate setup(), serial.analogRead() and loop() functions, serial.begin() serial.print(), serial.available(), serial.read() and serial.write() statement. 3. Write an arduino program to demonstrate user defined functions, data types, variables, constants, operators, if statements, switch case, loops, arrays etc. 4. Write an arduino program to demonstrate strings, string object. 5. Write an arduino program to demonstrate time based functions. 6. Write an arduino program to demonstrate random numbers generation 7. Write an arduino program to demonstrate the 7-segment display. 8. To interface Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds. 9. To interface Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED at sensor detection. 10. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. 11. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed. 12. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it. 13. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	26

14. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
15. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to things peak cloud.
16. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from things peak cloud.
17. Write a program on Arduino/Raspberry Pi to publish temperature to MQTT broker.
18. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
19. Write a program to create a TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
20. Write a program to create a UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
21. Transmit a string using UART.
22. Point-to-Point communication of two Motes over the radio frequency.
23. Multi-point to single point communication of Motes over the radio frequency.
24. LAN (Subnetting).
25. I2C protocol study

Course Outcomes:

Upon completion of this course, students will be able to:

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Appraise the role of IoT protocols for efficient network communication.
4. Elaborate the need for Data Analytics and Security in IoT.
5. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

TEXTBOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education
2. Vijay Madisetti, ArshdeepBahga, "Internet of Things- A Hands on Approach", UniversityPress

REFERENCE BOOKS:

1. Adrian McEwen, "Designing the Internet of Things",Wiley
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media

E-Books / Online Resources/ MOOC:

1. https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
2. www2.datainnovation.org/2013-internet-of-things.pdf
3. https://onlinecourses.nptel.ac.in/noc17_cs22/preview
4. https://www.coursera.org/learn/iot
5. https://www.class-central.com/mooc/6748/coursera-introduction-to-architecting-smart-iot-devices.

Table 1: Mapping Levels of COs to Pos

Cos	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3			3	2								3
CO2	3	3			3	2								3
CO3	3	3			3	2								3
CO4	3	3			3	2								3
CO5	3	3			3	2								3

Table 2: Mapping of Cos to PIs, Pos and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO2	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO3	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3,5.1.1, 9.1.1, 10.1.1	L2, L3
CO4	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 5.1.2, 9.1.1, 10.1.1	L2, L3
CO5	1, 2		1.3.1,1.4.1, 2.1.3

NATURAL LANGUAGE PROCESSING			
Course Code	21AM602	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

This Course will enable students to:

1) Analyze language and the tools available for processing the text.
2) Efficiently analyse the large collections of text.
3) Discuss how word level language is generated.
4) Understand the syntactic analysis of the given words and sentences.
5) Outline and understand design features of information retrieval.

UNIT – I	**Contact Hours**
Overview and Language Modeling: **Overview:** Definition, Origins of NLP, Language and Knowledge-Levels, Role of grammar in language processing, Transformational grammar, Challenges of NLP, Applications of NLP, Information	15

retrieval. **Language Modeling:** Various Grammar based Language Models Generative grammars, Hierarchical grammar, Paninian Framework, Karaka Theory. Statistical Language Model- n-gram model, Add-one Smoothing, Good-Turing Smoothing, Caching Techniques.	
UNIT - II	
Word Level and Syntactic Analysis: **Word Level Analysis:** Regular Expressions- Introduction, Finite State Automata Morphological parsing, Spelling Error Detection and Correction, Word and word classes, Part-of Speech Tagging-Rule based, Stochastic and hybrid taggers. **Syntactic Analysis:** Introduction, Context-Free Grammar, Constituency. Parsing-Top-down Parsing, Bottom-up Parsing, A-basic Top-down Parser, Early Parser. **Natural Language Understanding (NLU):** Definition, Approaches in NLU, Comparison between NLP and NLU , Approaches of machine translation in NLU	15
UNIT - III	
Information Retrieval and Lexical Resources: **Information Retrieval:** Design features of Information Retrieval Systems, Classical, Non classical, Alternative models of Information Retrieval. **Lexical Resources:** Word Net, Frame Net, Stemmers, POS Tagger.	9

Course Outcomes:

1. Understand and analyse the natural language text.
2. Acquaint with the tools, techniques, resources, applications and challenges in NLP
3. Learn natural language processing with manual and automated approaches.
4. Learn syntactic analysis for natural language processing.
5. Design different models of information retrieval systems.

TEXTBOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.

REFERENCE BOOKS:

1. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.
2. Natural Language understanding by James Allen, Pearson Education, 2002.
3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.

E Books / MOOCs/ NPTEL

1. https://www.coursera.org/specializations/natural-language-processing
2. https://en.wikipedia.org/wiki/Natural-language_understanding

Table 1: Mapping Levels of COs to POs

Cos	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2											2	
CO2	3	2	2										2	
CO3	3	2	2										2	
CO4	3	2	2										2	
CO5	3	2	2										2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1, PO2	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2	L2
CO2	PO1, PO2, PO3	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2, 3.3.3	L3
CO3	PO1, PO2, PO3	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2	L3
CO4	PO1, PO2, PO3	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2	L3
CO5	PO1, PO2, PO3	1.1.2, 1.1.3, 1.2.1, 2.1.2, 2.2.1, 3.1,2	L3

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	21AM603/21CC603	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits–3

UNIT - I	**Contact Hours**
Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as art or science, art or profession-Management & Administration-Roles of Management, Levels of Management, Development of Management Thought - early management approaches –Modem management approaches. **Planning**: Nature, importance and purpose of planning process objectives - Types of plans (meaning only) - Decision making, Importance of planning - steps in planning & planning premises-Hierarchy of plans. **Organizing and staffing**: Nature and purpose of organization, Principles of organization–Typesoforganization-DepartmentationCommittees-CentralizationVsDecentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only)Nature and importance of staffing--:Process of Selection &Recruitment(in brief). **Directing**: Meaning and nature of directing Leadership styles, Motivation,	15

Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of coordination. **Controlling**: Meaning and steps in controlling - Essentials of a sound control system –Methods of establishing control (in brief).	
UNIT – II	
Entrepreneur: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship-its Barriers. **Small scale industries**: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only). **Institutional support**: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.	14
UNIT – III	
Preparation of project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of. Business OpportUNITies: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study. **Industrial ownership**: Definition and meaning of Partnership, Characteristics of Partnership, Kinds of Partners, Partnership Agreement or Partnership Deed, Registration of Partnership Firm, Rights, Duties and Liabilities of Partners, Advantages and Disadvantages of Partnership, Sole proprietorship, Features, Scope Advantages and Disadvantages of Sole Proprietorship.	10

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explainmanagementfunctionsofamanager.Alsoexplainplanninganddecisionmakingprocesses.
2. Explain the organizational structure, staffing and leadership processes.
3. UnderstandingofEntrepreneurshipsandEntrepreneurshipdevelopmentprocess.
4. Illustrate Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur.
5. Summarize the preparation of project report, need significance of report. Also to explain about industrial ownership.

TEXTBOOKS:

1. Principles of Management–P.C.Tripathi, P.N.Reddy–Tata McGraw Hill.
2. Dynamics of Entrepreneurial Development & Management-Vasant Desai, Himalaya Publishing House.
3. Entrepreneurship Development – Poornima.M.Charantimath, Small Business Enterprises– Pearson Education-2006

REFERENCE BOOKS:

1. Management Fundamentals - Concepts, Application, Skill Development – Robers Lusier, Thomson.
2. Entrepreneurship Development -S.S.Khanka, S.Chand & Co. NewDelhi.
3. Management-Stephen Robbins, Pearson Education/PHI-17thEdition, 2003.

NATURAL LANGUAGE PROCESSING LAB			
Course Code	21AM604	**CIE Marks**	50
Number of Contact Hours/Week	0:0:2	**SEE Marks**	50
Total Number of Contact Hours	26	**Exam Hours**	03
Credits – 1			

Course Learning Objectives:

1. Analyze language and the tools available for processing the text.
2. Efficiently apply the techniques to the large collections of text.
3. Understand how word level language is generated.
4. Design the syntactic analysis of the given words and sentences.
5. Outline the features of information retrieval.

Students must carry out experiments from 21AM602 and not limited to following:

part-a

1. Perform word tokenization and sentence tokenization for the long paragraph using NLP libraries like:
   a. Tokenization Using Python's Inbuilt Method
   b. Tokenization Using Regular Expressions(RegEx)
   c. Tokenization Using NLTK
   d. Tokenize as a list Using SpaCy
   e. Tokenization using Keras
   f. Check token is Alphabet/Punctuation/Number/Currency or Not using Spacy and display appropriate messages for every token.

2. Consider students.txt and perform the following operations:
   a. Tokenize the email ids from the given students.txt using Spacy
   b. Tokenize all email ids from the given students.txt using NLTK
   c. Collecting dataset websites from a book paragraph using Spacy

   Text='''

   Look for data to help you address the question. Governments are good sources because data from public research is often freely available. Good places to start include http://www.data.gov/, and http://www.science.gov/, and in the UNITed Kingdom, http://data.gov.uk/. Two of my favorite data sets are the General Social Survey at http://www3.norc.org/gss+website/, and the European Social Survey at http://www.europeansocialsurvey.org/. The current representation will be formed by a well-organized collection

of agents, previously structured in a dynamic, control-based manner. This collection of agents will be built based on the analysis of activations of conception and structuring agents that intercommunicate. Having first deployed an intent, a global interpretation of the system's situation is formed by means of questionings, qualifying aspects of things, memorized cases, development of numerous cognitive aspects by activating agents that operate proper scaling up, all of which will allow for the efficient emergence of the representation. The system's interpretation of this collection of agents will take the form of http://www.systemsurvey.org/ a network of dynamic knowledge of apprehensions, operating through questions in a steadily activated loop. This knowledge network will be activated by the system and further developed based on inter-agent relations that will result in significant aggregations of knowledge, structures of dynamic knowledge with appropriate (domain.com) characteristics.

'''

d. Extract all money transaction from below sentence along with currency using Spacy.

Transactions = "Aron gave two $ to Shawn, Smith gave 500 $ to Johan"

Output should be,

two $

500 $

3. Implement text preprocessing techniques on email dataset using NLTK libraries and perform following operations:

a. Rename columns
b. Expand contractions
c. Lower case
d. Remove punctuations
e. Remove digits and word containing digits
f. Remove stop words and specified words

4. Perform following stop word operations on email dataset using Spacy, Gensim and NLTK libraries

a. Display existing stop words in the default list
b. Removing stop words from the default list
c. Adding stop words to the default list

5. Generate n-gram representation for the given corpus and perform following operations on the corpus:
a. Preprocess the corpus for n-gram representation
b. Display all tokens, distinct tokens and frequency of tokens in the corpus
c. Bi-gram and frequency representation using user defined functions
d. Tri-gram and frequency representation using user defined functions

6. Implement following operations on the tweets dataset using NLTK libraries:
a. Data cleaning
b. Rank most frequently occurring 15 n-grams (bigram and trigrams) in the given tweets dataset
c. Visualize most frequently occurring 15 n-grams (bigram and trigrams) in the given tweets dataset

7. Perform following operations on the given text data:
a. Stemming using porter stemmer, snowball stemmer, lancaster stemmer
b. Lemmatization using spacy lemmatizer, wordnet lemmatizer, textblob lemmatizer

PART-B

8. Visualize POS tagging for simple text using NLTK and SPACY libraries and perform following operations:
a. Display dependency tagging for the text
b. Display named entities in the taken text
c. Visualize the text with appropriate user defined entities and tokens.

9. Perform minimum edit distance for the given two strings using:
a. User defined function
b. Built in function

10. Perform given vectorization techniques on the following datasets:
a. Bag of Words (BOW) on 4 documents.
b. Term Frequency and Inverse Document Frequency (TF-IDF) on 4 documents.
c. Word2Vec model using CBOW for the large corpus in

word2vec.txt by preprocessing the corpus.

11. Demonstrate question answering application using gradio with transformers.

12. Demonstrate sentence classification using pipeline.

13. Demonstrate text summarization on the given input file summary. txt by performing following operations using spacy library:

a. Display the content of summary.txt file.
b. Print word with its frequency to the given text file.
c. Display maximum frequency of word in the given text file.
d. Normalization.
e. Find out sentence scores.
f. Summarize 30% of the sentences with maximum score.

Design and Implement NLP mini project based on either text or audio or video documents

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand and apply the natural language text.
2. Analyze with different tools and techniques in NLP
3. Learn natural language processing with manual and automated approaches.
4. Apply syntactic analysis for natural language processing.
5. Design different models of information retrieval systems.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3		2								3	
CO2	3	2	3		2								3	
CO3	3	2	3		2								3	
CO4	3	2	3		2								3	
CO5	3	2	2		2								3	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO2	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO3, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3

SOFTWARE ENGINEERING AND TESTING

Course Code	21AMV02	**CIE Marks**	50
Number of Contact Hours/Week	**1:0:2**	**SEE Marks**	50
Total Number of Contact Hours	26	**Exam Hours**	03

Credits – 1

Course Learning Objectives:

This Course will enable students to:

1. Learn the concepts and importance of software engineering and testing.
2. Learn strengths and weaknesses of various software engineering techniques used in industrial applications.
3. Select appropriate testing strategies based on the application
4. Analyze various software testing tools and techniques used in the industrial applications.
5. Able to construct software that is reasonably easy to understand, modify, maintain, reliable and test.

UNIT – I	Contact Hours
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics, Case Studies. Software Processes: Models: Waterfall Model Incremental Model and Spiral Model, Process activities. **Requirements Engineering:** Functional and non-functional requirements, Requirements Engineering Processes, Requirements Elicitation and Analysis, Requirements Specification, Software Requirements Document, Requirements Validation and Management. **System Models:** Context models, Interaction models, Structural models, Behavioral models.	10
UNIT - II	
Architectural Design: Architectural design decisions. Architectural Views and patterns, Application architectures. **Agile Software Development:** Coping with Change, The Agile Manifesto: Values and Principles, Agile methods and Extreme Programming, Plan-driven and agile development, Agile project management, Scaling agile methods. **Software Testing**: Introduction, Development testing, Test-driven development,	10

Release testing, Test Automation. **Tutorials:** Introduction to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing.	
UNIT - III	
Software Testing Strategies: A Strategic approach to software testing, Strategic issues, Test strategies for conventional software, Test strategies for object oriented software, Test strategies for Web Apps, Validation Testing, System Testing, White-box testing, Black box testing. **Tutorials:** Understanding TestNG framework with Selenium Web driver for automation testing, Introduction to Maven automation tool. **To work on mini projects developed in earlier semesters to apply software design and report making**.	6

Course Outcomes:

After completion of course, students would be able to:

1. Understand the process of designing, creating and maintaining software.
2. Create software for various application domains using the strategies.
3. Illustrate the challenges of various software engineering techniques in large-scale software development.
4. Understand the basic concepts of software testing
5. Analyze the importance of software testing strategies and project planning.

TEXTBOOKS:

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2012.
2. Roger S. Pressman: "Software Engineering-A Practitioners approach", 7th Edition, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Pankaj Jalote: "An Integrated Approach to Software Engineering", Wiley, India, 2010.
2. Software Engineering, N.S. Gill, Khanna Publishing Co., Delhi 2018.
3. An Integrated Approach to Software Engineering, Pankaj Jalote, Narosa, 2014
4. Fundamentals of Software Engineering, By Rajib Mall, PHI Learning Pvt. Ltd, 2014
5. Software Engineering (3rd ed.), By K.K Aggarwal & Yogesh Singh, New Age International Publishers, 2007
6. Rex Black , "Managing the Testing Process",2nd edition, John Wiley & Sons, 2001

E-Books / Online Resources:

1. https://www.softwaretestinghelp.com/selenium-tutorial-1/
2. http://softwaretestingfundamentals.com/software-testing-methods/
3. https://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf
4. http://docs.seleniumhq.org/docs/
5. http://www.seleniumhq.org/download/

MOOC:

c) http://nptel.ac.in/courses/106105150/

d) https://freevideolectures.com/course/3625/testing-with-selenium

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	3	2									3
CO2	3	3	2	3	2									2
CO3	3	3	2	2	3									2
CO4	3	3	1	2	3									2
CO5	3	3	1	2	3									2

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L3
CO4	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L3
CO5	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

PROFESSIONAL ELECTIVES (GROUP 1)

ANGULAR AND REACTJS			
Course Code	21AME011	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

The students will be able to understand

1) Design static web pages using HTML5 and Cascading Style Sheets (CSS).
2. Develop client side validations using JavaScript.
3. Understand the basics of AngularJS
4. Develop interactive AngularJS script at the clientside.
5. Understand the basics of ReactJS.

UNIT - I	Contact Hours
HTML5: Overview of HTML5, New features in HTML5, Removed elements from HTML, HTML5 Semantic elements, HTML5 input types, HTML5 new form elements and attributes, HTML5 Video and Audio. **THE BASICS OF JAVASCRIPT:** Overview, Object orientation and JavaScript, General syntactic characteristics, Primitives, Operations, and Expressions, Screen output and keyboard input, control statements, Object creation and modification, Arrays, Functions, Constructors, Patterns matching using Regular Expressions, Errors in Scripts. **JAVASCRIPT AND XHTML DOCUMENTS:** The JavaScript Execution Environment, The Document object model, Element access in JavaScript, Events and Event handling, Handling events from Body elements, Handling events from Button elements, Handling events from Text Box and Password elements, The DOM 2 Event Model, The navigatorObject.	15

UNIT - II	
Introduction To Angularjs: Angularjs Overview, Angularjs Mvc Architecture, Angularjs Expressions, Numbers, Strings, Objects, Arrays, Angularjs Modules, Angularjs Directives, Angularjs Model, Data Binding, Angularjs Controllers, Repeating Html Elements, Angularjs Scope, Angularjs Filters, Angularjs Services	15
UNIT - III	
Introduction To Reactjs: Introduction To Reactjs ,Reactjs Vs Angularjs, Pros And Cons Of Reactjs, React Components, React Class, React State, React Props, React Constructor, React Forms, React Events, React List, React Keys, React Fragments.	9
Course Outcomes: Upon completion of this course, students will be able to: 1. Design static web pages using HTML5 and Cascading Style Sheets (CSS). 2. Develop client side validations using JavaScript. 3. Understand the basics of AngularJS 4. Develop interactive AngularJS script at the clientside. 5. Understand the basics of ReactJS	
TEXTBOOKS: 1. Robert W. Sebesta, ―Programming the World Wide Web‖, Fourth Edition, Pearson,2014. 2.JakeSpurlock,―Bootstrap-ResponsiveWebDevelopment‖,O'Reilly publications,2013.	
REFERENCE BOOKS: 1. Ari Lerner, Ng-book, ―The complete book on Angular JS‖,2013.	

E Books / MOOCs/ NPTEL

- https://www.coursera.org/learn/angular
- https://nptel.ac.in/courses/106105084

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3		3	2								3	
CO2	3	2		2	2								2	
CO3	3	2		2	2								3	
CO4	3	2		2	2								3	
CO5	3	2		2	2								3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,4,5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	1,2,4,5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L2
CO3	1,2,4,5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L2
CO4	1,2,4,5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L2
CO5	1,2,4,5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L2

ARTIFICIAL INTELLIGENCE AND MEACHINE LEARNING IN HEALTHCARE			
Course Code	21AME012	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

This Course will enable students to:

1) Outline how AI is transforming the practice of medicine.
2) Understand different evaluation models
3) Understand image classification technique
4) Analyse the use knowledge-based techniques in AI
5) Apply Fuzzy Logic and Genetic Algorithm in disease prediction.

UNIT - I	Contact Hours
AI and ML in Health care Introduction, History of AI, Clinical Application of AI, AI technologies used in healthcare, AI-based healthcare system vs. Traditional healthcare system, Advantage of AI in health care, Use of AI in Health care, Roles of AI in Health, Challenges for AI in Healthcare Associate features of machine learning for healthcare structure, Pillars of machine learning for healthcare. **Artificial Intelligence Disease Diagnosis** Framework for AI in disease detection modelling , Medical imaging for diseases diagnosis , Symptoms of diseases and challenges to diagnostics, diseases with their sign and indications for events , Medical imaging types , Healthcare applications and their purpose , Use of AI in Diagnosis of Alzheimer's disease , Use of AI in Diabetes detection , Use of AI in Heart disease diagnosis , Use of AI in Hypertension disease detection , Use of AI in Cancer disease detection Cross Validation , The train , test and validation split , Evidence-Based Medicine, Automated Machine Learning for Health care. **Clinical information System** Introduction to clinical information systems, contemporary issues in	15

healthcare, workflow and related tools for workflow design, electronic health records databases, Healthcare IT & portable technology **Evaluating models** Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC and AUC curve and Threshold.	
UNIT - II	
Image Classification: What Is Image Classification? Image Processing, Purpose of Image processing, Phases of image processing, Steps in Image Classification, Image Classification Techniques, Maximum likelihood, Minimum-distance, Principal components, so cluster, Parallel piped, Mahala Nobis Distance, Application of Image Processing, Resolving Class imbalance Problem, SNOMED-CT : Classification of Conditions , The CAESAR-ALE Framework , Generating Perceptual-Gestural Sequences : Traces Merging and Somatization , Traces Enrichment , **Image segmentation on MRI images** Introduction, segmentation methods: Region Based Segmentation, Thresholding, Region growing, Region growing, Classification methods, boundary-based methods, Parametric deformable model, non-Parametric deformable model Medical, Hybrid methods, Level set methods, Graph cut method. Model Development and Workflow, Parameters and Hyperparameters, Hyper parameter Tuning, Multivariate Testing. **Knowledge Represent** Knowledge-Based Agent in Artificial intelligence , The architecture of knowledge-based agent , Inference system , Operations Performed by KBA , A generic knowledge-based agent , Various levels of knowledge-based agent , Approaches to designing a knowledge-based agent , What is knowledge representation , What to Represent , Types of knowledge , The relation between knowledge and intelligence , AI knowledge cycle , Approaches to knowledge representation , Requirements for knowledge Representation system , Techniques of knowledge representation, Bayesian Belief Network in artificial intelligence.	15

UNIT - III	
Use of Fuzzy System in AI Introduction, Fuzzy System history**,** Fuzzification, Defuzzification, Architecture of Fuzzy System, Member function, Advantages and Disadvantages of fuzzy logics. **Introduction to Genetic Algorithm** Introduction, Advantages of Gas, Limitations of Gas, Basic Terminology, Basic Structure, Algorithm of Genetic Algorithm, Classes of Search Techniques, Working Mechanism of Genetic Algorithms, The Genetic Algorithm Cycle of Reproduction, Two Armed and K – Armed Bandit Problem, Case study of Predicting Heart disease and kidney disease using Genetic Algorithm.	9

Course Outcomes:

Students should be able to do

1)Understand how AI can be applied to diagnosis of diseases.
2) Describe different evaluation models
3) Outline different Image Processing Technique
4) Analyse how to apply knowledge-based techniques to AI
5) Demonstrate the use of Genetic and Fuzzy logic in AI.

TEXTBOOKS:

1. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.
2. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st ed. Edition, 2019.

