B. Tech. (Artificial Intelligence and Machine Learning)

2018 Regulations, Curriculum & Syllabi

Academic Year: 2021 – 2022 Onwards

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

SATHYAMANGALAM - 638401 ERODE DISTRICT TAMILNADU INDIA

Ph : 04295-226000/221289 Fax : 04295-226666 E-mail : stayahead@bitsathy.ac.in Web : www.bitsathy.ac.in

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY, SATHYAMANGALAM

REGULATIONS 2018

(CHOICE BASED CREDIT SYSTEM)

(Common to all B.E./B.Tech. Degree Programmes)

Regulation 2018 has been prepared in accordance with the guidelines given by the University Grants Commission, All India Council for Technical Education and affiliating University incorporating the features of the Choice Based Credit System (CBCS). The Regulation 2018 is applicable to the candidates admitted to the Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) Degree Programmes of the Institution in the academic year 2018-2019 for Regular admission (Academic year 2019-2020 for Lateral Entry) and subsequently.

The regulations hereunder are subjected to amendments as may be decided by the Academic Council of the Institution from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already in the middle of the programme) as may be decided by the Academic Council.

1. ADMISSION

Candidate, seeking admission to the B.E./B.Tech. Programme, shall satisfy the conditions of admission prescribed by the Directorate of Technical Education and Anna University, Chennai as given below.

Regular Admission

Candidates, for admission to the first semester of the eight semesters B.E./B.Tech. Degree Programmes, shall be required to have passed:

- Higher Secondary Examination (10 +2) of curriculum (Regular Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics, and Chemistry as three of the four subjects of the study prescribed under Part-III or any other examinations of any Board or University or authority accepted by the Syndicate of the University / Directorate of Technical Education (DoTE), Chennai as equivalent thereto.

(or)

- Should have passed Higher Secondary Examination of Vocational Stream (Engineering/Technology), prescribed by the Government of Tamil Nadu.

Lateral Entry Admission

The candidates who possess Diploma in Engineering / Technology awarded by the State Board of Technical Education and Training, Tamil Nadu or its equivalent are eligible to apply for Lateral Entry admission to the third semester of B.E. / B.Tech. Programmes in the branch of study as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time.

(or)

The candidates who possess the Bachelor Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject in B.Sc. is eligible to apply for Lateral Entry admission to the third semester of B.E./B.Tech. Programmes, as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time. Such candidates shall undergo two additional Engineering subject(s) one each in third and fourth semesters, as bridge courses.

2. PROGRAMMES OFFERED

A candidate may be offered admission to any one of the programmes offered by the Institution for the candidates specified in Clause 1.1 and as per the eligibility criteria of DoTE for the candidates under Clause 1.2 from the list given below:

B. E. Programmes

i. Aeronautical Engineering
ii. Agricultural Engineering
iii. Automobile Engineering
iv. Civil Engineering
v. Computer Science and Engineering
vi. Electronics and Communication Engineering
vii. Electrical and Electronics Engineering
viii. Electronics and Instrumentation Engineering
ix. Mechanical Engineering
x. Mechatronics

B. Tech. Programmes

i. Biotechnology
ii. Fashion Technology
iii. Food Technology
iv. Information Technology
v. Textile Technology

3. STRUCTURE OF THE PROGRAMME

Every programme shall have a distinct curriculum with syllabi consisting of theory, laboratory, project, soft-skills and personality development courses, as prescribed by the respective Boards of Studies, broadly categorized under:

(i) **Basic Science** courses including Mathematics, Physics, Chemistry and further specialization in these subjects

(ii) **Basic Engineering** courses including Engineering Graphics, Engineering Practices, Basics of Electrical, Electronics, Civil, Mechanical Engineering, Engineering Mechanics and Computer Programming.

(iii) **Humanities and Social Science** courses including Language Courses, Management Courses, Soft Skills and Professional Ethics.

(iv) **Professional Courses** include Discipline Core Courses, Professional Electives, and Open Electives.

(v) **Employability Enhancement Courses (EEC)** includes Project Work and /or Internship, Seminar, Industrial /Practical Training, Value Added and Certificate Courses.

The medium of instruction is English for all the Courses, Examinations, Seminar Presentation, Projects and any other courses that a student registers for.

Each course is normally assigned a certain number of credits based on the following

Contact period per week	Credits
1 Lecture / 1 Tutorial period	1
2 laboratory Periods (Laboratory / Seminar / Project Work / etc.)	1

All the B.E. / B.Tech. Students will study Communicative English I during the First Semester. In the Second Semester, they will be divided into two streams based on their English language proficiency assessed in the Continuous Assessment during semester I, in which the upper segment will be provided an option to enroll and study Communicative English II / German / Japanese / French / Chinese / Hindi while the lower segment will study Communicative English II.

Every student shall be required to opt for **Nine** electives from the list of electives. Students can opt for the electives (Core / Professional) from his / her own discipline courses, during V to VIII Semesters, if he/she satisfies the prerequisite for that particular course.

However, out of nine electives, every student shall be required to opt for, a minimum of one and subject to a maximum of three courses as open elective from the list of electives of the branch / branches other than his / her branch of specialisation, if he/she satisfies the prerequisite for that particular course.