REFERENCE BOOK:

1. “Healthcare and Artificial Intelligence”, Springer, 2020

E Books / MOOCs/ NPTEL

1. https://www.coursera.org/learn/ai-for-medical-diagnosis
2. https://www.coursera.org/learn/ai-for-medical-prognosis#syllabus
3. https://www.coursera.org/learn/ai-for-medical-treatment#syllabus

Table 1: Mapping Levels of COs to POs														
COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2		1								2	
CO2	3	3	3	2	3								3	
CO3	3	3	2	2	3								3	
CO4	3	3	2		1								2	
CO5	3	3	3	2	3								2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO2	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO3	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO4	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO5	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2

ARTIFICIAL INTELLIGENCE IN AGRICULTURE

Course Code	21AME013	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Define the need of AI for Agriculture
2. Illustrate the use of Computer vision in Agriculture
3. Demonstrate the various applications which require AI
4. Analysis the impact od weather changes in crops
5. Illustrate the use of computer vision in crop analysis.

UNIT – I	**Contact Hours**
Why we need AI in Agriculture, OpportUNITies and key Challenges of AI in Agriculture. Predictive analytics: Machine Learning models to track and predict impacts of weather changes, Machine Learning models for crop sustainability. Machine learning algorithms for diagnosing soil defects.	15
UNIT – II	
Computer vision for crop analysis, disease prediction, crop and soil health monitoring, controlling pests.	15
UNIT – III	
Agricultural Robotics Weed control , Crop Harvesting , Autonomous Tractors, Drones for efficient agriculture practices	09

Course Outcomes:

Students should be able to do

1. Understand need of AI for Agriculture
2. Understand the use of Computer vision in Agriculture
3. Understand the various applications which require AI
4. Describe the impact od weather changes in crops
5. Illustrate the use of computer vision in crop analysis.

TEXTBOOKS:

1. "IoT and Analytics for Agriculture", springer, 2020
2. "Artificial Intelligence for Biology and Agriculture", Springer, 1998

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

AUGMENTED AND VIRTUAL REALITY			
Course Code	21AME014	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1) Outline the concept of virtual reality and its environment
2) Understand geometric modelling and its types
3) Describe virtual environment with linear interpolation and non-linear interpolation
4) Describe physical simulation and elastic collisions
5) Understand virtual reality applications

UNIT - I	Contact Hours
Introduction to Virtual Reality: Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation– Virtualenvironments–requirement–benefitsofvirtualreality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Color theory – Simple 3D modeling Illumination models – Reflection models – Shading algorithms- Radio city– Hidden Surface Removal – Realism-Stereographic image. **Geometric Modeling:** Introduction–From2Dto3D–3Dspacecurves–3Dboundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction– The virtual environment – the Computer environment – VR Technology – Model of interaction.	15

UNIT - II	
Virtual Environment: Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object in betweening – free from deformation – particle system **Physical Simulation:** Introduction – Objects falling in a gravitational field –Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft. **VR Hardwares:** Human factors : Introduction – the eye - the ear-the somatic senses –VR Hardware: Introduction–sensor hardware– Head-coupled displays – Acoustic hardware – Integrated VR systems	15
UNIT - III	
VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML. **VR Application:** Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction.	9

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand concepts of Virtual Reality & geometric modelling
2. Build Animations and simulations for Virtual environment
3. Describe virtual environment with linear interpolation and non-linear interpolation
4. Describe physical simulation and elastic collisions
5. Develop Virtual Reality Hard ware's &Soft wares and Virtual Reality applications

TEXTBOOK:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

REFERENCE BOOKS:

1. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill,2000.
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, 2nd Edition,2006.
3. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann,2008

E Books / MOOCs/ NPTEL:

1) https://www.udemy.com/topic/virtual-reality/ -Virtual reality

2) https://www.udemy.com/course/augmented_reality_with_UNITy/ Augmented reality

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3

AUTONOMOUS SYSTEMS			
Course Code	21AME015	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

At the completion of syllabus students will be able to :

1. Illustrate the fundamentals of autonomous systems versus robots.
2. Illustrate the fundamentals of robotics and its applications.
3. Analyze operation of industrial robots.
4. Understand the programming and design of an autonomous robot.
5. Learn the required components to implement an autonomous drone.

UNIT - I	Contact Hours
Introduction What are autonomous systems?, Examples of autonomous systems, Sensors and fusion, Autonomous system software architecture, Software foundation for safe systems, AI in autonomous systems, Autonomous systems vs robots. **Introduction to robots** Introduction, Definition, Types of robots, Automation and robotics, Advantages and disadvantages, The grand challenges in robotics, Overview of robots, The characteristics and application of the present robots (industrial), Advanced technological features of the modern robots, Needs for robots, The characteristics and applications of future Industrial robot.	15
UNIT - II	
Structure of robotic system Anatomy of a robot, classification of robots, robot configurations- Advantages, robotic system, joints in robots, robot specifications, robot drive system (actuators) in brief. **Sensors in robots** Terminology, Sensors that measure the robot's joint configuration, What is Robot Sensor: Working & Its Applications. **Operation, programming and path planning of robots** Types of industrial robot and their methods of operation- Pick and place manipulators, Point to point robots, Continuous path robots, Path	15

planning in robots: Algorithms used in robotics and industrial automation, Path planning, Overview of path planning algorithms used by robots, Programming languages for Robots.	
UNIT - III	
Introduction to Drones Unmanned Aerial Vehicles, Classification of UAVs, Physical structure of a drone, Advantages and disadvantages, Applications of drones. **Flight Mechanics** Forces acting on a drone, Flight mechanism, Degrees of a freedom of a quadcopter **Drone Electronics** Frame, Motor, Propeller, Electronic speed controller, Flight controller, GPS module, Battery, Radio transmitter, Radio receiver, Communication protocols-PWM,PPM	9

<u>Course Outcomes</u>:

Upon completion of this course, students will be able to:

1. Complete understanding fundamentals of autonomous systems versus robots.
2. Understanding the fundamentals of robotics and its applications.
3. Analyze operation and control of industrial robots.
4. Understand the programming and design of an autonomous robot.
5. Understand design, and implement an autonomous drone.

TEXTBOOKS:

1. Industrial Robotics: by Ganesh S. Hegde, 2nd edition, Laxmi publications,2015.
2. Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms by Nikolaus Correll, Bradley Hayes, Christoffer Heckman, and Alessandro Roncone, 2021
3. Syed Omar Faruk Towaha, "Building Smart Drones with ESP8266 and Arduino: Build exciting drones by leveraging the capabilities of Arduino and ESP8266" Packt Publishing, 2018.

REFERENCE BOOKS:

1. Intelligent Autonomous Systems Foundations and Applications by Pratihar, Dilip Kumar, Springer, 2010.
2. Fundamentals of Robot Technology: An Introduction to Industrial Robots, Teleoperators and Robot Vehicles by D J Todd, Springer, 2012.
3. Neeraj Kumar Singh, Porselvan Muthukrishnan, Satyanarayana Sanpini, "Industrial System Engineering for Drones: A Guide with Best Practices for Designing", Apress, 2019.
4. Aron Asadi, "Drones The Complete Manual. The essential handbook for drone enthusiasts", Imagine Publishing Limited, 2016.

E Books / MOOCs/ NPTEL

1. http://polypedal.berkeley.edu/wp-content/uploads/eaar7650.full_.pdf
2. https://cfdflowengineering.com/working-principle-and-components-of-drone/
3. https://www.dummies.com/article/technology/electronics/circuitry/radio-electronics-transmitters-and-receivers-179838/

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2		1								2	
CO2	3	2	2	2	1								2	
CO3	3	3	3	2	3								2	
CO4	3	3	3	3	3								3	
CO5	3	3	3	3	3								3	

Table 2: Mapping of cos to pis, pos and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
Co1	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1	L2
Co2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
Co3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
Co4	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3
Co5	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3

BIG DATA ANALYTICS			
Course Code	21AME016	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

The students should be able to

1. Understand basic terminologies used in data analytics.
2. understand and apply big data flow to actual projects
3. apply data analytics life cycle to big data projects.
4. identify and successfully apply appropriate techniques
5. tools to solve big data problems.

UNIT - I	Contact Hours
Overview of Big Data: Big data, Defining big data, Growth of and digitization of Global Information Storage Capacity, Big data types, Analytics, Industry Examples of Big data, Big data technologies, The evolution of big data architecture, Selecting big data technology, The Benefits of big data(Text Book 1). **Basics of Hadoop:** Big data and Hadoop, Architecture of Hadoop, Main components of Hadoop framework, Analysing big data with Hadoop, Distributed application concept: Comparison between Hadoop and RDBMS, Hadoop clustering, YARN, The Map Reducer's Engine, Advantages of Hadoop, Hadoop security concerns, Hadoop Streaming: Basics. (Text Book 1). **Hadoop Distributed File System:** HDFS**,** Architecture of Apache, Other file systems, HDFS File Blocks, HDFS File commands: cat, chgrp, chmod, chown, count, cp, ls, rm, mkdir (Text Book 1).	15

UNIT - II	
NO SQL Data management and MONGODB: NO SQL Data Management, Types of NO SQL databases, Benefits of No SQL(Text book 1) MongoDB: What, Why- Replication, Sharding, Terms used in RDBMS and MongoDB, Data types in MongoDB (Text Book 2), Advantages of MongoDB over RDBMS (Text book 1) **HBASE and CASSANDRA:** Introduction to HBase, Row-oriented vs column oriented data stores, HDFS vs HBase, HBase architecture, HBase Performance, Understanding HBase model (Text book 1) **Cassandra**: Introduction, Features of Cassandra, Data replication in Cassandra, Components of Cassandra ,Cassandra Data model, Data models of Cassandra and RDBMS (Text book 1), CQL Data types, CQLSH, Keyspaces (Text book 2) **MAP REDUCE:** Introduction to Map Reduce-5 steps, How Map reduce works, What is map operations, What is reduce operations, Submitting a map reduce job.(Text book 1)	15
UNIT - III	
Introduction to Hive-Define, features, architecture, Hive data models, Hive building blocks, Hive data file formats (Text Book 1). Hive data types, Basics of HQL(Text Book 2) **PIG: The higher level programming environment:** Introduction to pig, Components of Pig, Pig program execution modes, Data formats and models, Other capabilities, pig v/s map reduce, Difference between hive and pig(Text Book 1).	9
Course Outcomes: At the end of the course student will be able to: 1.Understand and apply big data flow to actual projects as well as apply data analytics life cycle to big data projects. 2. Apply appropriate techniques and tools to solve big data problems 3. Understand various clustering techniques used for unsupervised data modelling. 4. Describe big data and use cases from selected business domains 5. Explain NoSQL big data management and understand the usage of Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	

TEXTBOOKS:

1. V.K. Jain, Big Data & Hadoop, Khanna Book Publishing Co., Delhi. (ISBN 978-93-82609-131),2017
2. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", Wiley Publications, 2nd Edition, 2019.

REFERENCE BOOKS:

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to data Science and its applications", Wiley publications, 2014.
2. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2003.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2020.
4. Jeeva Jose, Beginner's Guide for Data Analysis using R Programming, Khanna Book Publishing House, 2019.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding OpportUNITies in Huge Data Streams with Advanced Analytics", Wiley, 2012.

E Books / MOOCs/ NPTEL

1. ftp://public.dhe.ibm.com/software/pdf/at/SWP10/Big_Data_Analytics.pdf
2. https://www.wileyindia.com/big-data-analytics-2ed.html
3. https://www.coursera.org/specializations/big-data
4. nptel.ac.in/courses/106104135/48

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	3	3	2	3								3	
CO3	3	3	2	2	3								3	
CO4	3	3	2		1								2	
CO5	3	3	3	2	3								2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO2	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO3	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO4	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO5	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2

BIO INFORMATICS

Course Code	21AME017	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Understand the concepts of bioinformatics
2. Identify different types of biological sequence
3. Analyse multiple sequences and find conserved regions
4. Understand RNA and Protein folding
5. Learn the algorithm for protein folding.

UNIT – I	Contact Hours
Bioinformatics and Computational Biology, Nature & Scope of Bioinformatics. The central dogma of molecular biology and bio-sequences associated with it, RNA classification –coding and non coding RNA- mRNA, tRNA, miRNA and sRNA, RNAi. DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Evolution Importance of databases - Biological databases-primary sequence databases, Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases, Types of databases, Data retrieval tools - Entrez	15
UNIT – II	
Sequence alignment – local/global, pairwise sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments. Multiple sequence alignment. Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix. Introduction, Advantages, Phylogenetic Trees, Tree topologies, Methods for phylogenetic analysis- Distance Matrix methods, Character based methods. HMM (Hidden Markov Model): Introduction to HMM, Forward algorithm, Viterbi algorithm, applications in Bioinformatics	15

UNIT – III	
General introduction to Gene expression in prokaryotes and eukaryotes Protein and RNA structure Prediction: Predicting RNA secondary structure - Nussinov Algorithm, Energy minimisation methods - Zuker Algorithm. Amino Acids, Polypeptide Composition, Protein Structures, Algorithm for protein folding, Structure prediction	09

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the concepts of bioinformatics
2. Identify different types of biological sequence
3. Analyse multiple sequences and find conserved regions
4. Understand RNA and Protein folding
5. Learn the algorithm for protein folding.

TEXTBOOKS:

1. S C Rastogi, N Mendiratta and P Rastogi, " Bioinformatics: Methods and Applications" ,New Delhi,2015.
2. D E Krane and M L Raymer, Fundamental Concepts of Bioinformatics, 2006.

REFERENCE BOOK:

1.Andreas D.Baxevanis, B F Francis Ouellette, "Bioinformatics - A Practical Guide to theAnalysis of Genes and Proteins", Third Edition,

2. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MITpress, 2004.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	3	3	2	3								3	
CO3	3	3	2	2	3								3	
CO4	3	3	2		1								2	
CO5	3	3	3	2	3								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO2	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO3	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO4	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO5	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2

BLOCKCHAIN TECHNOLOGY			
Course Code	21AME018	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1) Understand the basic concepts of block chain technology
2) Outline the concept of block chain currency
3) Learn about decentralization in block chain technology
4) Outline the concept of smart contract
5) Learn about Hyperledger

UNIT - I	Contact Hours
Introduction: What Is the Blockchain? What is Bitcoin? The Connected World and Blockchain: The Fifth Disruptive Computing Paradigm, Tiers of blockchain technology, Features of a blockchain, Types of blockchain. Benefits and limitations of blockchain: Technical Challenges, Business Model Challenges, Scandals and Public Perception, Government Regulation Overall: Decentralization Trends Likely to Persist. **Blockchain Currency:** Technology Stack: Blockchain, Protocol, Currency, The Double-Spend and Byzantine Generals' Computing Problems, how a Cryptocurrency Works, how blockchain works? How blockchain accumulates blocks? **Consensus:** Consensus mechanism, Types of consensus mechanisms, Consensus in blockchain, CAP theorem and blockchain ***(Test Book 1 : Chapter 1,6 Textbook 2 : Chapter)***	15

UNIT – II	
Decentralization: Decentralization using blockchain, Methods of decentralization, How to decentralize, Computing power and decentralization, DO, DAO,DAC,DAS,Dapps, **Ethereum and Smart Contracts:** Definition, Ricardian contracts, Deploying smart contracts on a blockchain, Ethereum Blockchain, Ethereum Network, Components of the Ethereum, ecosystem, Ether cryptocurrency, Introducing Solidity, Global Variables and Functions, Expressions and Control Structures, Writing Smart Contracts, Truffle Basics and UNIT Testing, Debugging Contracts Remix IDE: Programs execution. ***(Textbook 2: Chapter 1,2,9,10 Textbook 3: Chapter 3,4,5,6,9,10)***	15
UNIT – III	
Hyperlegder: Fabric, The reference architecture, Requirements and design goals of Hyperledger Fabric, Membership services, Blockchain services, Components of the fabric, Chain code implementation, The application model, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric ***(Textbook 2: Chapter 15)***	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the basic concepts of block chain and bit coin technology
2. Describe crypto currency and its usage
3. Describe about decentralization in block chain technology
4. Analyse the concept of smart contract
5. Analyse block chain services, applicational models

TEXTBOOK:

1) Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

REFERENCE BOOKS:

1. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
2. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017
3. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

MOOC/NPTEL

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview - Blockchain and its application-

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1										2	
CO2	2	2	1										2	
CO3	2	2	1										2	
CO4	2	2	1										2	
CO5	2	2	1										2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO3	1.1.1, 1.2.1, 1.2.3, 2.2.1, 3.1.1	L2
CO2	PO1, PO2, PO3	1.1.1, 1.2.1, 1.2.3, 2.2.1, 3.1.1	L2
CO3	PO1, PO2, PO3	1.1.1, 1.2.1, 1.2.3, 2.2.1, 3.1.1	L2
CO4	PO1, PO2, PO3	1.1.1, 1.2.1, 1.2.3, 2.2.1, 3.1.1	L2
CO5	PO1, PO2, PO3	1.1.1, 1.2.1, 1.2.3, 2.2.1, 3.1.1	L2

BUSINESS INTELLIGENCE			
Course Code	21AME019	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1. Identify the source and distinguish the data based on its type for a business application.
2. Identify various roles In a BI application and Design the ETL process for handling the data from a given application.
3. Apply the data warehousing concepts for a business application and Design a star / snowflake schema for a multi dimensional data of a given problem.
4. Illustrate the data mining concepts and association rules with suitable examples.
5. Apply classification, prediction and clustering concepts to various applications.

UNIT - I	Contact Hours
INTRODUCTION TO BUSINESS INTELLIGENCE: Types of digital data; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; Business Applications of BI; BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles &Responsibilities. Basics of Data Integration (Extraction Transformation Loading); Concepts of data integration; Need and advantages of using data integration; Introduction to common data integration approaches; Introduction to data quality, data profiling concepts and applications, Data Warehouse and OLAP Technology – Definition, A Multidimensional Data Model, Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema;	15
UNIT - II	
Data Warehouse Architecture. Introduction to data and dimension	16

modelling, multidimensional data model, ER Modelling vs. multi dimensional modelling; Introduction to business metrics and KPIs; Introduction to enterprise reporting; Concepts of dashboards, balanced scorecards; Applications of Data mining and Case studies of BI. Data Mining — On What Kind of Data? Data Mining Functionalities - What Kinds of Patterns Can Be Mined? Mining Association rules: Basic concepts, frequent item set mining methods. Definitions of classification, prediction and clustering;	
UNIT - III	
Classification and Prediction - Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Prediction, Cluster Analysis - Types of Data in Cluster Analysis, Hierarchical Methods.	08
Course Outcomes: Upon completion of this course, students will be able to: 1. Identify the source and distinguish the data based on its type for a business application. 2. Identify various roles In a BI application and Design the ETL process for handling the data from a given application. 3. Apply the data warehousing concepts for a business application and Design a star / snowflake schema for a multi dimensional data of a given problem. 4. Illustrate the data mining concepts and association rules with suitable examples. 5. Apply classification, prediction and clustering concepts to various applications.	
TEXTBOOKS: 1. R N Prasad and Seema Acharya, "Fundamentals of Business Analytics", Wiley-India,2011 2. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", 3. Morgan Kaufmann Publishers, (ISBN: 1-55860-489-8), 2000. 4. David Loshin, "Business Intelligence -The Savvy Manager's Guide", Morgan Kaufmann Publishers,2003.	
REFERENCE BOOKS: 1. Carlo Vercellis"Business Intelligence Datamining and Optimization for DecisionMaking",Wiley,2009 2. Uddagiri Chandrasekhar, S. K. Shinde,"Data Mining and Business Intelligence", DreamtechPress,2015.	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

CLOUD COMPUTING			
Course Code	21AME020	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

UNIT – I	**Contact Hours**
Erasofcomputing,Parallelvs.DistributedComputing,ElementsofParallel Computing-(Whatisparallelcomputing,hardwarearchitectureforParallel processing, approaches to parallel programming, levels of parallelism, Laws of caution). Elements of Distributed Computing- (General concepts anddefinitions,componentsofadistributedsystem,Architecturalstylesfor distributed computing, models for inter-process communication, Technologies for distributed computing-Remote procedure call, Service oriented computing). Classic data center, its elements, challenges and benefits. Data center managementStepsintransitioningtocloud-consolidation,automation,IT as a service. Cloud computing Architecture: - Introduction, Cloud reference models-(Architecture, Infrastructure/Hardware as a service, Platform as a service, Software as a service), Types of cloud – (Public Clouds, Private Clouds, Hybrid Clouds, CommUNITy Clouds),Economics of cloud ,Open challenges.	15
UNIT – II	
Virtualization: – Introduction, characteristics of virtualized environments, taxonomy of virtualization technique- (execution of virtualization, other types of virtualization-Compute, Storage, Network, Desktop, Application). Virtualization and cloud computing, Pros and Cons of virtualization, Technology examples- XEN, VMware, Microsoft Hyper-V. Security Concerns, Risk Issues:- Cloud Computing- Security Concerns. A Closer Examination: Virtualization, A Closer Examination:	15

Provisioning. Securing the Cloud: Key Strategies and Best Practices: - Overall Strategy: Effectively Managing Risk-Risk Management: Stages and Activities. Overview of Security Controls, Cloud Security Controls Must Meet Your Needs, NIST Definitions for Security Controls, Unclassified Models, Classified Model The Cloud Security Alliance Approach. The Limits of Security Controls - Security Exposure Will Vary over Time, Exploits Don't Play Fair. Best Practices: Best Practices for Cloud Computing- First Principals, Best Practices across the Cloud CommUNITy .Other Best Practices for Cloud Computing- Cloud Service Consumers, Cloud Service Providers. Security Monitoring.	
UNIT - III	
The Purpose of Security Monitoring, Transforming an Event Stream, The Need for C.I.A. in Security Monitoring, the Opportunity for MaaS. **Case studies:** Public cloud- AWS, Windows Azure, Google App Engine. Private Cloud- Open stack, Eucalyptus.	09
<u>Course Outcomes:</u> Upon completion of this course, students will be able to: **1.** Define the concept of cloud computing business need and various networkingmethods. **2.** Express the infrastructure management for cloudenvironment. **3.** Practice the Virtualization at all levels using technology XEN, Vmware, MicrosoftHyper-v. **4.** Explain the security concepts in cloud computing and securing the cloud. **5.** Practice the case studies of public cloud such as AWS, GoogleApp Engine and private cloud such as OpenStack.	
TEXTBOOKS: **1.** Buyya, Rajkumar, Christian Vecchiola and ThamaraiSelvi, "Mastering Cloud Computing Fundamentals and Applications Programming", McGraw Hill,2013. **2.** G, Somasundarm and Alok Srivatsa, "Information Storage and Managemnt.", EMC Education Services, Wiley Publishing Inc., 2009. **3.** Sitaram, Dinakar and Geetha Manjunath,"Moving to the Cloud - DevelopingAppsintheWorldofCloudComputing",Elsevier,2012. **4.** Sosinsky, Barrie,"Cloud Computing Bible.", Wiley India Pvt.Ltd , 2013. **5.** Winkler, Vic(J.R), "Securing the Cloud - Cloud Computer Security Techniques and Tactics.",ElsevierInc,2012.	