Students can also opt for **one-credit courses** of 15 to 20 hour duration, which will be offered by the experts from the industry on specialised topics. Students can opt for such **one-credit courses** during the semesters I to VII as and when these courses are offered. A student will also be permitted to register the **one-credit courses** offered by other Departments, provided the student has fulfilled the necessary pre-requisites or the courses that may not require any pre-requisites. Under no circumstances, the same one credit course shall be repeated in subsequent semesters in any Department / Centre for the same batch of the students and a maximum batch size for a given course shall not exceed 40. In case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) of students.

On successful completion of one credit courses, Credits will be indicated in the Grade Sheet, but will not be considered for computing the Cumulative Grade Point Average (CGPA). However, if a student wishes to avail the exemption from any one of the Electives (other than open elective) of the Semester VIII, he / she can do so by exercising his / her option in writing to the respective Head of the Department during the beginning of the VIII Semester, following the equivalence norm, that one **regular elective** (in the **VIII Semester**) is equivalent to **three one-credit courses** completed by the student during the previous semesters, IV to VII. Details of the one credit courses offered by the department shall be forwarded to the Office of the Controller of Examinations. However one credit courses completed during I to III semesters shall be maintained in the Grade sheet as “Additional credits earned” (not considered for the computation of SGPA/CGPA).

A student can register for Self-Study Elective(s) over and above the electives from any branch of Engineering / Technology at the rate of one per semester starting from V semester onwards provided he/she maintains a Cumulative Grade Point Average (CGPA) of 8.50 or above till the previous semesters with no current arrears. Credits will be indicated for such courses in the grade sheets (additional credits) but will not be considered for computing the CGPA.

A Student may be permitted to credit only one online course with the approval of the Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of three credits. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by the CoE. A student can get exemption for a maximum of 3 credits during the entire programme (in lieu of Core elective or Open elective). The Head of the Department may identify a faculty member as coordinator for the course, who is responsible for the evaluation process. The course shall be evaluated through the End Semester Examination only. The evaluation methodology may be decided by the course faculty coordinator.

Industrial Training / Internship

The students may undergo Industrial training / Internship optionally for a period as specified in the table during summer / winter vacation and the credits earned will be indicated in the Mark Sheet. If the student earns three credits in Industrial Training / Internship, the student may drop one Professional Elective. In such cases, Industrial Training / Internship need to be undergone continuously from one organization only. However, if the number of credits earned is 1 or 2, these credits shall not be considered for classification of the degree. The students may also undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) during summer / winter vacation, in lieu of Industrial training.

Duration of Training / Internship	Credits
2 Weeks	1
1 Month	2
2 Months	3

Socially Relevant Projects

A Student may be permitted to carry out a socially relevant project during semester II to semester VI in consultation with the Faculty Guide and submit the project report, in the prescribed format, at the end of the Semester for the valuation.

On successful completion of socially relevant project work, one credit will be indicated in the grade sheet (Additional credits), but these credits will not be considered for computing the CGPA.

4. VALUE ADDED COURSES

A Student can opt for the Value Added Courses offered by the various Department / Centres from Semester II to VII. Head of the Department / Centre shall submit the list of such courses, duly approved / ratified by the Academic Council, to the Controller of Examinations to administer the examination process. A separate Certificate will be issued on successful completion of the course by the Office of the Controller of Examinations.

5. DURATION OF THE PROGRAMME

A regular student (admitted after 10+2) or equivalent is normally expected to satisfactorily fulfil the requirements for award of the degree B.E. / B.Tech. within four academic years (8 semesters) from the date of admission but in any case not more than 7 years (14 Semesters); lateral entry students shall fulfil such requirements within three academic years (6 semesters) from the date of admission but in any case not more than six years (12 Semesters) leading to the award of Degree of Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) of Anna University, Chennai.

The total period for completion of the programme from the commencement of the semester, to which the student was admitted, shall not exceed the maximum period (Clause 5.1), regardless to the break-of-study (vide Clause 15) or period of prevention in order.

Each semester shall consist of minimum 90 working days. Head of the Department shall ensure that every faculty member teaches the subject / course as prescribed in the approved curriculum and syllabi.

Special Theory / Practical Sessions may be conducted for students who require additional inputs over and above the number of periods normally specified (Remedial Classes), as decided by the Head of the Department, within the specified duration of the Semester / Programme.

6. COURSE ENROLLMENT AND REGISTRATION

Each student, on admission shall be assigned to a Faculty Advisor (vide Clause 8) who shall advise / counsel the student about the details of the academic programme and the choice of course(s) considering the student's academic background and career objectives.

Every student shall enroll for the courses of the succeeding semester, in the current semester. However, the student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the semester concerned.

After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the End Semester Examinations.

Each student, on admission to the programme, shall register for **all the courses prescribed in the curriculum** in the **first Semester of study (III Semester** for students admitted under **lateral entry stream).**

The enrollment for all the courses of the Semester II will commence 10 working days prior to the last working day of Semester I. The student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the Semester II. In case, if astudent fails to register in course(s), he/ she may be permitted to register the same, as specified in the Clause 6.5, in the subsequent semesters or when it isoffered.

The enrollment for the courses of the Semesters III to VIII will commence 10 working days prior to the last working day of the preceding semester. The student shall enroll for the courses with the guidance of the student's Faculty Advisor. If a student wishes, the student may drop or add courses (vide Clause 6.4) within **five** working days after the commencement of the

semester concerned and complete the registration process duly authorized by the Faculty Advisor.