REFERENCE BOOKS:

1. Hurwitz, Judith, "Cloud computing for dummies." ,Wiley India Pvt Ltd,2011.
2. Rittinghouse, John, "Cloud computing – implementation, management and security", CRC Press, First edition,2009.
3. Velte, Toby, Anthony Velteand Robert Elsenpete "Cloud Computing, APracticalApproach.", Tata McGraw-Hill Authors, 2010.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

COMPILER DESIGN			
Course Code	21AME021	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

This Course will enable students to

1. Outline lexical analysis, use of regular expressions, transition diagrams, scanner- generator tools and context free grammars.
2. Get the idea of major parsing techniques top-down (recursive-descent, LL(1)) and Bottom up parsers.
3. Discuss LR parsers using items sets and parsing tables.
4. Make use of the principal ideas in syntax-directed definitions, syntax-directed translations and intermediate code representations for assignment statements and boolean expressions.
5. Describe how to construct the basic blocks from intermediate code, code optimization techniques and code generation algorithm.

UNIT - I	Contact Hours
INTRODUCTION: A Simple Compiler, The Phases of a Compiler. **LEXICAL ANALYSIS:** Lexical Analysis, Input Buffering, Specifications of Tokens, Recognition of Tokens, A Language for Specifying Lexical Analyzer, LEX programming. **SYNTAX ANALYSIS:** Context-free Grammars, ambiguity **SYNTAX ANALYSIS:** The Role of the Parser, Top-down Parsing: No recursive Predictive parsing, LL (1) grammars, Bottom-up Parsing: shift reduce conflicts.	15

UNIT - II	
SYNTAX ANALYSIS: Introduction to LR Parsers –Simple LR (SLR), LR (0) item set, LR (1) item set, Canonical LR (CLR), Look Ahead LR (LALR) Parsers, YACC programming. **SYNTAX-DIRECTED DEFINITIONS** Constructions of Syntax Trees, Bottom-up Evaluation of S-attributed definitions, L-attributed definitions. **INTERMEDIATE CODE GENERATION:** Intermediate Languages, Assignments, Boolean Expressions	15
UNIT - III	
Target Machine, Basic blocks and Flow graphs, Next-use information, A Simple Code Generator, Register Allocation and Assignment, The DAG representation of Basic Blocks Introduction, The Principle of Optimization, Optimization of Basic Blocks, Loops in flow graphs.	09
Course Outcomes: Upon completion of this course, students will be able to: **1. Explain** the various phases of compiler **Build** the regular expressions and transition diagrams by applying the knowledge of finite automata. **Develop and Implement** tokenizer using high level programming language and LEX Tool **2. Develop** top down parsers by applying the knowledge of context free grammar and parsing algorithms. **3. Construct** LR item sets by applying the knowledge of Closure and Go to functions. **Make use of** SLR, CLR and LALR parsing tables to parse the language constructs. **Design and Implement** parser using high level programming language and YACC Tool. **4.** Illustrate Syntax-Directed translation scheme for engineering problems. Apply three address code representations to **generate** an intermediate code for assignment statement and Boolean expressions. **5. Build** a code generator for the intermediate code by applying the knowledge of Basic blocks, address, register descriptors and next use information. **Apply** code optimization techniques to optimize the target code.	

TEXTBOOKS:

1. Alfred W Aho, Monica S. Lam,Ravi Sethi, Jeffrey D Ullman, "Compilers- Principles, Techniques and Tools", Addison-Wesley, Second edition, 2007.

REFERENCE BOOKS:

1. Andrew W Apple, "Modern Compiler Implementation in C", Cambridge University Press, 1997.

2. Kenneth C Louden, "Compiler Construction Principles & Practice",
Thomson Education, 1997.

3. John R. Levine, Tony Mason, Doug Brown, "LEX and YACC", O'Reilly
Publication,1999.

E-Books / Online Resources:

1. https://www.tutorialspoint.com/compiler_design/index.htm
2. http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf
3. http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf

MOOCs:

1. http://www.nptelvideos.in/2012/11/compiler-design.html

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2				2	2			2	
CO2	3	2	2		2				2	2			2	
CO3	3	2	2		2				2	2			2	
CO4	3	2	2		2				2	2			2	
CO5	3	2											2	

Table 2: Mapping of Cos to PIs, Pos and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO2	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO3	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3,5.1.1, 9.1.1, 10.1.1	L2, L3
CO4	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 5.1.2, 9.1.1, 10.1.1	L2, L3
CO5	1, 2	1.3.1,1.4.1, 2.1.3	L2

COMPUTER VISION WITH EMBEDDED MACHINE LEARNING			
Course Code	21AME022	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1. To help students understand advanced deep learning models for handling images. This course also helps students to generate synthetic dataset with the help of GANs.

UNIT - I	Contact Hours
Introduction and Overview Introduction to Image Formation, Capture and Representation; Linear Filtering, Correlation, Convolution **Visual Features and Representations** Edge, Blobs, Corner Detection; Scale Space and Scale Selection; SIFT, SURF; HoG, LBP, etc. **Visual Matching** Bag-of-words, VLAD; RANSAC, Hough transform; Pyramid Matching; Optical Flow **Convolutional Neural Networks (CNNs)** Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG, InceptionNets, ResNets, DenseNets **Visualization and Understanding CNNs** Visualization of Kernels; Backprop-to-image/Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM,Grad-CAM, Grad-CAM++; Recent Methods (IG, Segment-IG, SmoothGrad)	15
UNIT – II **CNNs for Recognition, Verification, Detection, Segmentation** CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN, Faster R-CNN, YOLO, SSD, RetinaNet; CNNs for Segmentation: FCN, SegNet, U-Net, Mask-RCNN **Recurrent Neural Networks (RNNs)** Review of RNNs; CNN + RNN Models for Video Understanding:	15

Spatio-temporal Models, Action/Activity Recognition **Attention Models** Introduction to Attention Models in Vision; Vision and Language: Image Captioning, Visual QA, Visual Dialog; Spatial Transformers Transformer Networks **Deep Generative Models** Review of (Popular) Deep Generative Models: GANs, VAEs; Other Generative Models: Pixel RNNs, NADE, Normalizing Flows, etc	
UNIT - III	
Variants and Applications of Generative Models in Vision Applications: Image Editing, Inpainting, Super resolution, 3D Object Generation, Security; Variants: Cycle GANs, Progressive GANs, Stack GANs, Pix2Pix, etc **Recent Trends** Zero-shot, One-shot, Few-shot Learning; Self-supervised Learning; Reinforcement Learning in Vision; Other Recent Topics and Applications	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand basic Computer Vision concepts.
2. Apply complex deep learning models to real-life problems and datasets
3. Create synthetic datasets with the help of GANs.
4. Use of transfer learning for image classification.
5. Use of LSTM for image captioning.

TEXTBOOKS:

1. Programming Computer Vision with Python: Techniques and Libraries for Imaging and Retrieving Information by Jan Erik Solem, O'Reilly, 2012
2. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi.

REFERENCE BOOKS:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
2. Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
3. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016
5. Michael Nielsen, Neural Networks and Deep Learning, 2016
6. Yoshua Bengio, Learning Deep Architectures for AI, 2009
7. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
8. Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006. ISBN 978-0-387-31073-2
9. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
10. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
11. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, 2004.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	2	2	2	1								2	
CO3	3	3	3	2	3								2	
CO4	3	3	3	3	3								3	
CO5	3	3	3	3	3								3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
CO4	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3
CO5	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3

CRYPTOGRAPHY AND CYBER SECURITY			
Course Code	21AME023	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 4			

Course Learning Objectives:

This Course will enable students to:

1. Analyze the principles and underlying mathematical theory of cryptography and classical encryption techniques.
2. Select appropriate data encryption techniques and apply them to solve a given problem.
3. Get the idea of various public key cryptosystems.
4. Analyze the fundamentals of cyber security and its essentials.
5. Describe various actions and motivations of attackers, involved in the cyber threat.

UNIT – I	Contact Hours
Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and The Data Encryption Standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, DES, Block cipher design principles, number of rounds, Design of function F, key schedule algorithm, AES algorithm introduction. **Public-Key Cryptography and RSA:** Principles of Public-key cryptosystems. Public-key cryptosystems. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.	15
UNIT - II	
Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, Elliptic curve cryptography, Analog of Diffie-Hellman key exchange, Elliptic curve encryption/decryption. **Cyber Security Fundamentals:** Information Assurance Fundamentals:	15

Authentication, Authorization, Nonrepudiation, Confidentiality, Integrity, Availability; Basic Cryptography; Symmetric Encryption: Example ofSimple Symmetric Encryption with Exclusive OR (XOR) and Improving upon Stream Ciphers withBlock Ciphers; Public Key Encryption; The Domain Name System (DNS) : Security and the DNS; Firewalls: History Lesson, What's in a Name? Packet-Filtering Firewalls, Stateful Firewalls,Application Gateway Firewalls	
UNIT - III	
Attacker Techniques And Motivations: How Hackers Cover Their Tracks (Antiforensics): How and Why Attackers Use Proxies, Types of Proxies, Detecting the Use of Proxies, Tunneling Techniques - HTTP, DNS, ICMP, Intermediaries, Steganography, and Other Concepts, Detection and Prevention; Fraud Techniques : Phishing, Smishing, Vishing, and Mobile Malicious Code - Mobile Malicious Code, Phishing against Mobile Devices; Rogue Antivirus - Following the Money: Payments; Click Fraud - Pay-per-Click, Click Fraud Motivations, Click Fraud Tactics and Detection. Threat Infrastructure: Botnets, Fast-Flux, Advanced Fast-Flux.	9
Course Outcomes: Upon completion of this course, students will be able to: 1. Comprehend the cryptography techniques. 2. Apply the Knowledge of number theory in public key crypto systems. 3. Analyze and determine various public key cryptosystems. 4. Explain the requirements of the cyber security and various methods to provide the security to the computer networks. 5. Determine the various actions and motivations of attackers, involved in the cyber threat.	
TEXTBOOKs: 1. William Stallings: Cryptography and Network Security, Pearson 6th Edition, 2013. 2. Cyber security essentials --Edited by James Graham, Richard Howard, Ryan Olson, publication: CRC press, Taylor and Francis group, 2011.	
REFERENCE BOOKS: 1. V K Pachghare: Cryptography and Information Security, PHE, 2013. 2. Yuri Diogenes, Erdal Ozkaya, "Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics (Kindle Edition)". 3. Joseph carson, "Cybersecurity for Dummies", CISSP 4. Scott Augenbaum, "The Secret to Cybersecurity A Simple Plan to Protect Your Family and Business from Cybercrime". 5. Cyber Security –Nina godbole, SUNIT Belapure, Publication: John Wiley, 2012.	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	3	1								2	
CO2	3	3	2	3	1								2	
CO3	3	3	2	2	1								2	
CO4	3	2	1		1								2	
CO5	3	3	1		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L3
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

CYBER FORENSICS

Course Code:	**21AME024**	**Course Typ**
Teaching Hours/Week (L: T: P)	**3:0:0**	**Credits**
Total Teaching Hours	**39+0+0**	**CIE + SEE**

Teaching Department: Computer Science and Engineering

Course Learning Objectives:

1. To understand the basics of Cyber Forensics.
2. To understand and analyze forensic data.
3. To analyze network logs.
4. To study cyber laws.
5. To apply cyber forensic skills to find out malicious users.

UNIT - I

15 Hours

Digital forensic evidence collection and processing Framework, Fundamentals of end point forensics for Microsoft windows - Kernel and device driver architecture, Registry, Auditing and security architecture. File system handling - Reconstruction of files and directory structures on the FAT and NTFS.
Fundamentals of host forensics for Unix derivatives - Linux operating system, Kernel and device drives architecture, Security and audit mechanisms, File system and pseudo file systems, Reconstruction of file and directory structures using UFS and EXT2/3/4 file systems as exemplars.

UNIT - II

15 Hours

Forensic analysis of database systems, Database tampering, Forensic analysis of database components, Table storage, Transaction logs, indexes, Forensic recovery for table storage.
Network device forensics, investigating logs, Network traffic and web attacks.

UNIT - III

09 Hours

Investigation of Mobile device, Social media and wireless forensics, Steganography and image file forensics, Email investigation. Cyber laws in India, Case studies and tools.

Course Outcomes: At the end of the course student will be able to

1. Understand how to perform cyber forensic on Windows devices.
2. Understand how to perform cyber forensic on Linux devices.
3. Demonstrate how to capture and analyze network traffic.
4. Demonstrate how to create a forensic report.
5. Understand Cyber Laws and latest Cyber Forensic use cases.

Course Outcomes Mapping with Program Outcomes & PSO

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	3	1								2	
CO2	3	3	2	3	1								2	
CO3	3	3	2	2	1								2	
CO4	3	2	1		1								2	
CO5	3	3	1		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L3
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

TEXTBOOKS:	
1.	Digital Forensics and Incident Response: Incident response techniques and procedures to respond to modern cyber threats, 2nd Edition by Gerard Johansen
2.	Brian Carrier, File System Forensic Analysis, Pearson, 2006.
3.	E. Casey, Handbook of Digital Forensics and Investigation, Academic Press, 2010
REFERENCE BOOKS:	
1.	Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations by Niranjan Reddy

DATA AND VISUAL ANALYTICS IN AI			
Course Code	21AME025	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 4			

Course Learning Objectives:-

The student will be able to understand techniques and algorithms for creating effective visualizations based on principles from graphic design. They will also be introduced to several industry-standard software tools to create a compelling and interactive visualization of various types of data.

UNIT - I	Contact Hours
Introduction: Data for Graphics, Design principles, Value for visualization, Categorical, time series, and statistical data graphics, Introduction to Visualization Tools. **Graphics Pipeline and Aesthetics and Perception:** Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space.	15
UNIT - II	
Visualization Design: Visual Display of Quantitative Information, Data-Ink Maximization, Graphical Design, Exploratory Data Analysis, Heat Map. **Multidimensional Data and Interaction:** Query, Analysis and Visualization of Multi-Dimensional Relational Databases, Interactive Exploration, tSNE, Interactive Dynamics for Visual Analysis, Visual Queries, Finding Patterns in Time Series Data, Trend visualization, Animation, Dashboard, Visual Storytelling	15

UNIT - III	
Collaboration: Graph Visualization and Navigation, Online Social Networks, Social Data Analysis, Collaborative Visual Analytics, Text, Map, Geospatial data	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the key techniques used for visualization of categorical, time series and statistical data.
2. Understand the theory used in visualization, including data models, graphical perception, and techniques for visual encoding and interaction.
3. Apply knowledge to a number of common data domains and corresponding analysis tasks, including multivariate data, networks, text, and cartography.
4. Describe big data and use cases from selected business domains.
5. Explain NoSQL big data management and other technologies such as Hadoop and HDFS

TEXTBOOKS:

1. The Visual Display of Quantitative Information by E. Tufte, Graphics Press, 2nd Edition, 2001
2. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019.

REFERENCE BOOKS:

1. Data Visualization Handbook by J. Koponen, J. Hildén, CRC Press, 2019
2. The Book of Trees: Visualizing Branches of Knowledge by M. Lima, Princeton Architectural Press, 2014
3. Handbook of Graph Drawing and Visualization by R. Tamassia, CRC Press, 2013
4. Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	1	2	2									
CO2	3	3	1											
CO3	3	3	3	2	2									
CO4	3	3	3	2	2									
CO5	3	2	3	2	3									

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators
CO1	PO1, PO2, PO3, PO4, PO5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1
CO2	PO1, PO2, PO3	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2
CO3	PO1,PO2,PO3,PO4, PO5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1
CO4	PO1.PO2.PO3.PO4.PO5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1
CO5	PO1.PO2.PO3.PO4.PO5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1

DATA MINING AND DATA WAREHOUSING			
Course Code	21AME026	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

Demonstrate Storing voluminous data for online processing, Preprocess the data for mining applications
2. Apply the association rules for mining the data
3. Design and deploy appropriate classification techniques
4. Cluster the high dimensional data for better organization of the data
5. Discover the knowledge imbibed in the high dimensional system

UNIT - I	Contact Hours
Introduction and Data Preprocessing: Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined. Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization. Data warehousing and online analytical processing: Data warehousing: Basic concepts, Data warehouse modeling: Data cube and OLAP, Data warehouse design and usage, Data warehouse implementation,	15
UNIT - II	
Classification: Basic Concepts: Basic Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy Cluster Analysis: Basic concepts and methods: Cluster Analysis, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods,	16

UNIT - III	
Data mining trends and research frontiers: Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society.	08

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate Storing voluminous data for online processing, Preprocess the data for mining applications
2. Apply the association rules for mining the data
3. Design and deploy appropriate classification techniques
4. Cluster the high dimensional data for better organization of the data
5. Discover the knowledge imbibed in the high dimensional system

TEXTBOOK:

1. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining Concepts and Techniques, ELSEVIER(MK) 3rd edition 2012

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

DISTRIBUTED SYSTEMS			
Course Code	21AME027	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

This Course will enable students to:

1. Identify the issues involved in designing distributed systems.
2. Describe various synchronization methods of distributed methods.
3. Analyze process migration approach and distributed deadlock management.
4. Describe features distributed shared memory and file system.
5. List and describe load balancing mechanisms in distributed systems.

UNIT - I	Contact Hours
Introduction to distributed systems: Fundamentals: -What is Distributed Computing Systems? Distributed Computing System Models, what is DOS? Issues in designing a DOS. Remote Procedure Calls: The RPC model, Transparency of RPC, Implementing RPC mechanism, Stub generation, RPC messages, Marshaling Arguments and results. Server management, Parameter passing semantics, call semantics, communication protocols RPC's. Complicated RPCs,Client –server binding, Exception handling, Security. Synchronization in distributed Systems: Clock synchronization – logical clocks – physical clocks – clock synchronization algorithms, Mutual exclusion – A centralized algorithm – A distributed algorithm – a token ring algorithm, Comparison of the three algorithms, Election algorithms – the Bully algorithm – ring algorithm.	15
UNIT - II	
Synchronization in distributed Systems: Dead locks in distributed systems – distributed deadlock avoidance algorithms – distributed deadlock prevention algorithms, distributed deadlock detection algorithms: Centralized approach, Hierarchical approach and Fully distributed approach. Process Migration: Desirable Features of a Good Migration Mechanism, Process Migration Mechanisms, Threads: Introduction, Motivation for using Threads, Models for Organizing Threads, Issues in Designing Threads Package,	15

Implementing Thread Package. Distributed Shared Memory: General structure, Design and implementation issues of DSM, Granularity, Structure of shared memory space, Consistency Models, Replacement Strategy, Thrashing. **UNIT - III**	
Distributed File Systems: Desirable features of a good distributed file system, file models, file accessing models, file sharing semantics, file Replication. Resource Management: Desirable features, task management approach, load balancing approach, load sharing approach. Naming: Introduction, Desirable Features of Good Naming System, System-Oriented Names, Object-Location Mechanism, Human Oriented Names, Name Cache.	09
Course Outcomes: Upon completion of this course, students will be able to: 1. Determine the benefits and issues involved in designing distributed systems. 2. Explain various synchronization methods of distributed methods. 3. Compare various process migration approaches and distributed deadlock management approaches. 4. Apply features of distributed shared memory and file system. 5. Describe load balancing mechanisms in distributed systems.	
TEXTBOOK: 1. Pradeep K Sinha," Distributed Operating Systems, Concepts & Design", PHI,2009.	
REFERENCE BOOKS: 1. Lampson (Ed), Distributed Systems, Singer – Verlay NY 1981. 2. Mukesh Singhal, Niranjan G,"Advanced Concepts in Operating Systems", Tata McGraw-Hill Education, 2001. **E-Books / Online Resources:** 1. http://www.gecg.in/papers/ds5thedn.pdf 2. http://cs-www.cs.yale.edu/homes/aspnes/classes/465/notes.pdf **MOOCs:** 1. nptel.ac.in/courses/117102060/ 2. https://www.coursera.org/learn/distributedsystem.	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		1								2	
CO2	3	3	1		1								2	
CO3	3	2	1		1								2	
CO4	3	2	1		1								3	
CO5	3	2	2		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO3	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	P1, P2,P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

FULL STACK DEVELOPMENT			
Course Code	21AME028	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Design static and modern web pages using HTML5, Cascading Style Sheets (CSS) and Bootstrap.
2. Develop client-side validations using JavaScript.
3. Develop the server-side script using PHP.
4. Design the server-side database using MySQL
5. Develop the interactive web application using NodeJS framework and MongoDB.

UNIT - I	Contact Hours
Basics of Html5, Css and Javascript: Overview of HTML5, HTML5 elements, Introduction to CSS, Levels of style sheets, The Box Model, The basics of Javascript, General syntactic characteristics, Event Handling. **Bootstrap** What is Bootstrap? Why use Bootstrap? Where to get Bootstrap? Bootstrap CDN, First Web Page with Bootstrap, Bootstrap Grid system, Contextual Colors and Backgrounds, Bootstrap Tables, Bootstrap Images, Bootstrap Jumbotron and Page Header, Bootstrap Wells, Bootstrap Alerts, Bootstrap Buttons, Bootstrap Badges and Labels, Bootstrap Progress Bars, Bootstrap List Groups, List Group with Badges, Tabs, Tabs with Dropdown Menu, Pills, Bootstrap Navigation Bar, Bootstrap Forms, Bootstrap Form Inputs, Bootstrap Media Objects, Bootstrap Carousel Plugin.	15
UNIT - II	
Introduction to Php: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, Operations and Expressions, Output,	15

Control statements, Arrays, Functions, Pattern Matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.	
UNIT - III	
NodeJS: Introduction to Node.js- Installing Node.js - Node.js Modules, Node.js File System, Node.js URL Module, Node.js NPM, Node.js Events, Node.js Upload Files, Node.js Email. **NodeJS MySQL**- Create Database, Create Table, Insert into, select from, Where, Order by, Delete, Drop Table, Update, Limit, Join. **Introduction to Mongo DB**- Node.js MongoDB, Create Database, Create Collection, Insert, Find, Query, Sort, Delete, Drop Collection, Update, Limit, Join	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe the fundamental features of HTML5, CSS and Bootstrap and Design static web pages.
2. Design and Implement the client-side validations using JavaScript.
3. Illustrate the concept of PHP and Develop the server-side script using PHP.
4. Design the server-side database using MySQL
5. Develop the interactive web application using NodeJS framework and MongoDB.

TEXTBOOKS:

1. Robert W. Sebesta, “Programming the World Wide Web”, Fourth Edition, Pearson, 2014.
2. Jake Spurlock, “Bootstrap-Responsive Web Development”, O’Reilly publications, 2013.
3. Ari Lerner, Ng-book, “The complete book on Angular JS”, 2013.
4. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer Paperback – Import, 20 November 2018.
5. David Herron, Node.js Web Development: Server-side web development made easy with Node 14 using practical examples, 5th Editio, 2020

REFERENCE BOOKS:

1. M. Deitel, P.J. Deitel, A. B. Goldberg," Internet & World Wide Web: How to Program, 4e Paperback – 1 January 2009.
2. Chris Bates,"Web Programming Building Internet Applications", Third Edition, Wiley India, 2006.