Flexibility to Add or Drop courses

A student has to earn the total number of credits specified in the Curriculum of the respective Programme of study in order to be eligible to obtain the degree. However, if a student wishes, the student is permitted to earn more than the total number of credits prescribed in the curriculum by opting for one- credit courses, self study electives or additional courses.

From the III to VIII semesters (from IV to VIII Semesters in case of lateral entry students), the student has the option of registering for additional courses or dropping existing courses. The total number of credits that a student can addor drop is limited to 8, subject to a maximum of 2 courses in a given Semester. In such cases, the attendance requirement as stated in Clause 7 is mandatory.

The student shall register Project work I in semester VII and Project work II in semester VIII only.

Reappearance Registration

If a student fails in a theory course, the student shall do reappearance registration (Examination) for that course in the subsequent semesters or when itis offered next.

On registration, a student may attend the classes for the reappearance registration courses, if the student wishes, and the attendance requirement (vide Clause 7) is not compulsory for such courses.

However, if a student wishes to improve his/ her continuous assessment, in the second attempt during reappearance, he/she shall satisfy the Clause 6.5.5 and appear for continuous assessment as given for that particular course.

If the theory course, in which the student has failed, is either a professional elective or an open elective, the student may register for the same or any other professional elective or open elective course, respectively in the subsequent semesters. However, the change of elective courses is permitted only once.

In this case (Clause 6.5.4), the student shall attend the classes, satisfy the attendance requirements (vide Clause 7), earn Continuous Assessment marks and appear for the End Semester Examination.

The student who fails in any continuous assessment courses (Laboratory/ Project work / Seminar or any other HSS/EEC courses) shall register for the same in the subsequent semesters or when offered next, and **repeat** the course as per Clause 6.5.5.

If a student is prevented from writing the end semester examination of a course or several courses due to lack of attendance, the student has to register for that / those course(s) again, when offered next, attend the classes and fulfill the requirements as per Clause 6.5.5 & 6.5.6. If the course, in which the student has 'lack of attendance', is a Core Elective or an Open Elective, the student may register for the same or any other Core Elective or Open Elective course(s) respectively in the subsequent semesters and appear in the examination as per Clause 6.5.5.

If a student fails to secure a pass in any theory courses (including elective) he/she is given a maximum of three arrear attempts to complete the courses. If the student still fails to secure a pass, he/she shall register for the same when offered next and repeat the course.

7. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (vide Clause 7.1 and 7.2) shall be deemed to have satisfied the attendance requirements for appearing for End Semester Examination of a particular course.

Every student is expected to attend all the periods and earn 100% attendance. However, a student shall secure not less than 80% attendance course wise taking into account the number of periods required for that course as specified in the curriculum.

If a student, secures attendance between 70% and 79% in any course(s) in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) or participation in Institution/ University/ State/ National/

International level extra and co-curricular activities, with prior permission from the Head of the Department, shall be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate / participation certificate attested by the Head of the Department (along with Condonation form). Such certificates along with the condonation forms shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations. However during the entire programme of study, a student can avail such Condonation in any two semesters only (regardless the number of courses).

A student shall normally be permitted to appear for End Semester Examination of the course(s) if the student has satisfied the attendance requirements (vide Clause 7.1 – 7.2) and has registered for examination in those courses of that semester by paying the prescribed fee.

Students who do not satisfy Clause 7.1 and 7.2 and who secure less than 70% attendance in a course will not be permitted to write the End-Semester Examination of that course. The student has to register and repeat this course in the subsequent semesters or when it is offered next (vide Clause 6.5).

If a student has shortage of attendance in all the registered courses, he/she would not be permitted to move to the higher semester and has to repeat the current semester in the subsequent year.

In the case of reappearance (Arrear) registration for a course, the attendance requirement as mentioned in Clauses 7.1 - 7.3 is not applicable. However, the student has to register for examination in that course by paying the prescribed fee.

A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of grades.

8. FACULTY ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty member of the Department who shall function as Faculty Advisor

for those students. The Faculty Advisor shall advise and guide the students in registering of courses, reappearance of courses, monitor their attendance and progress and counsel them periodically. The Faculty Advisor also discusses with or informs the parents about the progress / performance of the students concerned.

The responsibilities of the faculty advisor shall be:

- To inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- To guide student enrollment and registration of the courses.
- To authorize the final registration of the courses at the beginning of each semester.
- To monitor the academic and general performance of the students including attendance and to counsel them accordingly.

9. COMMITTEES

Common Course Committee

A theory course handled by more than one faculty including the discipline with multiple divisions (greater than or equal to 2) shall have a "Common Course Committee" comprising of all members of faculty teaching that course with one of the members as the Course Coordinator, nominated by the Head of the Institution (Head of the Department in the case of multiple divisions of a discipline) and student representatives (one per specialization or division) registered for that course in the current semester.

First meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. Two subsequent meetings in a semester may be held at suitable intervals. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all the students.

In addition, Common Course Committee (without the student representatives) shall meet to ensure uniform evaluation through the common question papers during Continuous Assessment and End Semester Examinations.

Class Committee Meeting

For all the courses taught, prescribed in the curriculum, Class Committee meeting shall be convened thrice in a semester (first meeting within 15 days from the commencement of the semester and other two meetings at equal interval after the first meeting) comprising members of the faculty handling all the courses and two student representatives from the class.