E Books / MOOCs/ NPTEL:

1. https://www.cs.uct.ac.za/mit_notes/web_programming.html
2. http://www.multitech.ac.ug/uploads/IntroductiontoWebProgramming.pdf
3. https://www.w3schools.com/php/
4. https://www.w3schools.com/bootstrap/

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		1								2	
CO2	3	3	1		1								2	
CO3	3	2	1		1								2	
CO4	3	2	1		1								3	
CO5	3	2	2		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO3	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	P1, P2,P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

FUNDAMENTALS OF IMAGE PROCESSING			
Course Code	21AME029	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

The students will be

1. Understand the basic terminologies of Image Processing
2. able to work with images and videos in several ways.
3. pre-processing steps for complex models. Students will
4. understand the basic image processing operations that
5. enables them to develop various vision based models.

UNIT - I	Contact Hours
Image representation and analysis Introduction to computer Vision, Numerical representation of images, Image augmentation, enhancement, processing, color transforms, geometric transforms, feature recognition and extraction. **Image Segmentation** Object detection, breaking image into parts, finding contours and edges of various objects in image, Background subtraction for video.	15
UNIT - II	
Object Motion and tracking Tracking a single point over time, motion models to define object movement over time, analyze videos as sequences of individual image frames, methods to track a set of features over time, matching features from image frame to other, tracking a moving car using optical flow. **Robotic localization** Bayesian statistics to locate a robot in space, sensor measurements to safely navigate an environment, Gaussian uncertainty, histogram	15

filter for robot localization in python.	
UNIT - III	
Image Restoration Degradation model, noise models, estimation of degradation function by modeling, restoration using Weiner filters and Inverse filters	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand images and videos representation in a detailed manner.
2. Understand basic image processing and image segmentation techniques
3. Understand and apply object tracking algorithms.
4. Understand the usage of computer vision in robotics
5. Apply various image restoration techniques and algorithms

TEXTBOOKS:

1. Audio Video Systems, Bali & Bali, Khanna Book Publishing, 2020.
2. Computer vision a modern approach, Forsyth and Ponce, 2011.

REFERENCE BOOKS:

1. Handbook of Image and Video Processing by Alan C. Bovik, Academic Press, 2000.
2. Python 3 Image Processing, Ashwin Pajankar, BPB Publication, 2019

https://www.coursera.org/learn/image-processing

E Books / MOOCs/ NPTEL:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/
2. https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	3	3	2	3								3	
CO3	3	3	2	2	3								3	
CO4	3	3	2		1								2	
CO5	3	3	3	2	3								2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO2	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO3	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO4	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO5	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2

GAME THEORY AND APPLICATIONS			
Course Code	21AME030	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Learn the Architecture of Games Understand the association of functions, relations, partial ordered set and lattices with problems related to theoretical computer science and network models.
2. Describe the Architecture of Game Playing, Apply the use of Equilibrium in Games.
3. Study the Concepts of extensive games
4. Illustrate the mixed strictly competitive games and rationzability.
5. Explain the application of Game theory.

UNIT - I

INTRODUCTION; STRATEGIC GAMES 15

What is game theory? Four elements, Classification of games, The theory of rational choice; Interacting decision makers, Strategic games; Example: The prisoner's dilemma; Nash equilibrium; Examples of Nash equilibrium; Best-response functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria, Interpretation of Nash Equilibrium

Games Theory.

Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

MIXED STRATEGY EQUILIBRIUM

Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Finding mixed strategy by graphical method; Finding mixed strategy by analysing subset of all actions; Dominated actions; Pure equilibria when randomization is allowed, examples; The formation of players beliefs; Eliminating dominated actions, Median Voter theorem.	
UNIT - II	
EXTENSIVE GAMES Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games. **EXTENSIONS** Allowing for simultaneous moves, examples, Discussion: subgame perfect equilibrium and backward induction. **STRICTLY COMPETITIVE GAMES AND MAXIMIZATION** Maximization and Nash equilibrium; Strictly Competitive Games; Maximization and Nash equilibrium in strictly competitive games **RATIONALIZABILITY** Iterated elimination of strictly dominated actions; Iterated elimination of weakly dominated actions; Dominance solvability.	16
UNIT - III	
APPLICATIONS OF GAME THEORY Assumptions and issues in Game theory, Mechanism design problem and examplesgametheoryandcryptography,gametheoryandwirelessAdhocnetworks,gametheoryandnetworksecurity,Paretooptimal,Selfishrouting, Correlatedequilibrium **Game Theory and Adversarial Machine Learning and Its applications** Adversarial learning and its connection to game theory, Game-theoretic models for security and robustness in machine learning, Strategies for defending against adversarial attacks **Game Theory in Recommender Systems** Modelling user-item interactions as strategic games, Collaborative filtering and matrix factorization techniques, Game-theoretic approaches to recommendation generation and personalization. **Game Theory in Online Advertising** Auction mechanisms for online advertising, Sponsored search auctions and bidding strategies, Revenue optimization and game-theoretic analysis in ad platforms	08

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the Architecture ofGames
2. Analyse the Architecture of Game Playing, Apply the use of Equilibrium inGames
3. Apply the Concepts of extensive games
4. Apply the mixed strictly competitive games and rationzability.
5. Understand the application of Game theory.

TEXTBOOKS:

1. Martin Osborne: An introduction to game theory, Oxford University Press, Indian Edition,2004.
2. An Introduction to Game Theory: Strategy, Joel Watson, W WNorton andCompany.
3. Algorithmic Game Theory, Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V Vazirani, Cambridge UniversityPress.

REFERENCE BOOK:

1. Roger B Myerson: Game theory: Analysis of Conflict, Harvard University Press, 1997.

Table 2: Mapping of COs to PIs, POs and BTL

Table 1: Mapping Levels of COs to POs
1: Low, 2: Medium, 3: High

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	3			3								2	

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2	1.1.1,1.3.1, 1.4.1, 2.1.3	L3
CO2	1,2,4	1.1.1,1.3.1,1.4.1, 2.1.3, 2.3.1, 2.4.1, 4.3.1,4.3.3,4.3.4	L4
CO3	1,2,4	1.1.1,1.3.1,1.4.1, 2.1.3, 2.3.1, 2.4.1, 4.3.1,4.3.3,4.3.4	L4
CO4	1,2,5	1.3.1, 1.4.1, 2.1.3, 5.1.1	L2
CO5	1,2,4,5	1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.4.1, 2.3.1, 2.4.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1	L4

GRAPHICS AND ANIMATION			
Course Code	21AME031	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives

1. Design and implement algorithms for 2D graphics algorithms
2. Illustrate Geometric transformations on 2Dobjects.
3. Understand the basics of computer animation
4. Analyse the different techniques in graphics
5. Demonstrate different animation technique

UNIT - I	Contact Hours
Introduction to Computer Graphics: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan), Video Basics. **Scan conversion**: Digital Differential Analyzer (DDA) algorithm, Bresenhams' Line drawing algorithm. Bresenhams' method of Circle drawing, Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Clipping Lines algorithms– Cyrus-Beck, Cohen- Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components. **Two-Dimensional Transformations**: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, TranslationsandHomogeneousCoordinates,Rotation,Reflection,Scaling, CombinedTransformation,TransformationofPoints,TransformationofTheUNITSquare,SolidBodyTransformations,RotationAboutanArbitraryPoint, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-ViewportTransformations.	16

UNIT - II	
Visible-Surface Determination: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface Ray Tracing, comparison ofthemethods. **Plane Curves and Surfaces:** Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, Representation of Space Curves, Cubic Splines, Bezier Curves, B-spline Curves, Bezier Surfaces.	15
UNIT - III	
Computer Animation: Principles of Animation, Key framing, Deformations, Character Animation, Phsics-Based Animation, Procedural Techniques, Groups of Objects. **Image Manipulation and Storage:** What is an Image? Digital image file formats, Image compression standard – JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.	08
Course Outcomes: Upon completion of this course, students will be able to: 1. Design and implement algorithms for 2D graphics algorithms 2. Illustrate Geometric transformations on 2Dobjects. 3. Understand the basics of computer animation 4. Analyse the different techniques in graphics 5. Demonstrate different animation technique	
TEXTBOOKS: 1. Donald D. Hearn, Warren Carithers, M. Pauline Baker. Computer Graphics with OpenGL (4e), Pearson, Education,2014. 2. Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, CRC Press, 4th Edition,2016.	
REFERENCE BOOKS: 1. Zhigang Xiang, Computer Graphics: Theory and Practice with OpenGL (3e), Pearson Education,2016. 2. Edward Angel, Interactive Computer Graphics- A top down approach using OpenGL (5e), Pearson Education,2012. 3. Foley J. D., Van Dam A., Feiner S. K., Hughes J. F., Computer Graphics, Principles and Practice (3e), Addision-Wesley,2014.	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

HIGH PERFORMANCE COMPUTING

Course Code	21AME032	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Define the need of graphical processing UNIT
2. Learn the simple CUDA programs
3. Show the memory model and GPU interaction with CPU
4. Describe the use of Memory hierarchy
5. Understand the usage of tools and programming.

UNIT – I	**Contact Hours**
Introduction to GPU computing: Why GPU, evolution of GPU pipeline and general purpose computation on GPU, GPU architecture case studies: NVIDIAG80,GT200,Fermi,AMD Radeon, AMD Fusion APU etc. Execution Model: Features of CUDA and OpenCL, Comparison of CUDA andOpenCL,Threadorganization,Kernel,errorhandling,andexecutionin CUDA and OpenCL	15
UNIT – II	
Programming Model: CUDA Introduction, basics of CUDA C, Complete CUDA structure, basic details of API and libraries, OpenCL overview, OpenCL basic specification, OpenCL C language, Vectorization. **Memory Model**: Introduction to memory model and GPU interaction with CPU, Memory model of CUDA and OpenCL, Memory hierarchy (local/register, shared and global) and optimizations.	15
UNIT – III	
Tools and programming: Introduction to installation and compilation process, usage of tools, profilers and debuggers. CUDA by Examples and OpenCL by Examples, Future Directions.	08

Course Outcomes:

Upon completion of this course, students will be able to:

1. Understand the need of graphical processing UNIT
2. Write simple CUDA programs
3. Analyse the memory model and GPU interaction with CPU
4. Describe the use of Memory hierarchy
5. Understand the usage of tools and programming.

TEXTBOOKS:

1. David B Kirk and Wen-Mei W.Hwu, Programming Massively Parallel Processors: A Hands-on Approach, 2010.
2. Jason Sanders and Edward Kandrot, CUDA by Example: An Introduction to General-Purpose GPU Programming,2010.

REFERENCE BOOKS:

1. T.Mattson, etal. Patterns of Paralle lProgramming, Addison Wesley, 2005
2. NVIDIA CUDA Programming Guide V3.0,NVIDIA
3. Benedict R. Gaster, Timothy G. Mattson and James Fung, OpenCL Programming Guide by Aaftab Munshi,2011.
4. Benedict Gaster, David R. Kaeli, Lee Howes and Perhaad Mistry, Heterogeneous Computing with OpenCL,2011.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		1								2	
CO2	3	3	1		1								2	
CO3	3	2	1		1								2	
CO4	3	2	1		1								3	
CO5	3	2	2		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO3	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	P1, P2,P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

HUMAN COMPUTER INTERACTION			
Course Code	21AME033	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1. Learn basics of HCI and different HCI models.
2. Understand the research methods and the guidelines to be followed in designing HCI.
3. Learn to design HCI systems.
4. Design task modelling
5. Use different techniques for cognitive architecture,

UNIT - I	Contact Hours
INTRODUCTION: Course Learning Objectives and overview, Historical evolution of the field. **INTERACTIVE SYSTEM DESIGN**: concept of usability -definition and elaboration, HCI and software engineering, GUI design and aesthetics, prototyping techniques. **MODEL-BASED DESIGN AND EVALUATION:** Introduction to different typesofmodels,GOMSfamilyofmodels(KLMandCMN-GOMS),Fitt'slaw and Hick-Hyman's law,Model based design case studies.	15
UNIT - II	
Guidelines in HCI: Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walk-through. **Empirical research methods in HCI**: Introduction (motivation, issues, research question formulation techniques) ,Experiment design and data analysis(with explanation of one-way ANOVA).	16

Task modeling and analysis: Introduction to formalism in dialog design, design using FSM (finite state machines),State charts and(classical) Petri Nets in dialog design.

UNIT - III

Cognitive architecture: Introduction to CA, CA types, relevance of CA in IS design ,Model Human Processor (MHP). 08

Design - Case Studies: Case Study 1- Multi- Key press Hindi Text Input MethodonaMobilePhone,CaseStudy2-GUIdesignforamobilephone based Matrimonial application. Case Study 3 - Employment Information System for unorganised construction workers on a MobilePhone.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Learn basics of HCI and different HCI models.
2. Understand the research methods and the guidelines to be followed in designing HCI.
3. Learn to design HCI systems.
4. Design task modeling
5. Use different techniques for cognitive architecture,

TEXTBOOKS:

1. Jennifer Preece, Helen Sharp and Yvonne Rogers, Interaction design: Beyond Human-Computer Interaction, 4th edition Helen Sharp, John Wiley and Sons, 2015, ISBN:978-1-119-02075-2
2. Ben Shneiderman and Catherine Plaisant, Designing the User Interface:StrategiesforEffectiveHuman-ComputerInteraction,6th Edition, Pearson,2017

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

INTRODUCTION TO DATA SCIENCE			
Course Code	21AME034	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

This course will enable students to:

1. Get the idea of lookup functions and Pivot Tables
2. Illustrate the use of Data validation and Data Visualization
3. Describe the basic concepts of R programming
4. Apply the Data visualization concepts using R programs
5. Explain the concepts of data mining and types of Analytics.

UNIT - I	Contact Hours
Introduction to Data Analysis using Excel: Introduction to Data Mining, Business Intelligence, Statistical Analysis, Predictive Analytics, Text Analytics, **Data Analysis Process:** Excel Formulas and Functions — Learn with Basic Examples, Logical Functions in Excel — IF, AND, OR, Nested IF and NOT. Conditional Formatting, Sorting and Filtering, Subtotals with Ranges. **Data Quick Analysis:** Understanding Lookup Functions, PivotTables, Data Visualization, Data Validation. What-If Analysis, Importing Data into Excel, Data Model, Exploring Data with PivotTable	15
UNIT - II	
R Programming Basics: Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions. **Data Visualization using R:** Reading and getting data into R (External Data): Using CSV files, Excel files. **Working with R Charts and Graphs:** Histograms, Box plots, Bar Charts, Line Graphs, Scatter plots, Pie Charts.	15

UNIT – III	
Introduction to Data Science: Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields **Introduction to Data Mining**: What is data mining, Challenges, Data Mining Tasks Textbook 3: Ch.1.1,1.2,1.4, 2.1 to 2.4 **Classification:** Decision Trees Induction, Rule Based Classifiers, Nearest Neighbour Classifiers, Bayesian Classifiers. K-Means.**,** Regression Model Textbook 3: Ch 4.3,4.6,5.1,5.2,5.3	9
Course Outcomes: Upon completion of this course, students will be able to: **1.** Acquire the knowledge of data analysis and carry out the data analysis process. **2.** Practice out quick data analysis, extracting data values from text. **3.** Demonstrate the export of data to excel, PivotTable **4.** Describe R basics, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, and analysis the data using different R graphs and Charts. **5.** Apply the concepts of Data science and study different data mining algorithms.	
TEXTBOOKS: **1.** Microsoft Excel 2019 Data Analysis and Business Modelling (Business Skills), 6th Edition, Wayne L Winston, ISBN-13: 978-1509305889, ISBN-10: 1509305882. **2.** Tilman M. Davies, "The Book of R: A First Course in Programming and Statistics", No Starch Press; 1st edition,2016. **3.** Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression, 2014	

REFERENCE BOOKS: 1. Paul Mc Fedries. Microsoft Excel 2019 Formulas and Functions (Business Skills), 1st Edition, ISBN-13: 978-1509306190, ISBN-10: 1509306196. 2. Gil Raviv, Collect, Combine, and Transform Data Using Power Query in Excel and Power BI (Business Skills) 1st Edition, ISBN-13: 978-1509307951, ISBN-10: 1509307958. 3. Devin Knight, Mitchell Pearson, Bradley Schacht, Erin Ostrowsky, Microsoft Power BI Quick Start Guide: Bring your data to life through data modelling, visualization, digital storytelling, and more, 2nd Edition, ISBN-13: 978-1800561571, ISBN-10: 1800561571 4. Andrie de Vries and Joris Meys, R for Dummies, 2nd Edition, John Wiley & Sons' 2nd edition, 2015. 5. Hadley Wickham, Garrett Grolemund, R for data Science: Import, Tidy, Transform, Visualize, And Model Data, O'Reilly; 1st edition, 2017. 6. Andrew Oleksy, Data Science with R: A Step by Step Guide With Visual Illustrations & Examples,	
1. Excel Skills for Data Analytics and Visualization Specialization https://www.coursera.org/specializations/excel-data-analytics-visualization 2. IBM Data Analytics with Excel and R Professional Certificate https://www.coursera.org/professional-certificates/ibm-data-analyst-r-excel 3. Introduction to Data Analysis Using Excel https://www.coursera.org/learn/excel-data-analysis	

Table 1: Mapping Levels of COs to POs														
COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	1										3	
CO2	3	3	1										3	
CO3	3	3	1										3	
CO4	3	3			1								3	
CO5	3	3	1		1								3	

Table 1: Mapping Levels of COs to POs														
COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	1										3	
CO2	3	3	1										3	
CO3	3	3	1										3	
CO4	3	3			1								3	
CO5	3	3	1		1								3	

INTRODUCTION TO DRONES

Course Code	21AME035	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives

1. understand drone concepts and terminology
2. describe the steps for drone design;
3. Understand the technical characteristics
4. describe the process for drone fabrication
5. describe the algorithm for drone programming

UNIT – I	**Contact Hours**
Overview and background. Definitions. History of UAVsc. Classifications of UAVsi. Scale lift generation method contemporary applications, military. Government. civil societal impact and future outlook. Operational considerations. Liability / legal issues. Insurance. Ethical implications. human factors	14
UNIT – II	
Introduction to Drone Technology, Drone design and fabrication , Drone programming, Drone flying and operation, Drone accessories, Drone maintenance, Safety and Regulations, Drone commercial applications	16
UNIT – III	
Case studies in the drone industry to show the potential for boosting entrepreneurial spirit, Drone technology and entrepreneurship, Drone Technology as a tool for social inclusion, Future of drones	09

Course Outcomes:

Upon completion of the course students should be able to

1. understand drone concepts and terminology
2. describe the steps for drone design;
3. Understand the technical characteristics
4. describe the process for drone fabrication
5. describe the algorithm for drone programming

TEXTBOOK:

1. Theory, Design, and Applications of Unmanned Aerial Vehicles- by A. R. Jha., 2016

REFERENCE BOOK:

1. Handbook of Unmanned Aerial Vehicles- Editors: Valavanis, K., Vachtsevanos, George J. (Eds.), 2014

Table 1: Mapping Levels of COs to POs
1: Low, 2: Medium, 3: High

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	3			3								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2	1.1.1,1.3.1, 1.4.1, 2.1.3	L3
CO2	1,2,4	1.1.1,1.3.1,1.4.1, 2.1.3, 2.3.1, 2.4.1, 4.3.1,4.3.3,4.3.4	L4
CO3	1,2,4	1.1.1,1.3.1,1.4.1, 2.1.3, 2.3.1, 2.4.1, 4.3.1,4.3.3,4.3.4	L4
CO4	1,2,5	1.3.1, 1.4.1, 2.1.3, 5.1.1	L2
CO5	1,2,4,5	1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.4.1, 2.3.1, 2.4.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1	L4

MICROCONTROLLERS AND EMBEDDED SYSTEMS			
Course Code	21AME036	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1. To gain a thorough understanding of the design and fundamentals of ARM-based systems.
2. To program an ARM controller with a variety of instruction sets.
3. To explore the fundamentals of the embedded system's structure and determine its applicability.
4. To learn about the fundamental hardware components and choose them based on the characteristics and attributes of an embedded device.
5. To make approaches for hardware/software co-design and firmware design.

UNIT – I	Contact Hours
ARM Embedded Systems, ARM Processor Fundamentals, ARM Instruction Set, and Programming Microprocessors versus Microcontrollers. **ARM Embedded Systems**[T1-Ch1]: The RISC design philosophy[T1-1.1], The ARM Design Philosophy[T1-1.2], Embedded System Hardware[T1-1.3], Embedded System Software[T1-1.4]. **ARM Processor Fundamentals**[T1-Ch2]: Registers[T1-2.1], Current Program Status Register[T1-2.2], Pipeline[T1-2.3], Exceptions, Interrupts, and the Vector Table[T1-2.4], Core Extensions[T1-2.5]. Instructions[T1-3.2], Load-Store Instructions[T1-3.3], Software Interrupt Instructions[T1-3.4], Program Status Register Instructions[T1-3.5], Coprocessor Instructions, Loading Constants[T1-3.6]. **Writing and Optimizing ARM Assembly Code**[T1-Ch6]: Writing Assembly Code[T1-6.1], Profiling and Cycle Counting [T1-6.2], Instruction Scheduling [T1-6.3]	15

UNIT - II	
Embedded System Components and Applications **Introduction to Embedded Systems**[T2-Ch1]: Embedded vs General Computing System[T2-1.2], History of Embedded Systems[T2-1.3], Classification of Embedded Systems[T2-1.4], Major Application Areas of Embedded Systems[T2-1.5], Purpose of Embedded Systems[T2-1.6]. **Typical Embedded System**[T2-Ch2]: Core of the Embedded System[T2-2.1], Memory[T2-2.2], Sensors and Actuators[T2-2.3], Communication Interface[T2-2.4], Embedded Firmware[T2-2.5], Other System Components[T2-2.6]. **Characteristics and Quality Attributes of Embedded Systems**[T2-Ch3]: Characteristics of an Embedded System[T2-3.1], Quality Attributes of Embedded Systems[T2-3.2]. **Embedded Systems – Application- and Domain-Specific**[T2-Ch4]: Washing Machine – Application-Specific Embedded System[T2-4.1], Automotive-Domain Specific Examples of Embedded System[T2-4.2]. **(T2: Chapter 1: 1.2 to 1.6, T2: Chapter 2: 2.1 to 2.6, Chapter 3:3.1, 3.2, Chapter 4:4.1, 4.2)**	15
UNIT – III	
Embedded System Design Components and IDE **Hardware Software Co-Design and Program Modelling**[T2-Ch7]: Fundamental Issues in Hardware Software Co-Design[T2-7.1], Computational Models in Embedded Design[T2-7.2]. **Embedded Firmware Design and Development**[T2-Ch9]: Embedded Firmware Design Approaches[T2-9.1], Embedded Firmware Development Languages[T2-9.2], 'C' vs 'Embedded C[T2-9.3.1], Compiler vs CrossComplier[T2-9.3.2]. **Integration and Testing of Embedded Hardware and Firmware**[T2-Ch12]: Integration of Hardware and Firmware[T2-12.1] **The Embedded System Development Environment**[T2-Ch13]: The Integrated Development Environment (IDE-Block Diagram Only) [T2-13.1], Disassembler/ Decomplier[T2-13.3], Simulators, Emulators, and Debugging[T2-13.4]. **(T2: Chapter 7: 7.1, 7.2, Chapter 9: 9.1, 9.2, 9.3.1, 9.3.2, Chapter 12: 12.1, Chapter 13: 13.1, 13.3, 13.4)**	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe the ARM microcontroller's architectural features and instructions.
2. Apply the knowledge gained for Programming ARM to a variety of applications.
3. Interface external devices and I/O with ARM microcontroller.
4. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
5. Develop the hardware /software co-design and firmware design approaches.

TEXTBOOKS:

1. Andrew N Sloss, Dominic Symes, and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman Publishers, 2008.
2. Shibu K V, Introduction to Embedded
3. Systems, Tata McGraw Hill Education Private Limited, 2nd Edition

REFERENCE BOOKS:

1. Raghunandan G. H., Microcontroller (ARM) and Embedded System, Cengage Learning Publication, 2019.
2. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005.
3. Steve Furber, ARM System-On-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

E Books / MOOCs/ NPTEL:

1. https://www.coursera.org/learn/introduction-embedded-systems
2. https://onlinecourses.nptel.ac.in/noc20_ee98/

Table 1: Mapping Levels of COs to POs														
COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2								1	1		1		
CO2	2	2	2						1	1		1		
CO3	2	2	2						1	1		1	2	
CO4	2	2	2						1	1		1	3	
CO5	2	2	2						1	1		1	2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1	1.3.1,1.4.1	**L1**
CO2	1,2,3	1.3.1,1.4.1,2.2.4, 3.2.1,3.2.2,	**L3**
CO3	1,2,3	1.3.1,1.4.1,2.2.4,3.2.1,3.2.2	**L3**
CO4	1,2,3	1.4.1,1.3.1,2.3.1, .2.1,3.2.2	**L3**
CO5	1,2,3	1.3.1,1.4.1,2.1.1,3.1.1,3.2.1,3.2.2	**L4**

MOBILE APPLICATION DEVELOPMENT WITH FLUTTER

Course Code	21AME037	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Learn about the features and installation of Flutter
2. Learn about the basic programming constructs of Dart
3. Develop simple mobile applications in Flutter using Dart language
4. Develop mobile applications using database Connections
5. Construct Flutter application using database

UNIT - I	Contact Hours
Introduction to Flutter Features of Flutter- Advantages of Flutter, Disadvantages of Flutter, Flutter Installation -Installation in Windows, Installation in Mac OS, Creating Simple Application in Android Studio, Architecture of Flutter Applications- Widgets, Gestures, Concept of State, Layers, Introduction to Dart Programming-Variables and Data types, Decision Making and Loops, Functions, Object Oriented Programming. Introduction to Widgets- Widget Build Visualization, Introduction to Layouts- Type of Layout Widgets, Single Child Widgets, Multiple Child Widgets, Advanced Layout Application, Introduction to Gestures, State Management in Flutter- Ephemeral State Management, Application State - scoped model	15
UNIT - II	
Animation on Flutter Navigation and Routing, Introduction to Animation Based Classes, Work flow of the Flutter Animation, Working Application, Android Specific Code on Flutter, Introduction to Package- Types of Packages, Using a Dart Package, Develop a Flutter Plugin Package, Accessing Rest API- Basic Concepts, Accessing Product service API	15

UNIT – III	
Database Concepts SQLite, Cloud Fire store, Internalization on Flutter- Using intl Package, Testing on Flutter- Types of Testing, Widget Testing, Steps Involved, Working Example, Deployment- Android Application, IOS Application, Flutter Development Tools- Widget Sets, Flutter Development with Visual Studio Code, Dart Dev Tools- Flutter SDK	9

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Install Flutter in Android Studio
CO2: Build simple Flutter application using simple widgets and layouts
CO3: Build Animation on Flutter
CO4: Develop Flutter applications using Dart packages
CO5: Construct Flutter application using database

TEXTBOOKS:

1. Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st ed. Edition, Rap Payne, Apress publication.
2. Beginning Flutter: A Hands On Guide to App Development, Marco L. Napoli

REFERENCE BOOK:

1. Flutter Application Development By Android ATC Team

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3

OPERATION RESEARCH			
Course Code	21AME038	**CIE Marks**	
Number of Contact Hours/Week	3:0:0	**SEE Marks**	
Total Number of Contact Hours	39	**Exam Hours**	

Course Learning Objectives:

This Course will enable students to:

1. Describe the scope and limitations of OR methods and outline the role of OR techniques in supporting the decisions.
2. Explain the concept of Linear Programming Model (LPM) and formulate Linear Programming problems.
3. Describe the various methods like Simplex Method, revised simplex Method, Big M Method, Two Phase Method, Dual Simplex Method and duality theory and use it on Linear Programming Problems.
4. Describe the formulation of Transportation problems, different methods in Transportation problems like North West Corner Rule, Row minima method, Column minima method, Matrix minima method, Vogel's approximation method, U-V method and use those methods on the respective real-world problems.
5. Describe the formulation of Assignment problems, use Hungarian method in Assignment problems, CPM and PERT (project management techniques) and use it on the respective real-world problems

UNIT - I	
INTRODUCTION Introduction to OR, nature and meaning, applications, modeling in OR, phases of OR study **LINEARPROGRAMMING** Introduction to Linear Programming through an example, graphical method, formulation of LP model from practical problems, assumptions and properties of linear programming, simplex method**,** Big M method, 2 phase method, Revised simplex method, Duality theory, Primal and dual relationship. ***(Text Book-1: Chapter 2,3,5,6,7,8)***	15

UNIT – II	
TRANSPORATION PROBLEMS Transportation problems, methods to find initial feasible solution and modification to obtain optimal solution (Degeneracy in transportation problems, unbalanced transportation problems **ASSIGNMENTPROBLEM** Mathematical formulation of an assignment problem, unbalanced assignment problem, Travelling Salesman Problem (TSP), Hungarian method. ***(Text Book-1: Chapter 15,16)***	15
UNIT - III	
CPM, PERT Representation of a project by a network, activities and events, starting times, finishing times, floats, slacks, CPM, Idea of crashing probabilistic times and PERT analysis ***(Text Book-1: Chapter 31)***	9
Course Outcomes: At the end of the course the student will be able to: 1. **Describe** the basics of OR, modelling and applications of OR and the linear programming model. 2. **Construct** linear programming problem and apply methods like Simplex method, revised simplex method, Big M method, 2 phase method and Dual simplex method **to solve** the different use cases of linear programming problem. 3. Apply the North West Corner Rule, Row minima method, Column minima method, Matrix minima method, Vogel's approximation method and U-V method to **solve** the Transportation Problems. 4. Apply the Hungarian method to solve the Assignment Problems and Travelling Salesman Problems. 5. Apply the CPM and PERT project management techniques on the respective use cases to **solve** the problems related to the use cases.	
TEXTBOOK: 1. Operations Research, S. D. Sharma, 17th Revised edition,2014.	

REFERENCE BOOKS:

1. Operations Research,Er. Premkumar Gupta,Dr. D.S. Hira, 4th edition, 2015.
2. Introduction to Operations Research - A Computer Oriented Algorithmic Approach, Gillelt B G, McGraw Hill, 2008.
3. Operations Research – An introduction, Hamdy A Taha, PHI, 8th edition,2007.

E-Books / Online Resources:

1. https://www.tutorialspoint.com/linear_programming/index.asp
2. https://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
3. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html

MOOCs:

1. Fundamentals of Operations Research IIT Madras Course, Prof. G. Srinivasan:https://swayam.gov.in/

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

PATTERN RECOGNITION			
Course Code	21AME039	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

1. Recall the basics of pattern recognition systems and Bayesian Decision Theory.
2. Determine the maximum likelihood and Bayesian parameter estimation.
3. Express the nonparametric techniques such as density estimation and nearest neighbour estimation.
4. Examine linear discriminant functions, minimizing the perception criterion function and minimum squared-error procedure
5. Describe the various unsupervised learning and clustering methods.

UNIT – I	Contact Hours
Introduction: Machine Perception, Pattern Recognition systems, Design cycle, learning and adaptation Bayesian Decision Theory: Introduction, Bayesian Decision theory – continuous features, classifiers, discriminant functions, and decision surfaces ,normal density and discriminant functions, Bayes decision theory–discrete features. Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian Estimation, Bayesian parameter estimation, problem of dimensionality, sufficient and exponential family, complex analysis & discriminants.	15
UNIT – II	
Nonparametric Techniques: Introduction, Density Estimation, Parzen Windows,kn-nearestneighbourestimation,nearestneighbourrule,metrics andnearest-neighbourclassification,fuzzyclassification,reducedcoulomb energy, approximations by series expansions. **Linear discriminant functions**: Introduction, linear discriminant	15

functions, generalized linear discriminant functions, minimizing the Perceptron criterion function, relaxation procedures, non separable behaviours, minimum squared-error procedures, Ho-Kashyap procedures.	
UNIT – III	
Unsupervised learning and clustering: Mixture densities and identifiability,maximum-likelihoodestimates,applicationtonormalmixtures, unsupervised Bayesian learning, data decryption and clustering, criterion functions and clustering, hierarchical clustering, on-line clustering. Component analysis, low-dimensional representations and multidimensional calling.	09
Course Outcomes: Upon completion of this course, students will be able to: 1. Recall the basics of pattern recognition systems and Bayesian Decision Theory. 2. Determine the maximum likelihood and Bayesian parameter estimation. 3. Express the nonparametric techniques such as density estimation and nearest neighbour estimation. 4. Examine linear discriminant functions, minimizing the perception criterion function and minimum squared-error procedures 5. Describe the various unsupervised learning and clustering methods.	
TEXTBOOKS: 1. Richard O. Duda, Peter E. Hart and David G Stork," Pattern Classification", John Wiley &Sons, Inc.2nd Ed.2001. 2. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley &Sons,Inc.1992.	
REFERENCE BOOKS: 1. Christopher M. Bishop, "Pattern recognition and machine learning (information science and statistics).", Springer -Verlag New York Inc, 2006. 2. Anzai,Yuichiro,"Pattern recognition and machinelearning",Elsevier, 2012.	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

PROMPT ENGINEERING			
Course Code	21AME040	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

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

1. Understand the details on transformers and BERT models
2. Analyze how pretrained models work
3. Apply prompt engineering with GPT3 and optimizing LLMs
4. Illustrate the advanced prompt engineering
5. Learn about hugging face and hugging face library

UNIT – I	Contact Hours
Introduction to Transformers: Motivation behind transformers, Self-attention mechanism, Transformer architecture and components **Pretrained language models (PLMs):** Introduction to PLMs, Transformer based models: BERT, Fine tuning, and transfer learning with PLMs **Introduction to Large language models:** What are large language models, Popular modern LLMs, Domain specific LLMs, Applications of LLMs	15
UNIT – II	
Prompt Engineering with GPT3: Introduction, Prompt engineering, working with prompts across models, Building Q/A bot with GPT **Optimizing LLMs with Customized Fine Tuning:** Introduction, Transfer learning and fine tuning, OpenAI Fine tuning API, Amazon Review category classification **Advanced Prompt Engineering:** Introduction, Prompt engineering, Introduction, Prompt injection attacks, Input/Output Validation, Batch Prompting, Prompt Chaining, chain of thought prompting, Testing and	15

Iterative prompt development.	
UNIT – III	
Hugging Face: Introduction, Features of hugging face platform, Components of hugging face, Pipelines **Tasks using hugging face library:** Introduction to Gradio, Creating a space on hugging face, Hugging face tasks.	09
Course Outcomes: Upon completion of this course, students will be able to: 1. Learn details on transformers and BERT models 2. Illustrate how pretrained models work 3. Apply prompt engineering with GPT3 and optimizing LLMs 4. Describe advanced prompt engineering 5. Learn about hugging face and hugging face library	
TEXTBOOKS: 1. "Quick Start Guide to Large Language Models: Strategies and Best Practices for using ChatGPT and Other LLMs" by Sinan Ozdemir, O'reilly publications, October 2023 2. "Introduction to Transformers for NLP: With the Hugging Face Library and Models to Solve Problems" by Shashak mohan Jain, O'reilly publications, October 2022	

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2				2	2			2	
CO2	3	2	2		2				2	2			2	
CO3	3	2	2		2				2	2			2	
CO4	3	2	2		2				2	2			2	
CO5	3	2											2	

Table 2: Mapping of Cos to PIs, Pos and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO2	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 3.2.1,5.1.1, 9.1.1, 10.1.1	L2, L3
CO3	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3,5.1.1, 9.1.1, 10.1.1	L2, L3
CO4	1, 2, 3, 5, 9, 10	1.3.1,1.4.1, 2.1.3, 5.1.2, 9.1.1, 10.1.1	L2, L3
CO5	1, 2	1.3.1,1.4.1, 2.1.3	L2

SEMANTIC WEB			
Course Code	21AME041	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

UNIT – I	**Contact Hours**
Web Intelligence: Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The NextGenerationWeb,MachineIntelligence,ArtificialIntelligence,Ontology, Inference engines, Software Agents, Semantic Road Map, Logic on the semantic Web. **Knowledge Representation for the Semantic Web:** Ontologiesandtheir role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.	16
UNIT – II	
Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines. **Semantic Web Applications, Services and Technology:** Semantic Web applications and services, Semantic Search, e-learning,	15
UNIT – III	
Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,	08

Course Outcomes:

Upon completion of this course, students will be able to:

1. To learn Web Intelligence
2. To learn Knowledge Representation for the Semantic Web
3. To learn Ontology Engineering
4. To learn Semantic Web Applications, Services and Technology

To learn Social Network Analysis and semantic web

TEXTBOOK:

1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science,2008.
2. SocialNetworksandtheSemanticWeb,PeterMika,Springer,2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons.
2. Semantic Web and Semantic WebServices-Liyang LuChapman and Hall/CRC Publishers,(Taylor &FrancisGroup)
3. Information sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web,T .Segaran ,C.Evans,J.Taylor, O'Reilly, SPD.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

SOCIAL AND WEB ANALYTICS			
Course Code	21AME042	**CIE Marks**	50
Number of Contact Hours/Week	**3:0:0**	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 1			

Course Learning Objectives:

1. Understand social media, web and social media analytics, and their potential impact.
2. Determine how to Leverage social media for better services and Understand usability metrics, web and social media metrics
3. Use various data sources and collect data relating to the metrics and key performance indicators
4. Identify key performance indicators for a given goal, identify data relating to the metrics and key performance indicators
5. Use ready-made web analytics tools (Google Analytics) and be able to understand a statistical programming language (R), also use its graphical development environment (Deduce) for data exploration and analysis.

UNIT – I	Contact Hours
Introduction to web and social analytics: Overview of web & social media (Web sites, web apps, mobile apps and social media), Impact of social media on business, Social media environment, how to leverage social media for better services, Usability, user experience, customer experience, customer sentiments, web marketing, conversion rates, ROI, brand reputation, competitive advantages. Need of using analytics, Web analytics technical requirements., current analytics platforms, Open Source vs licensed platform, choosing right specifications & optimal solution, Web analytics and a Web analytics 2.0 framework (clickstream, multiple outcomes Relevant Data And its Collection using statistical Programming language R.:Data (Structured data, unstructured data, metadata, Big Data and Linked Data), Participating with people centric approach, Data analysis basics (types of data, metrics and data, descriptive statistics, comparing, Basic overview of R:R-Data Types, R-Decision Making, R-Loops, R-functions, R-Strings, Arrays, R-Lists, R-Data Frame, R-CSV Files, R-Pie Charts, R-Bar charts, R-Barplots. Basic Text Mining in R and word cloud.	15
UNIT - II	
Kpi/Metrics: Understand the discipline of social analytics, aligning social objectives with business goals, identify common social business objectives, developing KPIs; Standard vs Critical metrics. PULSE metrics (Page views, Uptime, Latency, Seven-day active users) on business and technical Issues, HEART metrics (Happiness, Engagement, Adoption, Retention, and Task success) on user behavior issues; Bounce rate, exit rate, conversion rate, engagement, strategically aligned KPIs, Measuring Macro & micro conversions, On-site web analytics, off-site web analytics, the goal-signal-metric process. Case study on Ready-made tools for Web and social media analytics (Key Google Analytics metrics, dashboard, social reports, Tableau Public and KNIME **Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, and More:** Why Is Twitter All the Rage?, Exploring Twitter's API, Fundamental Twitter Terminology, Creating a Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analyzing the 140 Character, Extracting Tweet Entities, Analyzing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in	15

Retweets, Visualizing Frequency Data with Histograms.	
UNIT – III	
Mining Facebook: Analyzing Fan Pages, Examining Friendships, and More: Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analyzing Social Graph Connections, Analyzing Facebook Pages, Examining Friendships. **Data Mining in Social Media: Introduction**, Data Mining in a Nutshell, Social Media, Motivations for Data Mining in Social Media, Data Mining Methods for Social Media, Data Representation, Data Mining - A Process, Social Networking Sites: Illustrative Examples, The Blogosphere: Illustrative Examples, Related Efforts, Ethnography and Netnography, Event Maps **Text Mining in Social Networks** Introduction, Keyword Search, Query Semantics and Answer Ranking, Keyword search over XML and relational data, Keyword search over graph data, Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogeneous Networks	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Use Social Media Analytics and Web analytics,
2. Explain how to leverage social media for better services.
3. Develop KPIs and to build scorecards & dashboards to track KPIs.
4. Understand text mining and data mining in social networks.
5. Use ready-made web analytics tools (Google Analytics) and be able to understand a statistical programming language (R), also use its graphical development environment (Deduce) for data exploration and analysis

TEXTBOOKS:

1. Matthew A. Russell," Mining of Social web, O′Reilly", Second Edition, ISBN-13: 978-1449367619, 2013,
2. Charu C Agarwal, "Social Network Data Analytics", Springer; October 2014.

REFERENCE BOOKS:

1. Hand, Mannila, and Smyth. "Principles of Data Mining", Cambridge, MA: MIT Press, 2001. ISBN: 026208290X.
2. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", John Wiley & Sons; Pap/Cdr edition (27 Oct 2009).
3. Tom Tullis, Bill Albert, "Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics", Morgan Kaufmann; 1 edition (28 April 2008).
4. Jim Sterne, "Social Media Metrics: How to Measure and Optimize Your Marketing Investment", John Wiley & Sons (16 April 2010).
5. Brian Clifton, "Advanced Web Metrics with Google Analytics", John Wiley & Sons; 3rd Edition

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2							1	1		1	1	1
CO2	2	2							1	1		1	1	1
CO3	1	2							1	1		1	2	1
CO4	2	2							1	1		1	1	1
CO5	2	2							1	1		1	3	2

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO2	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO3	1,2	1.3.1, 1.4.1, 2.1.3,	L2
CO4	1,2	1.3.1, 1.4.1, 2.1.3,	L3
CO5	1,2	1.3.1, 1.4.1, 2.1.3, 2.2.5	L3

SOFT COMPUTING

Course Code	21AME043	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

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

1. Understand basics of the constitutes and applications Soft Computing
2. Perform reproduce operations like mutations and crossover
3. Illustrate the concepts of neural networks.
4. Analyze the fuzzy member ship functions and models
5. Understand decision making strategies to real world examples

UNIT – I	Contact Hours
INTRODUCTION TO SOFT COMPUTING: Evolution of Computing, Soft and Hard Computing, Soft Computing characteristics, Constituents and Applications, AI Definitions and Intelligent systems architecture. **GENETIC ALGORITHMS:** Introduction to Genetic Algorithms (GA) – Conceptual GA algorithm, Reproduction operators Mutation and cross over, Applications of GA, Learning Definitions, strategies, Machine Learning Approach, applications and Architecture of learning agent	16
UNIT - II	
NEURAL NETWORKS : Introduction to Neural Networks, Applications, Structure and function of Biological Neuron, ANN introduction, Perceptron, Multi-layer feed forward Networks with Back propagation **FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, Fuzzy Rules, Models, Fuzzy Reasoning and Fuzzy Inference Systems.	15
UNIT - III	
DECISION MAKING AND EXPERT SYSTEMS: Single person, multi person, Multi criteria and Multi stage decision making, Expert system features, architecture and applications	08

Course Outcomes:

1. Upon completion of this course, students will be able to:
2. Explain the constitutes and applications Soft Computing
3. Perform reproduce operations like mutations and crossover
4. Demonstrate the concepts of neural networks.
5. Explain the fuzzy member ship functions and models
6. Apply decision making strategies to real world examples

TEXTBOOKS:

1. Jyh-ShingRogerJang,Chuen-TsaiSun,EijiMizutani,"Neuro-Fuzzy and Soft Computing", Prentice-Hall of India,2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications",Prentice Hall,1995.
3. James A. Freeman and David M.Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition.,2003.
4. Simon Haylion "Neural Networks", Prentice-Hall of India,2003.

REFERENCE BOOKS:

2. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall,1998.
3. DavidE.Goldberg,"GeneticAlgorithmsinSearch,Optimizationand Machine Learning", Addison Wesley,1997.
4. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer,2007.
5. S. N. Sivanandam, S. N. Deepa,"IntroductiontoGeneticAlgorithms", Springer,2007.
6. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers,1992.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	2110	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	3	3	2	3								3	
CO3	3	3	2	2	3								3	
CO4	3	3	2		1								2	
CO5	3	3	3	2	3								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO2	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO3	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2
CO4	PO1,PO2,PO3,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L3
CO5	PO1,PO2,PO3,PO4,PO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1, 2.1.2,2.2.1,3.1.1,3.1.2, 4.1.1,5.1.1,5.1.2	L2

SOLVE BUSINESS PROBLEMS WITH AI

Course Code	21AME044	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Analyse the use of solving business problem with machine learning.
2. Understand the tools used in business.
3. Explain the automating customer interaction and data-based decision making.
4. Get the idea of predict the events and its outcome for business minds.
5. Describe and illustrate the idea of prompting data privacy and ethical practise.