One of the members of the faculty (preferably not handling any courses to that class), nominated by the Head of the Department, shall coordinate the activities of the Committee. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all other students.

10. SYSTEM OF EXAMINATION

Performance in each course of study shall be evaluated based on (i) Continuous Assessment throughout the semester and (ii) End Semester examination at the end of the semester for the regular courses or as given in the Clause 16. However, the final examination in the case of certificate / value added courses may be conducted, as and when the course is completed, through the office of the Controller of Examinations.

Each course, both theory and laboratory including project work, shall be evaluated as per the Scheme of Assessment given in Clause 16.

The End Semester Examinations shall normally be conducted after satisfying the Clause 5.2.

For the End Semester examinations, both theory and project work, the internal and external examiners (from Academia or Industry) shall be appointed by the Controller of Examinations as per the guidelines given by the Examination cum Evaluation committee of the Institute.

11. PASSING REQUIREMENTS AND PROVISIONS

The Passing requirement for a student in a course is determined based on the marks obtained both in Continuous Assessment and End Semester Examinations. If the student gets <50% of marks in End Semester Examination, then the student will be awarded only RA (Reappearance) grade.

11.1.1 If a student fails to secure a pass in a particular course, i.e., failing to obtain minimum marks, as stated above, it is mandatory that he/she shall reappear for the examination in that course in the subsequent semester(s) whenever the examinations are conducted for that course, till he / she secures a 'Pass'.

Continuous Assessment (CA) marks obtained by the student in the first appearance shall be retained and considered valid for one subsequent attempt, except Clause 6.5.4, 6.5.5, 6.5.6 and 6.5.7. However, from the third attempt onwards, the student shall be declared to have passed the course if he/she secures a minimum of 6 Grade Points (B Grade) in the course prescribed during the End Semester Examinations.

If a candidate fails in the seventh semester examinations of Project work I, he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. If he / she fails in the End semester examination of Project work II, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of the project report and the subsequent viva-voce examination will be considered as reappearance with payment of exam fee. In case a student fails in the resubmission of a project report and subsequent viva-voce examination, the student shall register for the course again, when offered next.

The passing requirement for the courses which are assessed only through continuous assessment (Laboratory and EEC courses except project work), shall be fixed as minimum 50% and the remaining grades are decided as per clause 12.4. If a candidate fails in EEC courses (Except Project work), he/she has to register and repeat the course within 30 days from the date of declaration of the

results. In case a student fails to register within 30 days, he/she shall register for the course again, when offered next.

The minimum number of total credits to be earned by a student to qualify for the award of Degree in the various branches of study as prescribed by the respective Boards of Studies is given below:

Branch of Study	Minimum Credits	
	Regular Admission	Lateral Entry
B.E. Programmes		
Aeronautical Engineering	172	135
Agricultural Engineering	172	134
Automobile Engineering	170	133
Civil Engineering	171	133
Computer Science and Engineering	171	133
Electronics and Communication Engineering	172	131
Electrical and Electronics Engineering	170	131
Electronics and Instrumentation Engineering	170	131
Mechanical Engineering	170	131
Mechatronics	170	132
B.Tech. Programmes		
Biotechnology	172	134
Fashion Technology	172	134
Food Technology	170	132
Information Technology	170	132
Textile Technology	171	133

Student Migration and Credit Transfer: Normalization of the Credits will be carried out in consultation with the Board of Studies of the programme concerned and approved by the Head of Institution, if a student migrates from other Autonomous institutions to Bannari Amman Institution of Technology or rejoins from previous regulation to this regulation.

A student shall be declared to have qualified for award of B.E/B.Tech. Degree if he/she successfully completes the course requirements (vide Clause 7, 10 and 11) and passed all the prescribed courses of study of the respective programme (listed in Clause 2), within the duration specified in Clause 5.1.

12. ASSESSMENT AND AWARD OF LETTER GRADES

The assessment shall be based on the performance in the End Semester Examinations and / or Continuous Assessment, carrying marks as specified in Clause 16. Letter Grades (based on Credit Point and Grade Point) are awarded to the students based on the performance in the evaluation process.

Credit Point is the product of Grade Point and number of credits for a course and Grade Point is a numerical weight allotted to each letter grade on a 10-point scale (as specified in the Clause 12.4), while the Letter Grade is an index of the performance of a student in a said course.

Condition for Relative Grading

The minimum number of students for applying relative grading system is 30. If the students' strength is less than 30 then absolute grading system will be applied. The relative grading system shall not be applied for laboratory and EEC courses.

The performance of a student will be reported using Letter Grades in absolute grading, each carrying certain points as detailed below: In relative grading, grades will be decided by the faculty concerned. A student who earns a minimum of 6 grade points in a course is declared to have successfully passed the course.

Range of Total Marks (as specified in Clause 16) / Specific Reason	**Grade Points**	**Letter Grade**
91 to 100	10	O (Outstanding)
81 to 90	9	A + (Excellent)
71 to 80	8	A (Very Good)
61 to 70	7	B + (Good)
50 to 60	6	B (Above average)
0 to 49	0	RA (Reappearance Registration)
Incomplete	0	I
Withdrawal	0	W
Absent	0	AB

Shortage of Attendance	0	SA

'RA' ---Reappearance registration is required for that particular course

'I' --- Continuous evaluation is required for that particular course in the subsequent examinations.