UNIT – I	Contact Hours
Solve Business Problems with AI and Machine Learning Introduction, Identify Data-Driven Emerging Technologies Module Introduction, The Data Hierarchy, Big Data, Data Mining, Applied AI and ML in Business, Appropriate Business Problems, Challenges of AI/ML, Machine Learning Model, Machine Learning Workflow, Useful Skillsets, Concept Drift and Transfer Learning, Problem Formulation, Differences Between Traditional Programming and Machine Learning, Differences Between Supervised and Unsupervised Learning, Randomness and Uncertainty. Machine Learning Outcomes Overview, Guidelines for Following the Machine Learning Workflow, Guidelines for Formulating a Machine Learning Outcome, Applying AI and ML to Business Problems. **Select Appropriate Tools Module** Introduction, New Tools and Technologies, Hardware Requirements, Cloud Platforms, Overview, Open Source AI Tools, Proprietary AI Tools, GPU Platforms, Guidelines for Configuring a Machine Learning Toolset, Machine Learning Tools.	15

UNIT – II	
Automating Customer Interactions. Choosing Natural Language Technologies, Review the Top Tools for Creating Chatbots and Virtual Agents, Chapter Takeaways, **Improving Data-Based Decision-Making** Choosing Between Automated and Intuitive Decision-Making, Gathering Data in Real Time from IoT Devices, Reviewing Automated Decision-Making Tools **Using Machine Learning to Predict Events and Outcomes** Machine Learning Is Really About Labelling, Data Looking at What Machine Learning Can Do, Predict What Customers Will Buy. Answer Questions Before They're Asked, Make Better Decisions Faster, Replicate Expertise in Your Business, Use Your Power for Good, Not Evil: Machine Learning Ethics. **Harnessing the Power of Natural Language Processing** Extracting Meaning from Text and Speech with NLU, Delivering Sensible Responses with NLG, Automating Customer Service, Reviewing the Top NLP Tools and Resources. **Building Artificial Minds** Separating Intelligence from Automation, Adding Layers for Deep Learning, Considering Applications for Artificial Neural Networks, Classifying Your Best Customers, Recommending Store Layouts , Analysing and Tracking Biometrics, Reviewing the Top Deep Learning Tools.	16
UNIT - III	
Promote Data Privacy and Ethical Practices Introduction, Data Protection, Data Privacy Laws, Privacy by Design, Data Privacy Principles at Odds with Machine Learning, Compliance with Data Privacy Laws and Standards*5m*Data Sharing and Privacy, The Big Data Challenge, Preconceived Notions, The Black Box Challenge, Bias, Prejudice, and Discrimination, Ethics in NLP, Use of Data for Unintended Purposes, Intellectual Property, Humanitarian Principles, Asilomar AI Principles Data Privacy Overview, Guidelines for Protecting Data Privacy, Guidelines for Promoting Ethical Practices, Privacy and Data Governance for AI and ML, Guidelines for Establishing Policies Covering Data Privacy and Ethics.	08

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify the source for solving business problems and machine learning outcome.
2. Identifythe tools used in business.
3. Applythedataidea of predict the events and its outcome for business.
4. Illustrate the idea of predict the events and its outcome for business minds

Apply idea of prompting data privacy and ethical practise.

TEXTBOOKS:

1. Doug Rose "Artificial Intelligence for Business , What we need to do know about machine learning " , 2nd edition Pearson.

Applied Artificial Intelligence: A Handbook for Business Leaders" by Mariya Yao, Adelyn Zhou, and Marlene Jia.

REFERENCE BOOKs:

1. Prediction Machines: The Simple Economics of Artificial Intelligence by Ajay Agrawal, Joshua Gans, and Avi Goldfarb.
2. The AI Advantage: How to Put the Artificial Intelligence Revolution to Work" by Thomas H. Davenport.

MOOC :

1. https://www.coursera.org/learn/solve-problems-ai-machine-learning

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

SPEECH PROCESSING

Course Code	21AME045	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning objectives

1. Learn the speech production system and describe the fundamentals of speech
2. Understand the different speech parameters.
3. Describe an appropriate statistical speech model for a given application.
4. Study the speech recognition system.
5. Understand the different speech synthesis techniques

UNIT - I	Contact Hours
BASIC CONCEPTS Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods. MFCC vectors -Acoustic Likelihood Computation -Evaluation. Triphones – Discriminative Training -Modelling Variation. Computational Phonology- Finite-State Phonology –Computational Optimality Theory -Syllabification -Learning Phonology and Morphology .	15
UNIT - II	
Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. SPEECH MODELING Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.	16
UNIT - III	
Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword UNITs for TTS, intelligibility and naturalness – role of prosody, Applications and present status	08
Course Outcomes: Upon completion of the course, students will be able to: 1. Model speech production system and describe the fundamentals of speech. 2. Extract and compare different speech parameters. 3. Choose an appropriate statistical speech model for a given application. 4. Design a speech recognition system. 5. Use different speech synthesis techniques	

TEXTBOOKS:

1. Lawrence RabinerandBiing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2.Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education

REFERENCE BOOK:

1.Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
2.Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2								2	
CO2	3	2			2								2	
CO3	3	2			2								2	
CO4	3	2			2								2	
CO5	3	2			2								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3, 5.1.1	L3
CO2	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO3	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO4	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1	L3
CO5	PO1, PO2, PO5	1.3.1,1.4.1, 2.1.2, 3.1.1,3.1.2,3.1.3,5.1.1, 5.3.1	L3

SYSTEM MODELLING AND SIMULATION

Course Code	21AME046	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

UNIT - I	**Contact Hours**
Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation Simulation examples: Simulation of queuing systems. General Principles. **Statistical Models in Simulation**: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. **Queuing Models:** Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems, Steady-state behavior of M/G/1 queue, Networks of queues,	15
UNIT – II	
Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, **Random-VariateGeneration:**,Inverse transform technique Acceptance-Rejection technique. **Input Modeling:** Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.	15

UNIT - III	
Estimation of Absolute Performance: Types of simulations with respect to output analysis, Stochastic nature of output data, Measures of performance and their estimation, Measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations. **Verification, Calibration And Validation:** Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation.	09

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the system concept and apply functional modeling method to model the activities of a static system
2. Describe the behavior of a dynamic system and create an analogous model for a dynamic system;

Simulate the operation of a dynamic system and make improvement according to the simulation results.

TEXTBOOK:

Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		1								2	
CO2	3	2	2	2	1								2	
CO3	3	3	3	2	3								2	
CO4	3	3	3	3	3								3	
CO5	3	3	3	3	3								3	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2,3,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1	L2
CO2	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
CO3	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L2
CO4	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3
CO5	1,2,3,4,5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 4.1.1,4.1.2,4.2.1,4.3.1,5.1.1,5.2.1	L3

TEXT MINING

Course Code	21AME047	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

Course Learning Objectives

1. Design text extraction techniques.
2. Design clustering techniques for text.
3. Design classification techniques for text
4. Practice visualization methodologies using tools.
5. Practice feature extraction using tools

UNIT – I	**Contact Hours**
Text Extraction Text Extraction: Introduction, Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords, Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles. Clustering Clustering: Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments.	15
UNIT – II	
Classification: Content-based spam email classification using machine-learning algorithms, Utilizing nonnegative matrix factorization for email classification problems, Constrained clustering with k-means type algorithms. Anomaly and trend detectionAnomaly and trend detection: Text Visualization techniques such as tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery, adaptive threshold setting for novelty mining.	16

UNIT – III	
Text streams Text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions, Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.	08

Course Outcomes:

Upon completion of this course, the students will be able to:

1. Design text extraction techniques.
2. Design clustering techniques for text.
3. Design classification techniques for text
4. Practice visualization methodologies using tools.

Practice feature extraction using tools

TEXTBOOKS:

1. Michael W. Berry & Jacob Kogan ,"Text Mining Applications and Theory", Wiley publications.

Aggarwal, Charu C., and ChengXiangZhai, eds. Mining text data. Springer Science & Business Media, 2012.

REFERENCE BOOK:

1. Miner, Gary, et al. Practical text mining and statistical analysis for non-structured text data applications. Academic Press, 2012.

2.Srivastava, Ashok N., and Mehran Sahami. Text mining: Classification, clustering, and applications. Chapman and Hall/CRC, 2009.

3.Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds. Ontology learning from text: methods, evaluation and applications. Vol. 123. IOS press, 2005.

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
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CO1	1	2							1	1		1	1	1
CO2	2	2							1	1		1	1	1
CO3	1	2							1	1		1	2	1
CO4	2	2							1	1		1	1	1
CO5	2	2							1	1		1	3	2

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO2	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO3	1,2	1.3.1, 1.4.1, 2.1.3,	L2
CO4	1,2	1.3.1, 1.4.1, 2.1.3,	L3
CO5	1,2	1.3.1, 1.4.1, 2.1.3, 2.2.5	L3

UNIX SYSTEM PROGRAMMING			
Course Code	21AME048	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1) Interpret the features of UNIX and basic commands.
2) Demonstrate different UNIX files and permissions
3) Implement shell programs.
4) Explain UNIX process, IPC and signals.

UNIT - I	**Contact Hours**
Introduction: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics. **UNIX Files and APIs:** File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs	15

UNIT – II **UNIX Processes and Process Control:** The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.	
Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.	15
UNIT – III	
Interprocess Communication: Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.	9

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the basic concepts of UNIX Architecture, File system and basic commands.
2. Understand the basic file system commands, concepts of Shell programming.
3. Describe the concepts UNIX API's and process control.
4. Explain the concepts of process accounting, User identification and different IPC mechanisms.
5. Understand signal handling mechanism, daemon characteristics, coding rules and error logging.

TEXTBOOKS:

1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2. Advanced Programming in the UNIX Environment - W.Richard Stevens, Stephen A. Rago, 3nd Edition, Pearson Education / PHI, 2005.

REFERENCE BOOKS:

1. Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.
2. The Design of the UNIX Operating System - Maurice.J.Bach, Pearson Education / PHI, 1987.
3. Unix Internals - Uresh Vahalia, Pearson Education, 2001.

E Books / MOOCs/ NPTEL:

1) https://nptel.ac.in/courses/117106113
2) https://www.udemy.com/course/linux-system-programming/

Table 1: Mapping Levels of COs to Pos

Cos	Program Objectives (POs)												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2												2
CO2	3	2												2
CO3	3	2												2
CO4	3	2												2
CO5	3	3												2

WEB APPLICATIONS USING ML			
Course Code	21AME049	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03
Credits – 3			

Course Learning Objectives:

1. Gain technical competencies in web application development and maintenance.
2. Implement interactive web pages and apply validation checks using client side programming languages like HTML, CSS, Java Script and AngularJS.
3. Process the business data and generate responses dynamically using PHP.
4. Use web application development frameworks for designing web applications
5. Understand the IOT connectivity..

UNIT - I	**Contact Hours**
HTML5:Overview of HTML5, New features in HTML5, Removed elements from HTML, HTML5 Semantic elements, HTML5 input types, HTML5 new form elements and attributes, HTML5 Video and Audio. CASCADING STYLE SHEETS (CSS): Introduction, Levels of style sheets, style specification formats, selector forms, Property Value forms, Font properties, List properties, Color, Alignment of Text, The Box model, Background images, The and tags, Conflict resolution.THE BASICS OF JAVASCRIPT:Overview, Object orientation and JavaScript, General syntactic characteristics, Primitives, Operations, and Expressions, Screen output and keyboard input, control statements, Object creation and modification, Arrays, Functions, Constructors, Patterns matching using Regular Expressions, Errors in Scripts.JAVASCRIPT The JavaScript Execution Environment, The Document object model, Element access in JavaScript, Events and Event handling, Handling events from Body elements, Handling events from Button elements, Handling events from Text Box and Password elements.	15

UNIT - II	
IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices. **IoT Case Studies:** Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, and Productivity Applications.	15
UNIT - III	
Managing Data in web apps, Data Integration, Extracting and organizing SQL databases, deployment, Visualization, Integrating,	09

Course Outcomes:

Upon completion of this course, students will be able to:

1. Gain technical competencies in web application development and maintenance.
2. Implement interactive web pages and apply validation checks using client side programming languages like HTML, CSS, Java Script and AngularJS.
3. Process the business data and generate responses dynamically using PHP.
4. Use web application development frameworks for designing web applications.

Understand the IOT connectivity..

TEXTBOOKS:

1. HTML5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery", Kogent Learning Solutions Inc. Dreamtech Press, First Edition, ISBN 9789350040959.
2. Html, Xthml, CSS & XML by Example", TeodoreGugoiu Publication – FIREWAL MEDIA

REFERENCE BOOKS:

1. "Beginning PHP5", Dave W. Mercer, Allan Kent, Steven D. Nowicki, David Mercer, Wrox Publication, First Edition, ISBN 978-0764557835
2. "Commence Web Development with PHP and MySQL", Sagar S. Sawant & Ashwini B. Patil, Aruta Publication, First Edition, ISBN-978-93-81476-13-0
3. "Real-World Solutions for Developing High-Quality PHP Frameworks and Applications", Sebastian Bergmann, Stefan Priebsch, Wrox, ISBN:978-1-4571-0652- 1.

Table 1: Mapping Levels of COs to POs														
COs	**Program Objectives (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2							1	1		1	1	1
CO2	2	2							1	1		1	1	1
CO3	1	2							1	1		1	2	1
CO4	2	2							1	1		1	1	1
CO5	2	2							1	1		1	3	2

Table 2: Mapping of COs to PIs, POs and BTL			
Course outcomes	**Program Outcomes**	**Performance Indicators**	**Bloom's Taxonomy Level**
CO1	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO2	1,2	1.3.1, 1.4.1, 2.2.5	L2
CO3	1,2	1.3.1, 1.4.1, 2.1.3,	L2
CO4	1,2	1.3.1, 1.4.1, 2.1.3,	L3
CO5	1,2	1.3.1, 1.4.1, 2.1.3, 2.2.5	L3

WIRELESS SENSOR NETWORKS

Course Code	21AME050	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	39	**Exam Hours**	03

Credits – 3

UNIT - I	**Contact Hours**
CHARACTERISTICS OF WSN Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. **MEDIUM ACCESS CONTROL PROTOCOLS** Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.	15
UNIT - II	
ROUTING AND DATA GATHERING PROTOCOLS Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing – Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.	15
UNIT - III	
EMBEDDED OPERATING SYSTEMS Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems –	09

TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components - Programming in Tiny OS using NesC, Emulator TOSSIM.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Know the basics, characteristics and challenges of Wireless Sensor Network
2. Apply the knowledge to identify appropriate physical and MAC layer protocol
3. Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement

Be familiar with the OS used in Wireless Sensor Networks and build basic modules

TEXTBOOKS:

1. Kazem Sohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Network, John Wiley & Sons, 2005

REFERENCE BOOKS:

1. David Gay and Philip A. Levis, TinyOS Programming, Cambridge University Press, 2009
2. Mohammad S. Obaidat, Sudip Misra, Principles of Wireless Sensor Networks, Cambridge University Press, 2014

Table 1: Mapping Levels of COs to POs

COs	Program Objectives (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1		1								2	
CO2	3	3	1		1								2	
CO3	3	2	1		1								2	
CO4	3	2	1		1								3	
CO5	3	2	2		1								2	

Table 2: Mapping of COs to PIs, POs and BTL

Course outcomes	Program Outcomes	Performance Indicators	Bloom's Taxonomy Level
CO1	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO2	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO3	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO4	P1, P2, P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2
CO5	P1, P2,P3, P5	1.1.1,1.1.2,1.2.1,1.3.1,2.1.1,2.1.2,3.1.1,3.1.2 5.1.1,5.2.1,5.2.2,5.3.1	L2

OPEN ELECTIVE (VI Semester) - 2023-2024

Sl. No.	Code	Name
1.	21MA8X02	Linear Algebra (for all except CS, IS, EC, CCE & AIML)
2.	21HU8X03	Intellectual property rights (for all)
3.	21CV8X07	Environment Impact Assessment (for all except Civil)
4.	21ME8X08	Industrial Pollution Control (for all except Mechanical)
5.	21HU8X24	Professional and Cognitive Communique (for all)
6.	21ME8X28	Operations Management and Entrepreneurship (for all except Mechanical)
7.	21IS8X38	Introduction to Python Programming (for all except CS & IS)
8.	21BT8X40	Bio Fuel Engineering (for all except BT)
9.	21BT8X42	Solid Waste Management (for all except BT & Civil)
10.	21EC8X59	PCB Design (For all except E&C)
11.	21ME8X63	Innovation & Entrepreneurship (for all)
12.	21HU8X68	Introduction to Yoga (The classes will be conducted from 7.00 a.m. to 8.00 a.m. Those who are willing to come at 7.00 a.m. should only register)
13.	21HU8X70	Overview of Indian Culture and Arts (for all)
14.	21HU8X71	Principles to Physical Education (The classes will be conducted from 5.30 p.m. to 6.30 p.m. Those who are willing to come at 5.30 p.m. should only register)
15.	21HU8X72	Introduction to Japanese language (Students with no backlogs, CGPA should be above 7.0 & who opt to get placed in Japanese companies in Japan/India are eligible to register)
16.	21HU8X74	Introduction to German Language (for all)
17.	21ME8X75	Sustainable Development Goals (for all)
18.	21IS8X76	Web Technologies (for all except CS & IS)
19.	21CS8X77	Programming in Java (for all except EC,CS & IS)
21.	21CS8X78	Data Structures & Algorithms (for all except EC,CS & IS)
21.	21EE8X79	Electric Vehicle Technology (for all except EE)
22.	21HU8X81	National Cadet Corps: Organization, Functions & Capabilities (for only NCC Cadet Students)
23.	21EC8X82	Fundamentals of Image Processing – a practical approach (Only for CV, ME & BT)
24.	21HU8X86	Introduction to Yakshagana (for all - who are familiar with kannada Language)
25.	21ME8X88	Marketing Management (for all except Mechanical)

LINEAR ALGEBRA			
Course Code	**21MA8X02**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable the students to

1. Understand the concepts of vectors, bases.
2. Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3. Find the canonical forms and appraise its importance in various fields.
4. Make use of Gram-Schmidt process to produce an orthonormal basis.
5. Learn the concepts of singular value decomposition and PCA.

UNIT - I

Vector spaces

Vector spaces, subspaces, bases and dimensions, coordinate vecotrs, null spaces and column spaces of the matrices.

Linear Transformations

15 Hours

UNIT - II

Canonical Forms

Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.

Inner Product Spaces

Inner products; inner product spaces, orthogonal sets and projections, Gram-Schmidt process, QR-factorization, Least-squares problems.

15 Hours

UNIT - III

Symmetric Matrices and Quadratic Forms:

Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.

09 Hours

Course Outcomes: At the end of the course student will be able to

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	**Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.**

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2										
CO2	2	2										
CO3	3	1										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Mode of Teaching and Learning:
Class room teaching. Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)	
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.	
Continuous Internal Evaluation:	
1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.
Semester End Examination:	
	There will be **8** questions of **21** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

TEXTBOOKS:	
1.	**Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2104.**
2.	David C.Lay, "Linear Algebra and its Applications",3rd edition, Pearson Education (Asia) Pte. Ltd, 2105.
REFERENCE BOOKS:	
1.	M. Artin , Algebra Prentice Hall of India.2104.
2.	Gilbert Strang, "Linear Algebra and its Applications", 4th edition, Thomson Learning Asia, 2103.
3.	Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications", Pearson Education (Asia) Pte.Ltd 7th edition ,2103.
4.	Sheldon Axler, "Linear Algebra Done Right", Springer International Publication, Third Edition,2115.

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INTELLECTUAL PROPERTY RIGHTS

Course Code	**21HU8X03**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Learning Objectives:	
1.	Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.
2.	Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.
3.	Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.

UNIT - I	
Introduction to Intellectual Property Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.	8
Agreements and Treaties History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2117	8
UNIT - II	
Basics of Patents and Concept of Prior Art Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of "prior art"; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)	8
Patent filing procedures National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies	8
UNIT - III	
Case Studies: Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa)	7

Course Outcomes: At the end of the course student will be able to

1.	Have a General understanding of the Intellectual Property Rights.
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.
4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights
5.	Be aware and have a general understanding of patenting procedures and licensing.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1		3	3	2		3			2	2		3		
CO2	2	2	3			3		3	1	1	2	2		
CO3	2			2		3			2	2	2	3		
CO4			1	1		3			1	2		3		
CO5	3	2	1			3			3	1		2		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2107
2.	Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2107
3.	Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
4.	Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
5.	Intellectual Property Today: Volume 8, No. 5, May 2101,
6.	WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.
7.	Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and

	policy options, Zed Books, New York 2100
8.	Wadehra, B. L. Law relating to patents, trademarks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2100
9.	Sinha, Prabhas Chandra Encyclopedia of Intellectual Property Rights, 3 Vols. Eastern Book Corporation, 2106.
10.	"Practical Approach to Intellectual Property Rights"; Rachna Singh Puri and Arvind Vishwanathan, I. K. International Publishing House Pvt. Ltd.
E-RESOURCES:	
1.	http://www.w3.org/IPR/
2.	http://www.wipo.int/portal/index.html.en
3.	http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4.	www.patentoffice.nic.in
5.	www.iprlawindia.org/

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ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	**21CV8X07**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Identify the need to assess and evaluate the impact of projects on environment.
2. Explain major principles of environmental impact assessment.
3. Understand the different steps within environmental impact assessment.
4. Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT – I

Evolution of EIA: Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

16 Hours

UNIT - II

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

10 Hours

UNIT – III

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

13 Hours

Course Outcomes:

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

1. Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2. Liaise with and list the importance of stakeholders in the EIA process.
3. Know the role of public in EIA studies.
4. Overview and assess risks posing threats to the environment.
5. Assess different case studies/examples of EIA in practice.

Course Articulation Matrix :

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

Note:- 1:Low 2:Medium 3: High

TEXTBOOKS:

1. Noble, L. 2110. Introduction to environmental impact assessment. A Guide to Principles and Practice. 2nd edition. Oxford University Press, Don Mills, Ontario.
2. Larry W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996

ADDITIONAL REFERENCE MATERIALS

1. Morris and Therivel, 2109. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2. Hanna, K.S. 2109. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.

NPTEL SOURCES

http://nptel.ac.in/courses/121108004/
http://nptel.ac.in/courses/121108004/module3/lecture3.pdf

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INDUSTRIAL POLLUTION CONTROL			
Course Code	**21ME8X08**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives: This Course will enable students to,	
1	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.

UNIT - I

Introduction to Pollution

Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.

Meteorology

Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems

15 Hours

UNIT - II

Separation techniques

Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber

Smoke and gaseous pollutants

Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope &
Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So2, Co, UBHC, Nox their ill effects and & control methods..

15 Hours

UNIT - III

Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards. **9 Hours**

Course Outcomes:

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

CO 1	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
CO 2	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams.
CO 3	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency.
CO 4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
CO 5	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

TEXTBOOKS:

1. "Environmental Pollution Control Engineering, *Wiley Eastern Ltd.*,
2. "Introduction to Environmental Engineering & Science", Gilbert M Masters, PHI,1995
3. "Environmental Pollution Control Engineering, *C. S RAO New Age Int.*

REFERENCE BOOKS:

1. *"Air Pollution"*, Henry C. Perkins, Mc-Graw Hill, 1974.
2. *"Air Pollution control"*, W. L. Faith, *John Wiley*

MOOC/NPTEL Resources:

1. http://nptel.ac.in/courses/105106119/36

Course Articulation Matrix

Course Code / Name : 21ME8X08/ Industrial Pollution Control														
Course Outcomes (CO)	**Program Outcomes (PO)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X08.1	2								1	1		1		
C-21ME8X08.2	2								1	1		1		
C-21ME8X08.3	2								1	1		1		
C-21ME8X08.4	2								1	1		1		
C-21ME8X08.5	2								1	1		1		

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Course Code	**21HU8X24**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Learning Objectives:

1.	To Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

UNIT - I

Common sense and Emotional Intelligence Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking; Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence	15
Etiquettes & Workplace Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace	

UNIT - II

Social Networking Sites and its Impacts Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour	15
Gender and Body Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA	

UNIT - III

Writing Types of Writing, Note Taking Methods, Plagiarism **Reading** Styles of Reading, Types of Reading,Scanning, Skimming	9

Course Outcomes: At the end of the course student will be able to

1.	Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1		3							3	3		3		
CO2		2						3	2	3		2		
CO3		3							2	2		3		
CO4		3							2	2		3		
CO5		2							3	3		2		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Geetha.V. Gender. Kolkatta: Web Impressions, 2109.
2.	Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2113): 91-112.
3.	Barry, Peter. Beginning Theory. New Delhi: Viva Books, 2110.
4.	Berger, John. Ways of Seeing. London: Penguin Books, 1977.
5.	Cranny-Francis, Anny, et al. Gender Studies: Terms and Debates. New York: Palgrave Macmillan, 2103.
6.	Gauntlett, David. Media, Gender and Identity: An Introduction. London: Routledge, 2108
7.	Pilcher, Jane, and Imelda Whelehan. 50 Key Concepts in Gender Studies. London: Sage, 2104. Print.
8.	Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.
9.	Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2104): 199-215.Web.

E-RESOURCES:

1.	http://www.cyberpsychology.eu/view.php?cisloclanku=2109061501/ >.
2.	http://www.surveillance-and-society.org/articles2(2)/webcams.pdf
3.	http://eprints.rclis.org/19790/>.

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OPERATIONS MANAGEMENT & ENTREPRENEURSHIP

Course code	**21ME8X28**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**(3:0:0)**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives: This Course will enable students to,

1	Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP
2	Appreciate the importance of Quality tools and methods in operations management
3	Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability
4	Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.
5	Identify and differentiate the different national and state level funding agencies.

UNIT – I

Introduction to Production/ Operations Management: Concept of production, Classification of production systems, Production Management, Concept of operations, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management (Customer Service and Resource utilization/ Competitive advantage through Quality-Delivery-Cost), Scope of Operations Management. Introduction to

Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).

7 Hours

Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.

TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.

Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools,

Philosophy of statistical process control and modeling process quality: Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits)

9 Hours

UNIT – II

Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,

Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.

Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.

8 Hours

Entrepreneurship: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.

Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Application of Operations Management concepts in Facility/ Business Location: General procedure for making locations decisions, Numerical Problems on application of Breakeven analysis and Transportation method to make location decisions.

8 Hours

UNIT – III

Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)

Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

Course Outcomes (CO)

CO 1	Differentiate production and service systems. Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
CO 2	Discuss Total Quality Management tools and methods. Solve problems on fundamentals of statistics and normal distribution.
CO 3	Draw and Analyze variable process control charts and determine process capability. Calculate reliability of series and parallel systems using the information on failure rate and time.
CO 4	Discuss entrepreneurship, characteristics of an entrepreneur and barriers to entrepreneurship. Discuss the elements of a project report and feasibility studies conducted in the project appraisal.
CO 5	Identify and differentiate the national and state level funding agencies. Discuss the effect of GATT and WTO on Indian economy.

TEXTBOOKS:

1. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books
2. **Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
3. **Statistical Quality Control**: RC Gupta, Khanna Publishers, New Delhi, 2105.
4. **Total Quality Management**: Dale H. Besterfield, Pearson Education, 2103.
5. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
6. **Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2106 (2 & 4).

REFERENCE BOOKS:

1. **Statistical Quality Control:** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
2. **Statistical Process Control and Quality Improvement:** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
3. **Statistical Quality Control for Manufacturing Managers:** W S Messina, Wiley & Sons, Inc. New York, 1987
4. **Statistical Quality Control:** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2105, Hoboken, NJ (ISBN 0-471-65631-3).
5. **Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.
6. **Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.

MOOC/NPTEL Resources:

1. http://nptel.ac.in/courses/110105067/
2. https://www.edx.org/course/operations-management-iimbx-om101-1x

Course Articulation Matrix

Course Code / Name: 18ME8X28/ Operations Management & Entrepreneurship															
Course Outcomes (CO)	**Program Outcomes (PO)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C-21ME8X28.1	3	1	0					1	1	1	1				
C-21ME8X28.2	1	2	0						1	1	3				
C-21ME8X28.3	2	2	0				1	0	1	1	3				
C-21ME8X28.4	3	1	0			1	0	1	1		2				
C-21ME8X28.5	1	1	0			1	1	1	1		3				

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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INTRODUCTION TO PYTHON PROGRAMMING			
Course Code	**21IS8X38**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Prerequisites:

Student must have fundamental knowledge of procedure-oriented programming.

Course Learning Objectives (CLOs):

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

- Construct Python programs using data types and looping.
- Design object-oriented Python programs using classes and objects.
- Design useful stand-alone and CGI applications in Python.

UNIT - I

INTRODUCTION: Introduction to python, Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages. Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation.

STRING MANIPULATIONS: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers

LISTS, TUPLES, AND DICTIONARIES: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

15 Hours

UNIT – II

FUNCTIONS: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions

CLASSES AND OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block

15 Hours

UNIT – III

FILE HANDLING: Manipulating files and directories, Reading from Text Files, Writing to Text Files, Reading from Binary Files, Writing to Binary Files, Seeking Within Files, Creating and Reading a formatted file (csv or tab-separated).

GRAPHICAL USER INTERFACES: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X38.1	Demonstrate the basics of Python programming like data types and looping	L2
C8X38.2	Apply the basic data structures in solving the problems	L3
C8X38.3	Experiment with usage of functions in a given problem	L3
C8X38.4	Develop Objects by creating classes and apply object-oriented features	L3
C8X38.5	Develop applications in Python using File Programming &User Interface	L3

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1	L2
CO2	1,2,3	1.4.1,1.3.1,2.3.1,3.1.1,3.2.2	L3
CO3	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X38.1	1	2	1											
C8X38.2	1	2	1										2	2
C8X38.3	1	2	2										2	3
C8X38.4	1	2	2										2	3
C8X38.5	1	2	2										2	3

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

1) Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2111, Cengage Learning, ISBN: 978-1111822705

ADDITIONAL RESOURCES:
1. Think Python. PDF is free.

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into**3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I &Unit – II** and **1** full question from **Unit – III.**

BIOFUEL ENGINEERING			
Course Code	**21BT8X40**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

***Prerequisites*:** Nil
***Co-requisites*:** Nil

Course Learning Objectives:
The objective of this course is
- To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.
- To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT – I

LIQUID BIOFUELS
Description and classification of Biofuels; Primary biomass: Plant materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products-wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).
Production of biodiesel: Sources of Oils – edible and non edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase mediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607).Algal Biodiesel production.
Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

15 Hours

UNIT – II

BIOHYDROGEN AND MICROBIAL FUEL CELLS
Enzymes involved in H_2 Production; Photobiological H_2 Production: Biophotolysis and Photofermentation; H_2 Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H_2 production, Carbon sources, Detection and Quantification of H_2. Reactors for biohydrogen production.
Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness; Advances in MFC.

15 Hours

UNIT – III

RECOVERY OF BIOLOGICAL CONVERSION PRODUCTS

Biogasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

9 Hours

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

1. Mark the significance of biofuels and raw materials and Identify suitable feedstock for production of biofuels.
2. Illustrate the production of liquid biofuels from various feed stocks.
3. Demonstrate production of biohydrogen using microbial sources.
4. Extend the concepts of microbial fuel cells towards development of specific application.
5. Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Mapping of POs &COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1		M							L			
CO2		M							L			
CO3		M							L			
CO4		M							L			
CO5		M							L			

REFERENCE BOOKS:

1. Drapcho, C. M., Nhuan, N. P. and Walker, T. H. *Biofuels Engineering Process Technology*, Mc Graw Hill Publishers, New York, 2108.
2. Jonathan R.M, *Biofuels – Methods and Protocols (Methods in Molecular Biology Series),* Humana Press, New York, 2109.
3. Olsson L. (Ed.), *Biofuels (Advances in Biochemical Engineering/Biotechnology Series*, Springer-Verlag Publishers, Berlin, 2107.
4. Glazer, A. and Nikaido, H. *Microbial Biotechnology – Fundamentals of Applied Microbiology*, 2 Ed., Cambridge University Press, 2107.
5. Godfrey Boyle (Ed). *Renewable Energy- Power for sustainable future*, 3rd Ed. Oxford. 2112.
6. Ramachandran, T. V. *Management of municipal solid waste*. Environmental Engineering Series. Teri Press, 2116.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

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SOLID WASTE MANAGEMENT			
Course Code	**21BT8X42**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

***Prerequisites*:** Nil
***Co-requisites*:** Nil

Course Learning Objectives:
The objective of this course is

1. To learn types of solid wastes, collection, treatment and disposal methods.
2. To understand various processing techniques and regulations of treatment and disposal.

UNIT – I

INTRODUCTION TO SOLID WASTES AND ITS SEGREGATION & TRANSPORTATION

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.

Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.

Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

15 Hours

UNIT – II

PROCESSING TECHNIQUES, RECOVERY OF RESOURCES AND WASTE DISPOSAL

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.

Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.

Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

16 Hours

UNIT – III

SOLID WASTE MANAGEMENT RULES AND PLANNING ISSUES

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2111.

Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

8 Hours

Course Outcomes:

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

1. Identify the sources, classification and characteristics of solid wastes
2. Develop insight into the collection, transfer, and transport of solid waste.
3. Apply waste processing techniques and recovery of resources from the waste.
4. Select the alternatives of solid waste disposals and its impacts.
5. Acquire knowledge about solid and hazardous waste management legislative rules.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L								L			
CO2	L	L				L	L		L			
CO3		M							L			
CO4		M				L	L		L			
CO5	L								L			L

REFERENCE BOOKS:

1. Tchobanaglous, G., Theisen, H. and Vigil, S. A. *Integrated Solid Waste Management,* McGraw – Hill. 1993.
2. Tchobanoglous, G., Thiesen, H., Ellasen, *Solid Waste Engineering Principles and Management*, McGraw – Hill, 1997.
3. Landrefh, R. E. And Rebers, P. A. Lewis, *Municipal Solid Wastes-Problems & Solutions*, 1997.
4. Bhide, A. D. and Sundaresan, B. B. *Solid Waste Management in Developing Countries*, Indian National Scientific Documentation Centre. New Delhi, 2100.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

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PCB DESIGN			
Course Code	**21EC8X59**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Pre-requisites:

Basic electrical and electronics engineering.

Course Learning Objectives:

1. To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2. To expose students to complete PCB Design & manufacturing process

List of Experiments

- Introduction to PCB design tool: building a schematic circuit and layout
- Exploring the PCB design tool by creating new components, using existing components and footprint, simulation features, Active & Passive Components
- Drawing a PCB layout in a single layer with constraints such as board area, track width, packages, via etc
- Creating a double layer PCB for a given schematic circuit
- Creating and using different component package types
- Fabrication of single and double layer PCB on a copper clad board using hatching/engraving technique.
- Handling PCB prototype machine using Mach3 CNC tool for the PCB prototype.

Detailed Course Plan

Lab 1
Introduction to PCB design tool : building a schematic circuit.

Lab 2
Creating Library & Components, using existing components and footprint, simulation features, Active & Passive Components.

Lab 3
Designing a single layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 4
Designing a double layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 5
Simulating digital and analog circuits for given test cases.

Lab 6
Handling programmable microcontroller circuit in the simulation environment of schematic editor .

Lab 7
Defining a footprint for a component in the PCB layout.

Lab 8
Fabrication of single layer PCB using PCB prototype machine – Generating bit filein Copper Cam tool.

Lab 9
Fabrication of single layer PCB using PCB prototype machine – Setting up Mach3 CNC tool.

Lab 10
Fabrication of double layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 11
Fabrication of double layer PCB using PCB prototype machine -Setting up Mach3 CNC tool.

Lab 12
Component placement and soldering.

Lab 13
Desoldering and testing.

Scheme of SEE Examination
It is a 3-Hour exam at the end of the semester where the student is to demonstrate the PCB designing process.

Sl.No	Activity	Max. Marks
1	Creating schematic for a given circuit diagram	15
2	PCB Layout design	21
3	Setting up fabrication	15
Total		**50**

Course Outcomes:
At the end of the course the student will be able to
1. Draw schematic circuit and create PCB layout for single or multilayer PCB
2. Fabricate single and double-layer PCB using Mach3Mill operated CNC machine.

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INNOVATION AND ENTREPRENEURSHIP			
Course Code	**21ME8X63**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Prerequisites:
The student must have learnt basics of Engineering concepts, applications and business as a whole.

Course Learning Objectives: This Course will enable students to,

1	Understand Technological Innovation
2	Understand Innovation management and the difference between Invention and Innovation.
3	Appreciate the importance of Innovation as management process and Innovation management techniques.
4	Define Innovation system and Understand the importance of Technology management and Transfer.
5	Identify Technological Entrepreneurship and its types and Understand the Institutional support provided for Entrepreneurs

UNIT – I

INTRODUCTION TO TECHNOLOGICAL INNOVATION **14 Hours**

Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.

INTRODUCTION TO INNOVATION MANAGEMENT

Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation.

INNOVATION AND COMPETITIVENESS

Case Study – Barriers for Innovation and Competitiveness.

UNIT – II	
INNOVATION AS A MANAGEMENT PROCESS	**14 Hours**
Activities to enhance companies capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	
INNOVATION SYSTEMS	
The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National.	
TECHNOLOGY MANAGEMENT AND TRANSFER	
Technology Transfer - Impacts of MNCs in technology transfer -	
UNIT – III	
INTRODUCTION TO TECHNOLOGICAL ENTREPRENEURSHIP	**11 Hours**
Types of Entrepreneurship: Mixed Entrepreneurship, Pure Entrepreneurship, Social Entrepreneurship, Collaborative Entrepreneurship, Internal Entrepreneurship, External Entrepreneurship - Sustainable Entrepreneurship -	
INSTITUTIONAL SUPPORT	
Business Incubator (Bi) - Determination of the Five Incubator Services - Incubation Centres in India – Atal Incubation Centre – Startup India - NSIC, KIADB, KSFC.	

Course Outcomes (CO):

At the end of the course the student will be able to,	
CO 1	Describe technological innovation and its key features for business.
CO 2	Describe innovation management and difference between invention and innovation.
CO 3	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
CO 4	Explain innovation system, technology management and transfer.
CO 5	Explain technological entrepreneurship and institutional support.

TEXTBOOK:

1	Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., "Innovation and Entrepreneurship Theory, Policy and Practice", Springer, 2115.

REFERENCE BOOKS:

1	Dick Whittington, "Digital Innovation and Entrepreneurship", Cambridge University Press, 2118.

Course Articulation Matrix:

Course Code / Name : 21ME8X63/ INNOVATION AND ENTREPRENEURSHIP														
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C-21ME8X63.1	3	2				1	1		1			1	3	1
C-21ME8X63.2	3	2				1	1		1			1	3	1
C-21ME8X63.3	2	2				1	1		1			1	3	1
C-21ME8X63.4	2	2				1	1		1			1	3	1
C-21ME8X63.5	3	2				1	1		1			1	3	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

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INTRODUCTION TO YOGA

Course Code:	**21HU8X68**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical Engineering

Course Learning Objectives:

1.	To give a brief history of the development of Yoga
2.	Identify names of different classical texts on Yoga
3.	To illustrate how Yoga is important for healthy living
4.	To explain the Asanas and other Yogic practices
5.	To explain, how Yoga practices can be applied for overall improvement

UNIT – I

Yoga: Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga.Yogic practices for healthy living. General guidelines for Yoga practices for the beginners: Asanas, Pranayama.	**09 Hours**
Classification of Yoga and Yogic texts:Yogasutra of Patanjali, Hatha yogic practices- Asanas, Pranayama, Dharana, Mudras and bandhas.	**07 Hours**

UNIT – II

Yoga and Health: Concept of health and Diseases-Yogic concept of body – pancakosaviveka, Concept of disease according to Yoga Vasistha.	**06 Hours**
Yogic concept of healthy living- rules & regulations, yogic diet, ahara, vihara. Yogic concept of holistic health.	**04 Hours**
Applied Yoga for elementary education:Personality development- physical level,mental level,emotional level. Specific guidelines and Yoga practices f**or** - Concentration development,Memory development	**04 Hours**

UNIT - III

Yoga and physical development: Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.	**05 Hours**
Specific guidelines and Yoga practices for **–** Flexibility, Stamina, Endurance (Surya Namaskara)	**04 Hours**

Course Outcomes: At the end of the course student will be able to

1.	Understand a brief history of the development of Yoga
2.	Know important practices and principles of Yoga
3.	Explain how Yoga is important for healthy living
4.	Practice meditation to improvement of concentration etc.
5.	Have knowledge about specific guidelines of yoga practices

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1						1			1			1		
CO2						1			1			3		
CO3						2			1			3		
CO4						3			2			3		
CO5						2			2			3		

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	B.K.S. Iyengar, "Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority", Thorsons publisher 2116.
2.	MakarandMadhukar Gore, "Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices", MotilalBanarsidass Publishers; 6 edition (2116).
3.	Swami SatyanandaSaraswati, "Asana, Pranayama, Mudra and Bandha: 1", Yoga Publications Trust.
REFERENCE BOOKS:	
1.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice by Ann Swanson
2.	Yoga for Everyone : 50 Poses For Every Type of Body by Dianne Bondy
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2.	https://youtu.be/FMf3bPS5wDs

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OVERVIEW OF INDIAN CULTURE AND ART

Course Code	**21HU8X70**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Humanities

Course Learning Objectives:

1.	To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.
2.	To understand the local culture and its vibrancies.
3.	To develop awareness about Indian Society, Culture and Arts under Western rule.
4.	To comprehend different dimension and aspects of the Indian culture and arts.
5.	To appreciate cultural performances in India.

UNIT - I

Knowing Culture What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture	7
Influence of Culture Relationship of Culture with: Language, Religion and History, Gender	7

UNIT - II

Media and Culture Role of News Papers, Indian Cinema, Music, Advertisements	7
Languages, Literature and Culture Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature	7

UNIT - III	
Arts and Culture Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.	7
(Self-study Component) **Contribution of Indian History to Culture** Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning. Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages. Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.	4

Course Outcomes: At the end of the course student will be able to

1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.
2.	Appreciate their own local culture from an academic perspective.
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1		1				3		3	3	1		3		
CO2				2		3		2	3	3		3		
CO3						3		1				1		
CO4						3		2	1	2		3		
CO5						3		3	3	3		2		

1: Low 2: Medium 3: High

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PRINCIPLES TO PHYSICAL EDUCATION			
Course Code	**21HU8X71**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Appreciate and understand the value of physical education and its relationship to a healthy active lifestyle.
2. Work to their optimal level of physical fitness.
3. Show knowledge and understanding in a variety of physical activities and evaluate their own and others' performances.

UNIT - I

History of Physical Education - Olympic games, Modern Olympic games, Olympic Ideals & Objectives, Olympic Symbols, Olympic Flag, Olympic Emblem, Olympic Motto, Olympic Flame, Asian games
International Olympic Committee (IOC), Indian Olympic Association (IOA)
Sports awards - Eligibility, Objectives & Criteria
Yoga - Meaning and Importance
World Health organization (WHO)

10 Hours

UNIT – II

Concept of Health - Meaning of Health, Health Definition, Factors Affecting Health, Qualities of Healthy Person. Health Hazards of College Students, Physical Fitness and Exercises.
Food and Nutrition -Food & Nutrition Defined, Nutrients and their Functions - i) Proteins ii) Carbohydrates iii) Fats iv) Vitamins
Balanced Diet & Malnutrition

Health Education - Meaning of Health Education, Health Education Defined, Scope of Health Education, Importance of Health Education.
Posture - Concept of Posture, Correct Postures, Common Postural Defects
First Aid - First Aid Defined, Need and importance of First Aid, The Requisites of FirstAid, Scope of FirstAid, Qualities of a First Aider, Fundamental Principles to be followed and the Duties to be performed by the First Aider, First Aid in Different Cases.
Physical Education - Concept of Physical Education, Physical Education Defined, Importance of Physical Education, Scope of Physical Education, Aims and Objectives of Physical Education.
Teaching Aid in Physical Education
Competition - Introduction, Types of competition, Knock out, League or Round Robin Tournament.

12 Hours

UNIT – III

Training in Sports – Meaning, Principles, Warming Up & Limbering Down
Importance of Anatomy and Physiology in Physical Education, Oxygen Debt and Second wind
Leadership and Supervision – Leadership, Qualities of a good leader in Physical Education, Types of Leadership in Physical Education - 1. Teacher Leadership 2. Student Leadership.
Measurement & specification of various playing fields – Cricket, Volley Ball, Basket Ball, Badminton, Ball Badminton, Foot Ball, Hand Ball & their basic playing skills.