'SA' --- shortage of attendance (Clause 7) and hence prevented from writing end semester examination.

After completion of the evaluation process, Semester Grade Point Average (SGPA), and the Cumulative Grade Point Average (CGPA) is calculated using the formula:

$$SGPA/CGPA = \frac{\sum_{1}^{n} C_i * g_i}{\sum_{1}^{n} C_i}$$

Where

C_i : Credit allotted to the course.

g_i : Grade Point secured corresponding to the course.

n : number of courses successfully cleared during the particular semester in the case of SGPA and all the semesters, under consideration, in the case CGPA.

A student who does not appear for the End Semester Examinations in a course, after registering for the same, shall be deemed to have appeared for that examination for the purpose of classification (Subject to Clause 14 and 15).

For the non credit courses grades shall be indicated as given in the Clause 16 and shall not be counted for the computation of SGPA/CGPA.

For the Co-curricular activities such as NCC / NSS / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. A satisfactory grade in the above co-curricular activities is compulsory for the award of degree.

Revaluation: A student, who seeks the re-valuation of the answer script, is directed to apply through proper application to the Controller of Examinations in the prescribed format through the Head of the Department. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses. In the case of theory courses with laboratory component, a student can seek revaluation for the theory component only, following the procedure stated above.

Supplementary Examinations: If a student fails to secure a pass in theory course(s) of VIII semester examination, he/she is eligible to appear for a one time Supplementary Examination which shall be conducted at the end of VIII semester, for the subjects of VIII semester alone within 30 days from the date of declaration of the results.

Eligibility for the Award of Degree

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.
ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the courses prescribed in all the 8 semesters within a maximum period of 7 years reckoned from the commencement of the first semester to which the candidate was admitted.
iii. Successfully completed the NCC / NSS / NSO / YRC / Extra-curricular/ Co-curricular requirements.
iv. No disciplinary action is pending against the student.
v. The award of Degree must have been approved by the Syndicate of the University.

13. CLASSIFICATION OF THE DEGREE AWARDED

For the purpose of the 'Award of Degree', the duration of completion of the programme shall be the total duration taken by a student for completing first time registration of all the required courses and satisfying Clause 11, regardless to the period of Break-of-study as per Clause 15 and satisfy any one of the conditions required as given below.

First Class with Distinction: A student who satisfies the following conditions shall be declared to have passed the examination in **First class with Distinction**:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry students) in the student's First Appearance within five years, which includes authorized break of study of one year. Withdrawal from examination (vide Clause 15) will not be considered as an appearance.
- Should have secured a CGPA of **not less than 8.50**
- Should **NOT** have been prevented from writing end semester examination due to lack of attendance in any of the courses.

First Class: A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry students) within five years, which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).
- Should have secured a CGPA of **not less than 7.00**

Second Class: All other students (not covered in clauses 13.1 and 13.2) who qualify for the award of the degree shall be declared to have passed the examination in **Second Class.**

14. WITHDRAWAL FROM THE EXAMINATION

A student may, for valid reasons, be granted permission by the Head of the Department to withdraw from appearing in the examination in any course(s) only once during the entire duration of the degree programme.

Withdrawal application shall be valid only, if the student is eligible to write the examination as per Clause 7 and, if it is made within TEN working days before the commencement of the end semester examination in that course or courses and also recommended by the Head of the Department.

Notwithstanding the requirement of mandatory TEN working days' notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

If a student withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examination(s).

Withdrawal shall not be considered as an appearance in the examination for the eligibility of a student for First Class with Distinction or First Class.

Withdrawal is permitted for the end semester examinations in the final semester, only if the period of study of the student concerned does not exceed 5 years as per clause 13.1 & 13.2.

15. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

A student is permitted to go on break of study for a fixed period of one year as a single break in the entire course of study.

A student is normally not permitted to break the period of study temporarily. However, if a student happens to discontinue the programme temporarily during the middle of programme of study, for reasons such as personal accident or hospitalization due to ill health or in need of health care, he/she shall apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester examination, through the Head of the Department stating the reasons for the break-of-study (for one academic semester or 6 months, whichever is earlier). However, a student detained for want of minimum attendance

requirement as per Clause 7 shall not be considered as permitted 'Break of Study' and Clause 15.3 is not applicable for such case.

The student is permitted to rejoin the programme after the break / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Dean Academics in the prescribed format through the Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

Authorized break of study will be counted towards the duration specified for passing all the courses (vide Clause 5.1 and 5.2) and for the purpose of classification of Degree (vide Clause 13).

The total period for completion of the programme reckoned from the commencement of the first semester to which the student is admitted shall not exceed the maximum period specified in Clause 5.1, irrespective of the period of break of study in order that he / she may be eligible, for the award of the degree (vide Clause 13).

In case of valid reasons (as stated in Clause 15.2) extended break-of-study may be granted by the Head of the Institution for a period not more than one year in addition to the earlier authorized break of study.

If a student does not report back to the Institute, even after the extended Break of Study, the name of the student shall be deleted permanently from the college enrollment. Such students are not entitled to seek readmission under any circumstances.