16 Hours

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

1. Demonstrate an understanding of the principles and concepts related to a variety of physical activities.
2. Apply health and fitness principles effectively through a variety of physical activities.
3. Support and encourage others (towards a positive working environment).
4. Show self-motivation, organization and responsible behavior.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1						3			2	1		1		
CO2						3			2	1		1		
CO3						3			2	1		1		
CO4						3			2	1		1		
CO5						3			2	1		1		

1: Low 2: Medium 3: High

TEXT AND REFERENCE BOOKS:

1. A. K. Uppal, “Physical Education and Health”
2. M. L. Kamlesh, “Fundamental Elements of physical Education”,
3. Swami Ramdev, “Yog its philosophy and practice”, Divya Prakashan
4. V. K. Sharma, “Health and Physical Education”

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INTRODUCTION TO JAPANESE LANGUAGE

Course Code	**21HU8X72**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department:

Course Objectives:

1.	Have basic spoken communication skills
2.	Write Simple Sentences
3.	Listen and comprehend basic Japanese spoken Japanese
4.	Read and understand basic Japanese characters including Kanji

UNIT - I

(Lessons 1-6) **Grammar –** Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense **Vocabulary –** Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips	13

UNIT - II

(Lessons 7-13) Communication skills – Time, Addective, Seasons, Conversation, Q&A Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc**.**	13

UNIT - III

(Lessons 14-21) Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji Characters, and sentence making, Video Clips	13

Course Outcomes: At the end of the course student will be able to

1.	Understand Simple words, expressions and sentences, spoken slowly and distinctly
2.	Speak slowly and distinctly to comprehend
3.	Read and Understand common words and sentences
4.	Ask Basic questions and speak in simple sentences
5.	Write Hiragana/Katakana and Kanji (121) characters.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
CO1						3			2	1		1		
CO2						3			2	1		1		
CO3						3			2	1		1		
CO4						3			2	1		1		
CO5						3			2	1		1		

1: Low 2: Medium 3: High

INTRODUCTION TO GERMAN LANGUAGE			
Course Code	**21HU8X74**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Mechanical

Course Objectives:

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

UNIT - I

Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischenKarte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vierJahreszeiten, die Jahre Mir gehtes gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings), Wieschreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles: the ┐ der/die/das; a/an ┐ ein/eine Die vierFälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv(Not in level A-1) Deklination des bestimmtenArtikels der/die/das Deklination des unbestimmtenArtikelsein/eine (Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified) Deklination von Substantiven (Declension of nouns) (Singular and Plural) (German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects). Nominativ und Akkusativ(nominative and accusative cases) The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive. (Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs) Negation „kein/e/er "(negation with „kein/e/er ") (Singular und Plural) The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k" at the beginning of the declined form of ein/eine/ein. Peter siehteinHaus. ┐ Negation ┐ Peter siehtkeinHaus. (Peter sees a house. ┐ negation ┐ Peter does not see a house.) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	13

UNIT - II

Dativ (the dative) (You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask "(To) whom?") Der Plural (the plural)	13

There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular. Das Personalpronomen (the personal pronoun) The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced. Die Formen des Personal pronomenimNominativ (The nominative forms of the personal pronoun): Präpositionen (prepositions) German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But there are also prepositions which can be followed by both. In this case, the question "Where(to)?" (accusative) or "Where?" (dative) determines the case of the object. PräpositionenmitAkkusativ und Dativ (Prepositions with accusative and dative) 1. PräpositionenmitAkkusativ (prepositions with accusative) 2. PräpositionenmitDativ (prepositions with dative) 3. PräpositionenmitAkkusativoderDativ (prepositions with accusative or dative) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	
UNIT - III	
Konjugation von VerbenimPräsens (Conjugation of verbs in present tense) Verbs are conjugated by attaching certain endings, depending on the person and number of the subject. Trennbare und untrennbareVerben (separable and inseparable verbs) Verbs with prefixes are dinstinguished between separable and inseparable verbs. The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be-kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen 1. TrennbareVerben (separable verbs) 2. UntrennbareVerben (inseparable verbs) Konjugation von VerbenimPerfekt (Conjugation of verbs in present perfect) The present perfect (Perfekt) describes something which happened in the past and is especially used in spoken German. It is formed with the present tense form of „haben" or „sein" and the past participle of the main verb. 1. Die Bildung des Partizips (the formation of the past participle) 2. Die Bildung des Perfektsmit „haben" und „sein" (the formation of the present perfect with „haben" and „sein") Modalverben (modal verbs) A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. While the main verb remains in the infinitive, the modal verb is conjugated. In German, there are 7 modal verbs: können (can/be able), dürfen (may/be allowed), wollen (want), müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like) 1. Konjugation der Modalverben (Conjugation of the modal verbs) 2. Stellung des ModalverbsimSatz (Position of the modal verb within a sentence) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	13

Course Outcomes: At the end of the course student will be able to

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1502-1.1						3			2	1		1		
HU1502-1.2						3			2	1		1		
HU1502-1.3						3			2	1		1		
HU1502-1.4						3			2	1		1		
HU1502-1.5						3			2	1		1		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, UnterrichtswerkfuerErwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989
2.	Paul Coggle and HeinerSchenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden& Stoughton Educational, UK, 2101
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2111

REFERENCE MATERIALS:

1.	Deutsche SprachlehrefürAusländer.
2.	ThemenAktuell (Text and workbook).
3.	Deutsch alsFremdsprache 1A.
4.	Tangram Aktuell 1A/1B (Text and workbook).
5.	Wherever required the Videos/Audios are also played in the class room sessions

E-RESOURCES:

1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. MilindBrahme | IIT Madras
2.	https://www.traingerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online

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SUSTAINABLE DEVELOPMENT GOALS			
Course code	**21ME8X75**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

Sustainable Development Goals is a 2116 United Nations officially released Agendas for Sustainable approach environmental integrity, economic viability and a just society for present and future generations. It aims to provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Learn more and take action. This SDG program is organized in such a way to be research-led, applied interdisciplinary program that considers sustainability in both developed and developing societies, and addresses critical global challenges put forth by UN.

UNIT – I

The origin, development and idea of the SDGs

History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals?

SDGs and Society: Ensuring resilience and primary needs in society

In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education

13 Hours

UNIT – II

SDGs and Society: Strengthening Institutions for Sustainability

In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions

SDGs and the Economy: Shaping a Sustainable Economy

In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption

13 Hours

UNIT – III

SDGs and the Biosphere: Development within Planetary Boundaries

In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land

Realizing the SDGs: Implementation through Global Partnerships

In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.

13 Hours

Course Outcomes:

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

CO 1	Summarize the UN's Sustainable Development Goals and how their aims, methodology and perspectives.
CO 2	Analyze the major issues affecting sustainable development and how sustainable development can be achieved in practice.
CO 3	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
CO 4	Evaluate the implications of overuse of resources, population growth and economic growth and sustainability & Explore the challenges the society faces in making transition to renewable resource use
CO 5	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

TEXTBOOKS:

1. Sachs, Jeffrey D. The age of sustainable development. Columbia University Press, 2115
2. Gagnon, B., Leduc, R., and Savard, L., Sustainable development in engineering: a review of principles and definition of a conceptual framework. Cahier de recherche / Working Paper 08-18, 2108.
3. Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge, 2119.
4. Sustainability: A Comprehensive Foundation by Tom Thesis and JonathanTomkin, Editors.

REFERENCE BOOKS:

1. Elliott, Jennifer. An introduction to sustainable development. Routledge, 2112.
2. Day, G.S., and P.J.H. Schoemaker (2111), Innovating in uncertain markets: 10 lessons for green technologies, MIT Sloan Management Review, 52.4: 37-45.

MOOC Resources:

1. https://www.un.org/sustainabledevelopment/poverty/

Course Articulation Matrix

Course Code / Name : 21ME/ SUSTAINABLE DEVELOPMENT GOALS														
Course Outcomes (CO)	**Program Outcomes (PO)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	**1**	**2**	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**1**		**2**	**1**	**1**
2	**2**	**2**	**1**	**1**	**1**	**3**	**3**	**2**	**1**	**1**		**1**	**1**	**1**
3	**3**	**2**	**2**	**1**	**1**	**3**	**3**	**2**	**3**	**1**		**1**	**1**	**2**
4	**3**	**2**	**3**	**1**	**1**	**3**	**3**	**2**	**1**	**1**		**1**	**3**	**2**
5	**1**	**2**	**2**	**1**	**1**	**3**	**3**	**2**	**2**	**2**		**1**	**1**	**1**

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi &contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I**&**Unit – II** and **1** full question from **Unit – III**.

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WEB TECHNOLOGIES			
Course Code	**21IS8X76**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives (CLOs):

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

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Illustrate the Database connectivity using PHP
- Examine JavaScript frameworks such as jQuery

UNIT - I

Introduction to HTML- Html tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

15 Hours

UNIT - II

Client side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

15 Hours

UNIT – III

PHP Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X52.1	Adapt HTML and CSS syntax and semantics to build web pages	L2
C8X52.2	Construct and visually format tables and forms using HTML and CSS	L3
C8X52.3	Experiment with the usage of Event handling and Form validation using Java script	L3
C8X52.4	Understand the principles of object oriented development using PHP and Database concepts	L2
C8X52.5	Inspect JavaScript frameworks like jQuery whichfacilitates developer to focus on core features.	L2

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,3	1.3.1,1.4.1,3.2.1,	L2
CO2	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L3
CO3	1,3	1.4.1,3.2.1,3.2.2,3.4.3	L3
CO4	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L2
CO5	1,3	1.4.1,3.2.1,3.2.2	L2

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X52.1	1	2		2								1	2	
C8X52.2	1			2								1	2	
C8X52.3	1	2		2	3							1	2	
C8X52.4	1	2		2	3							1	2	
C8X52.5	1			2	3							1	2	

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)

E RESOURCES:

1. nptel.ac.in/courses/106105084/11

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into**3 Units** as per the syllabus& contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I &Unit – II** and **1** full question from **Unit – III.**

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PROGRAMMING IN JAVA			
Course Code	**21CS8X77**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable students to:

1. Learn fundamental features of object oriented language and JAVA programming constructs.
2. Develop and run simple Java programs using OOPS concepts of java
3. Create multi-threaded programs and event driven Graphical User Interface (GUI) programming using swing package.

UNIT – I

Introduction to Java: Java's magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Classes, Inheritance: Classes fundamentals; Declaring objects; Call by value and Call by Reference, array of objects, Constructors, this keyword, and usage of static keyword.
Inheritance: inheritance basics, using super, creating multi-level hierarchy, method Overriding, abstract classes, final classes.

15 Hours

UNIT – II

Exception handling, packages and interfaces: Exception handling in Java, use of try, catch blocks, multiple catch blocks, finally block, use of throw and throws clauses, creating custom exceptions. Packages, Access Protection, Importing Packages, Interfaces. IO Streams for file handling.

Multi-Threaded Programming:
What are threads? How to make the classes threadable; Extending threads; Implementing runnable interface; creating multiple threads, join and is Alive methods of Thread class, Thread Synchronization; achieving thread synchronization among multiple threads. Thread priorities, methods to get and set thread priority

15 Hours

UNIT – III

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model;

Swings:
The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

09 Hours

Course Outcomes:
Upon completion of this course, students will be able to:

1. Apply the object-oriented concepts to solve real world problems using JAVA programming features
2. Illustrate the basic constructs and object orients features of the Java language
3. Design a multi-threaded program using Java with exception handling
4. Develop Java programs that includes packages and interfaces and preform file operations in Java
5. Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings

Table-2: Mapping Levels of COs to POs / PSOs															
COs	**Program Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3			2				1	1		1	2	3	
CO2	1	2	2		1				1	1		1		3	
CO3	1	2	3		1				1	1		1		3	2
CO4	1	2	3		1				1	1		1	2	3	3
CO5	1	2	3		1				1	1		1		3	3

Graduate Attributes (GA)

This course will map the following GA as per NBA:

1. Design/Development of Solutions
2. Problem Analysis
3. Modern tool usage

TEXTBOOK:

1. Herbert Scheldt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2107. (Chapters 2-11, 22-24, 29,30)

REFERENCE BOOKS:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2108, ISBN:9788131721806
2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with Java, Tata McGraw Hill education private limited.
3. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

E-Books / Online Resources:

1. Online course material by Oracle :
   http://docs.oracle.com/javase/tutorial/index.html
2. https://www.udemy.com/courses/search/?q=java&price=price-free&view=grid

MOOC:

1. Oracle: *www.oracle.com/events/global/en/java.../java-a-beginners-guide-1721064.pdf*
2. NPTEL:*www.nptelvideos.com/java/java_video_lectures_tutorials.php*

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into**3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III.**

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DATA STRUCTURES AND ALGORITHMS			
Course Code	**21CS8X78**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable students to:

1. **Outline** the concepts of data structures, its types, structures and pointers.
2. **Understand** linear data structures, namely, stack, queue, singly linked list and doubly linked list.
3. **Analyze** nonlineardata structures, namely, binary tree and graphs.
4. **Analyze** the non-recursive and recursive algorithms and to represent Efficiency of these algorithms in terms of the standard Asymptotic notations.
5. **Explain** the various algorithm design techniques and apply them to solve various real world problems.

UNIT – I

INTRODUCTION:

Data Structure, Classification (Primitive and non-primitive), data structure operations.

POINTERS:

Definition and Concepts, Accessing variables through pointers, Arrays and pointers. Structures, pointers to structures.

LINEAR DATA STRUCTURES – STACKS:

Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks using C functions (Push(), Pop(), IsStackFull(), IsStackEmpty()).

LINEAR DATA STRUCTURES – QUEUES:

Introduction and Definition Representation of Queue: Array and Structure representation of queue, Operations on Ordinary Queue using C functions (Insert(), Remove(), IsQueueFul(), IsQueueEmpty())

15 Hours

UNIT – II

LINEAR DATA STRUCTURES - SINGLY LINKED LISTS:

Dynamic Memory allocation functions. Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List using C functions (Insert node at front, Remove a node from front, display singly linked list).

LINEAR DATA STRUCTURES - DOUBLY LINKED LISTS:

Doubly Linked List: Representation. (Operations not included).

NONLINEAR DATA STRUCTURES – BINARY TREES:

Binary Trees: Properties, Linked representation of Binary Tree, Binary Tree Traversals, Introduction to Binary Search Tree.

INTRODUCTION TO ALGORITHMS:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving, understanding and representing graphs using adjacency matrix and linked list.

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms.

15 Hours

UNIT – III

DECREASE & CONQUER:

Concept of Decrease and Conquer, Graph traversal algorithms - Depth First Search, Breadth First Search.

DYNAMIC PROGRAMMING:

Concept of Dynamic Programming, Computing a Binomial Coefficient.

GREEDY METHOD:

Concept of Greedy technique, Prims algorithm.

BACKTRACKING:

Concept of Backtracking technique, N-Queens problem.

9 Hours

Course Outcomes:

1. **Acquire** the fundamental knowledge of various types of data structures and pointers using that knowledge, analyze and design the programs using pointers
2. **Apply** the fundamental programming knowledge of data structures to analyze and design linear data structures, namely, stack, queue, singly linked list and doubly linked list and use them for solving problems.
3. **Implement** and apply the concept of binary trees and graph data structures and also understand their traversals.
4. **Analyze** non-recursive or recursive algorithm and to represent in terms of standard Asymptotic notations.
5. **Apply** Divide and Conquer, Decrease and Conquer, Dynamic programming, Greedy, and Backtracking algorithm design techniques to solve real time problems.

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2						1				1	3		
CO2	3	1	2					1				1	3		
CO3	3	2						1				1	3		
CO4	2	3												2	
CO5	2	2	3	2	3				1			1		3	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXTBOOKS:

1. Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, "Data Structures using C", Pearson Education/PHI, 2106.
2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2107.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2114.
2. Seymour Lipschutz, "Data Structures, Schaum's Outlines", Revised 1st edition, McGraw Hill, 2114.
3. Thomas H. Cormen, Charles E.Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, PHI, 2106.

MOOCs:

1. Introduction to Data Structures by edx , URL: https://www.edx.org/course/
2. Advance Data Structures by MIT OCW , URL: https://www.mooclab.club/
3. Data Structure by Harvard Extension School, URL: http://www.extension.harvard.
4. http://nptel.ac.in/courses/106101060/

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into**3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit –III**

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ELECTRIC VEHICLE TECHNOLOGY			
Course Code	**21EE8X79**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Eligible Students: For all engineering stream except E&E Engineering

Course Learning Objectives:

1. To Understand the fundamental laws and vehicle mechanics.
2. To Understand working of Electric Vehicles and recent trends.
3. Ability to analyze different power converter topology used for electric vehicle application.
4. Ability to develop the electric propulsion unit and its control for application of electric vehicles.

UNIT – I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **14 Hours**

UNIT – II

Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super capacitors.

Electric Propulsion:

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. **16 Hours**

UNIT – III

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

9 Hours

Course Outcomes:

At the end of the course student will be able to

1. Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
2. Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3. Model batteries, Fuel cells, PEMFC and super capacitors.
4. Analyze DC and AC drive topologies used for electric vehicle application.
5. Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes & PSO												
Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
21EE8X .1	2	3										
21EE 8X .2	1	2	3									
21EE 8X .3	1	2	3									
21EE 8X .4	1	2	3									
21EE 8X .5	1	2	2									

1: Low 2: Medium 3: High

SEE QUESTION PAPER PATTERN:

- There will be **8** questions of **21** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit – I** & **Unit – II** and **1** full question from **Unit – III**.

TEXTBOOKS:

1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2103
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2105

REFERENCE BOOKS:

1. Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2113.
2. Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, OXFORD University, 2101
3. Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2101

E-Books / MOOC:

1. Introduction to Mechanics | Coursera
2. NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
3. Electric Vehicles - Part 1 - Course (nptel.ac.in)
4. Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
5. NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
6. Electric Cars: Technology | My MOOC (my-mooc.com)

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NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES

Course Code	**21HU8X81**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Chemistry

Course Learning Objectives:

1.	To create evolved youth, who will be equipped to contribute in the development of the nation.
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of a smart soldier and to inculcate the sense of authority by commanding the troop under him/her.
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.
4.	To understand and develop life skills, soft skills and to improve the emotional quotient of the student.
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values

UNIT – I

NCC: Aims, Objectives and Organization NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.	7
Personality Development Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.	7

UNIT – II

Naval Communication and Seamanship Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work. Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.	8
Disaster management and environmental awareness Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities. Dos and Don'ts, Fire services and Firefighting, Environmental Awareness and Conservation.	8

UNIT – III

Naval Orientation Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy. Border and Coastal areas: Security Challenges & role of cadets in Border management	9

Course Outcomes: At the end of the course student will be able to

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1505-1.1						3	3	1						
HU1505-1.2						3	3							
HU1505-1.3									1					

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Cadets Handbook, R.K. Guptha, Ramesh Publishing House, New Delhi.

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FUNDAMENTALS OF IMAGE PROCESSING – A PRACTICAL APPROACH			
Course Code	**21EC8X82**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:1**	**SEE Marks**	**50**
Total Hours	**26:0:26**	**Credits**	**03**

Course Learning Objectives:

This course will enable the students to

1. Understand basic operations on images.
2. Understand the concepts of colour models.
3. Explain image enhancement techniques.
4. Perform morphological operations on images.
5. Perform thresholding operation for image segmentation.

Software Tool Required: MATLAB

Image Fundamentals: Description of Image and Basic operations: Image Brightening, Darkening, Addition, Subtraction, Multiplication and logic operations,Binary and Gray scale images, Color Fundamentals.

Image Enhancement Techniques: Concept & Importance of Histogram, Basic gray level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening filters.

Morphological Operations and Thresholding: Introduction, Erosion and Dilation, Opening and Closing, Thresholding, segmentation methods.

26 Hours

List of Experiments:

1. Introduction to MATLAB.
2. Reading and analyzing images.
3. Image Conversions.
4. Basic operations on images.
5. Basic Arithmetic operations on images- Addition, Subtraction and Multiplication.

6. Exploring Image manipulation operations.
7. Histogram processing.
8. Demonstration of Effects of Filters on images-Smoothing.
9. Demonstration of Effects of Filters on images-Sharpening.
10. Exploring different color models.
11. Demonstration of Morphological Operations.
12. Demonstration of thresholding operations.
13. Exploring image segmentation methods.

Scheme of SEE
Laboratory based evaluation

Course Outcomes:
At the end of the course the student will be able to

1. Demonstrate the understanding of basic operations on images
2. Apply image enhancement methods
3. Perform segmentation operation

Mapping of PO's/ PSO's & CO's:

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

3 – High **2 – Medium** **1 - Low**

TEXTBOOKS:

1. R. C. Gonzalez and R. E Woods, "**Digital Image Processing**", Pearson education (Asia)/Prentice Hall of India, 3rd Edition, 2109.
2. R. C. Gonzalez and R. E Woods, "**Digital Image Processing Using MATLAB**", Pearson education (Asia)/Prentice Hall of India, 2nd Edition, 2111.
3. 1.S. Jayaraman, S Esskairajan "**Digital Image Processing**", illustrated, Tata McGraw-Hill Education,2111.

NPTEL/ MOOC Link:

1. https://nptel.ac.in/courses/117105135/
2. https://nptel.ac.in/courses/117105079

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INTRODUCTION TO YAKSHAGANA			
Course Code	**21HU8X86**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning objectives:

The course will enable the students to:

1. Gain basic understanding of Thenku Thittu Yakshagana.
2. Perform basic movements.
3. Understand speech/dialogue, rhythm, Entry and improvisation skills.

UNIT – I

Introduction: Meaning and features, Origin and development, Difference between Thenkuthittu
and Badaguthittu yakshagana. A brief introduction to Thenkuthittu Yakshagana.
Thalas-Aadi thala, yeka thala, Kore thala and Asta Thala with biditha and mukthya- Practice.
Dhingina – Practice…….

14 Hours

UNIT – II

Thalas- Rupaka Thala, Trivide Thala, Jampe thala etc. with biditha and mukthaya.
Dhigina – Practice
Rangasthala Pravesha steps and Eripada ettugade steps.
Revision of all Thalas. ……

14 Hours

UNIT – III

Yakshagana Prasanga Practice- Abhinaya and presentation……..

11 Hours

Performance: The final part of the course is the performance. A Prasanga will be chosen and taught
to the participants and they will perform the same in front of a live audience.

REFERENCE BOOKS:

1. Arthayana: Yakshagana Talamaddale Arthagarike: Ondu Vishleshane: Dr.Ramananda Banari.
2. Yaksha Naatyanjali Thenkuthittu- Sampadaka: Sathish Madivala, Karkala.
3. Yakshagna Shikshana Patya Pustka- Prathamika vibhaga (Karnatka Patya pusthaka sangha-
   Bengaluru)
4. Koralara: YakshaganaVimarsha Sankalana: Dr.M. Prabhakara Joshi
5. Vaagartha Gawrava: (Dr. Joshi Abhinandana Guchaha): Ga. Na. Bhat

MARKETING MANAGEMENT			
Course Code	**21ME8X88**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Understand and learn the marketing concepts and their application to profit-orientedand non-profit oriented organizations.
2. Able to apply the marketing concepts to analyze the buying behavior & marketing segments to solve these problems.
3. Understand and learn the need for a customer orientation in product pricing & marketing research in the competitive global business environment;
4. Able to develop an understanding and acquiring skills in how to successfully design and implement marketing plans and strategies.
5. Understand and learn the concept of sales, advertising &distribution of marketing mix and its application in traditional and novel environments characterized by emerging information technologies.

UNIT - I

BASICS

Definition, Marketing Process, Dynamics, Needs, Wants & Demands, Marketing Concepts, Environment, mix, types, philosophies, Selling Vs. Marketing, organization, Industrial Vs. Consumer Marketing, Consumer goods, Industrial goods, Product hierarchy.

8 Hours

BUYING BEHAVIOUR & MARKET SEGMENTATION

Cultural, Demographic factors, Motives, types, Buying decisions, segmentation factors, Demographic, Psychographic & Geographic Segmentation, Process, Patterns.

8 Hours

UNIT - II

PRODUCT PRICING & MARKETING RESEARCH

Objectives, pricing, Decisions and Pricing methods, Pricing Management. Introduction,Uses, process of Marketing Research.

8 Hours

MARKETING PLANNING & STRATEGY FORMULATION

Components of a marketing plan, strategy formulations and the marketing process, implementation, Portfolio analysis, BCG, GEC grids.

8 Hours

UNIT - III

ADVERTISING, SALES PROMOTION & DISTRIBUTION

Characteristics, Impact, goals, types, Sales promotion-Point of Purchase, Unique Selling proposition.

Characteristics, Wholesaling, Retailing, channel design, logistics, Modern Trends inretailing.

7 Hours

Course Outcomes (CO):

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

CO1	Explain the basic marketing concepts
CO 2	Interpret the buying behaviour of customers and role of marketing segments
CO3	Explain the role of product pricing and marketing research in the competitive global business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve thegoals of marketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House,New Delhi, 1999

REFERENCE BOOKS:

1. Philip Kolter, " Marketing Management: Analysis, Planning, Implementation and Control ", 1998.
2. Green Paul.E. and Donald Tull, " Research for Marketing Decisions ", 1975.
3. Ramaswamy.V.S. and S.Namakumari, " Marketing Environment: Planning, Implementation and Control the Indian Context ", 1990
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing Strategies.

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