16. SCHEME OF ASSESSMENT

Courses offered under B.E. / B.Tech. Programmes are assessed as given below:

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	End Semester Examination	**50**
	Total Marks	**100**

II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	(Laboratory Assessment & Report)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**

III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (20)	
	ii. Experiment and Analysis of Results (20)	
	iii. Record (10)	
	Test – Cycle I (25)	
	Test – Cycle II (25)	
	Total Marks	**100**

IV	**PROJECT WORK I**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Literature Survey (5)	
	Identification of topic and Justification (5)	
	Work plan (10)	
	Review II	
	Approach & Results (15)	
	Conclusion (15)	

	End Semester Examination	**50**
	Report[#] (20)	
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**

V	**PROJECT WORK II**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Progress (10)	
	Review II	
	Approach & Results (10)	
	Review III	
	Conclusion & Final Presentation (10)	
	Report (15)	
	Publication of Paper in Conferences / Journals (5)	
	End Semester Examination	
	Presentation (30)	**50**
	Viva voce (20)	
	Total Marks	**100**

VI	**LANGUAGE ELECTIVE (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test 1	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Test 2	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**

VII	**ONE-CREDIT COURSE (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**50**
	Quiz/ Assignment	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

VIII	**INDUSTRIAL TRAINING/ INTERNSHIP (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Assessment by Industry	**30**
	Viva-voce	**20**
	Presentation	**30**
	Case Study / Report	**20**
	Total Marks	**100**

IX	**SOFT SKILLS (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	

X	**VALUE ADDED / CERTIFICATE COURSES (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Evaluation / Test	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	

XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Exercise (Minimum 10 Exercises/Modelling)	**60**
	Model Examination	**40**
	Total Marks	**100**

Optional Test: *A student becomes eligible to appear for an optional test conducted after the Periodical Test II, only under the following circumstances: (i) absent for Test I or Test II or both on account of medical reasons (hospitalization / accident / specific illness), or (ii) participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Institution and (iii) on satisfying the conditions (i) or (ii), the student should have registered for the Optional Test, through the concerned member of faculty who handles the course or through the respective Head of the Department, submitted to the Controller of Examinations. Such Optional Tests are not conducted for the courses under the categories III, IV, V, VI, VII, VIII, IX, X and XI listed above.*

17. FIELD / INDUSTRIAL VISIT / INTERNSHIP

In order to provide the experiential learning to the students, Head of the Department shall take efforts to arrange at least two industrial visits / field visits. The students may also undergo in-plant training / internship during summer / winter vacation between III and VII semesters.

18. PERSONALITY AND CHARACTER DEVELOPMENT

Every student shall be required to undergo a minimum of 40 hours of Personality Development Programmes viz, NSS / NCC / YRC / YOGA / Sports and Games / Technical and Non-technical Club activities during the first year. The attendance of the personality and character development courses / events shall be maintained on the regular basis by the concerned First Year Co-ordinators and made available in the Office of the Controller of Examinations before the commencement of Semester examinations of Semester I or Semester II.

19. DISCIPLINE

A student is expected to follow the rules and regulations laid down by the Institute and the affiliating University, as published from time to time. Any violations, if any, shall be treated as per the procedures stated thereof.

If a student indulges in malpractice in any of the End Semester / Continuous Assessments, he / she shall be liable for punitive action as prescribed by the Institution / University from time to time.

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The Institution reserves the right to revise/amend/change the Regulations, Curriculum, Syllabi, Scheme of Examinations and date of implementation and to introduce Additional Electives, Open Electives, One Credit Courses and Value Added Courses through the Academic Council.

PROGRAMME EDUCATIONAL OBJECTIVIES (PEOs)

After few years (3 to 5 years) of graduation, our graduates are expected to

I. To perform well in their professional career by acquiring enough knowledge in the domain of Artificial Intelligence and Machine Learning.

II. To improve communication skills, follow professional ethics and involve in team work in their profession.

III. To update with evolving technology and use it for career advancement.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

a) **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **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.

c) **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.

d) **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.

e) **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) **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.

g) **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.

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

i) **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **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.

k) **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.

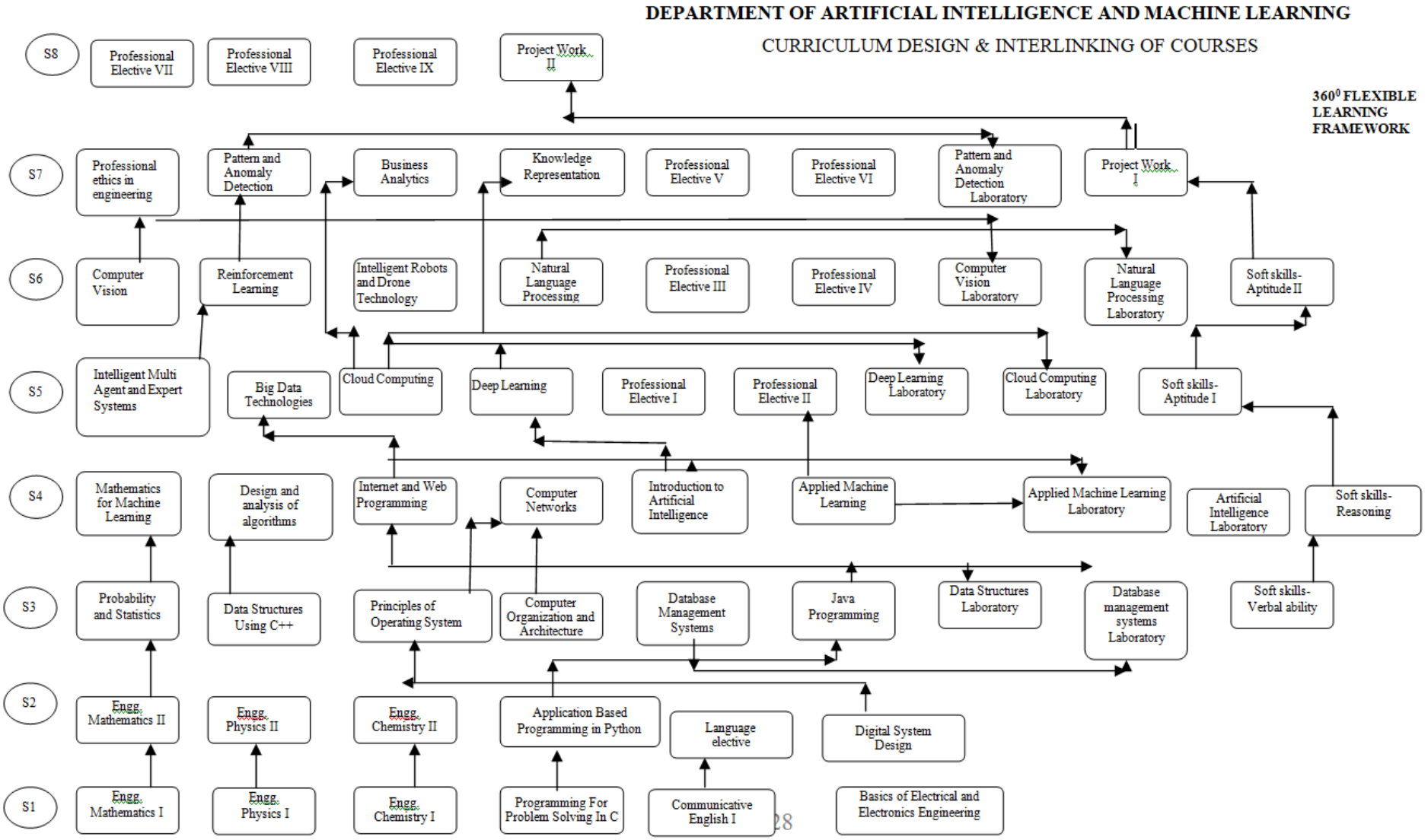
l) **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Develop models in Data Science, Machine learning, deep learning and Big data technologies, using AI and modern tools.
2. Formulate solutions for interdisciplinary AI problems through acquired programming knowledge in the respective domains fulfilling with real-time constraints.

MAPPING OF PEOs AND POs

POs	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
PEO1	X						X					X	X		
PEO2						X	X	X	X	X					X
PEO3		X	X	X	X								X	X	
PEO4						X			X		X			X	X



General Electives (I to IX) are the courses offered by the department

B. TECH (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING) R2018
Minimum Credits to be Earned: 172

I SEMESTER

Code No.	Course Title	L	T	P	C	Hours/ week	Maximum marks			Category
							CA	ES	Total	
21AM101	Engineering Mathematics I	3	1	0	4	4	50	50	100	BS
21AM102	Engineering Physics I	2	0	2	3	4	50	50	100	BS
21AM103	Engineering Chemistry I	2	0	2	3	4	50	50	100	BS
21AM104	Programming For Problem Solving In C	2	0	2	3	4	50	50	100	ES
21AM105	Basics of Electrical and Electronics Engineering	2	0	2	3	4	50	50	100	ES
18HS101	Communicative English I	1	0	2	2	3	100	0	100	HSS
Total		**12**	**1**	**10**	**18**	**23**				

II SEMESTER

Code No.	Course Title	L	T	P	C	Hours/ week	Maximum marks			Category
							CA	ES	Total	
21AM201	Engineering Mathematics II	3	1	0	4	4	50	50	100	BS
21AM202	Engineering Physics II	2	0	2	3	4	50	50	100	BS
21AM203	Engineering Chemistry II	2	0	2	3	4	50	50	100	BS
21AM204	Application Based Programming In Python	2	0	2	3	4	50	50	100	ES
21AM205	Digital System Design	3	0	2	4	4	50	50	100	ES
	Language Elective	1	0	2	2	3	100	0	100	HSS
Total		**13**	**1**	**10**	**19**	**23**				

III SEMESTER										
Code No.	**Course Title**	**L**	**T**	**P**	**C**	**Hours/ week**	**Maximum marks**			**Category**
							CA	**ES**	**Total**	
21AM301	Probability And Statistics	3	1	0	4	4	50	50	100	BS
21AM302	Data Structures Using C++	3	1	0	4	4	50	50	100	PC
21AM303	Principles of Operating System	3	0	0	3	3	50	50	100	PC
21AM304	Computer Organization and Architecture	3	0	0	3	3	50	50	100	PC
21AM305	Database Management System	3	0	0	3	3	50	50	100	PC
21AM306	Java Programming	3	1	0	4	4	50	50	100	PC
21AM307	Data Structures Laboratory	0	0	4	2	2	100	0	100	PC
21AM308	Database Management System Laboratory	0	0	4	2	2	100	0	100	PC
18GE301	Soft Skills - Verbal Ability	2	0	0	0	2	100	0	100	EEC
Total		**20**	**3**	**8**	**25**	**27**				

IV SEMESTER										
Code No.	**Course Title**	**L**	**T**	**P**	**C**	**Hours/ week**	**Maximum marks**			**Category**
							CA	**ES**	**Total**	
21AM401	Mathematics For Machine Learning	3	1	0	4	4	50	50	100	BS
21AM402	Design And Analysis of Algorithm	3	1	0	4	4	50	50	100	PC
21AM403	Internet And Web Programming	3	1	0	4	4	50	50	100	PC
21AM404	Computer Networks	3	0	0	3	3	50	50	100	PC
21AM405	Introduction To Artificial Intelligence	3	0	0	3	3	50	50	100	ES
21AM406	Applied Machine Learning	3	0	0	3	0	50	50	100	PC
21AM407	Applied Machine Learning Laboratory	0	0	4	2	4	100	0	100	PC
21AM408	Artificial Intelligence Laboratory	0	0	4	2	4	100	0	100	ES
18GE401	Soft Skills – Reasoning	2	0	0	0	2	100	0	100	EEC

Total	**20**	**3**	**8**	**25**	**28**				

V SEMESTER

Code No.	Course Title	L	T	P	C	Hours/ week	Maximum marks			Category
							CA	ES	Total	
21AM501	Intelligent Multi Agent And Expert Systems	3	0	0	3	3	50	50	100	PC
21AM502	Big Data Technologies	3	1	0	4	4	50	50	100	PC
21AM503	Cloud Computing	3	0	0	3	3	50	50	100	PC
21AM504	Deep Learning	3	0	0	3	3	50	50	100	PC
	Professional Elective I	3	0	0	3	3	50	50	100	PE
	Professional Elective II	3	0	0	3	3	50	50	100	PE
21AM507	Deep Learning Laboratory	0	0	4	2	4	100	0	100	PC
21AM508	Cloud Computing Laboratory	0	0	4	2	4	100	0	100	PC
18GE501	Soft Skills - Aptitude I	0	0	2	0	2	100	0	100	EEC
Total		**18**	**1**	**10**	**23**	**29**				

VI SEMESTER

Code No.	Course Title	L	T	P	C	Hours/ week	Maximum marks			Category
							CA	ES	Total	
21AM601	Computer Vision	3	0	0	3	3	50	50	100	PC
21AM602	Reinforcement Learning	3	0	0	3	3	50	50	100	PC
21AM603	Intelligent Robots And Drone Technology	3	0	0	3	3	50	50	100	PC
21AM604	Natural Language Processing	3	0	0	3	3	50	50	100	EEC
	Professional Elective III	3	0	0	3	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	3	50	50	100	PE
21AM607	Natural Language Processing Laboratory	0	0	4	2	4	100	0	100	EEC
21AM608	Computer Vision Laboratory	0	0	4	2	4	100	0	100	PC

18GE601	Soft Skills - Aptitude II	0	0	2	0	2	100	0	100	EEC
Total		**18**	**0**	**10**	**22**	**28**				

VII SEMESTER										
Code No.	**Course Title**	**L**	**T**	**P**	**C**	**Hours/ week**	**Maximum marks**			**Category**
							CA	**ES**	**Total**	
18HS002	Professional Ethics In Engineering	2	0	0	2	2	50	50	100	HSS
21AM702	Pattern And Anomaly Detection	3	0	0	3	3	50	50	100	PC
21AM703	Business Analytics	3	0	0	3	3	50	50	100	EEC
21AM704	Knowledge Representation	3	0	0	3	3	50	50	100	PC
	Professional Elective V	3	0	0	3	3	50	50	100	PE
	Professional Elective VI	3	0	0	3	3	50	50	100	PE
21AM707	Pattern And Anomaly Detection Laboratory	0	0	4	2	4	100	0	100	EEC
21AM708	Project Work I	0	0	6	3	6	50	50	100	EEC
Total		**17**	**0**	**10**	**22**	**27**				
VIII SEMESTER										
Code No.	**Course Title**	**L**	**T**	**P**	**C**	**Hours/ week**	**Maximum marks**			**Category**
							CA	**ES**	**Total**	
	Professional Elective VII	3	0	0	3	3	50	50	100	PE
	Professional Elective VIII	3	0	0	3	3	50	50	100	PE
	Professional Elective IX	3	0	0	3	3	50	50	100	PE
21AM804	Project Work II	0	0	18	9	18	50	50	100	EEC
Total		**9**	**0**	**18**	**18**	**27**				

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
18HSC01	CHINESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
PHYSICS ELECTIVES										
18GE0P1	NANOMATERIALS SCIENCE	3	0	0	3	3	50	50	100	BS
18GE0P2	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	50	50	100	BS
18GE0P3	APPLIED LASER SCIENCE	3	0	0	3	3	50	50	100	BS
CHEMISTRY ELECTIVES										
18GE0C1	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	50	50	100	BS
18GE0C2	ENERGY STORING DEVICES	3	0	0	3	3	50	50	100	BS
18GE0C3	POLYMER SCIENCE	3	0	0	3	3	50	50	100	BS
MATHEMATICS ELECTIVES										
18GE0M1	GRAPH THEORY AND COMBINATORICS	3	0	0	3	3	50	50	100	BS
18GE0M2	ALGEBRA AND NUMBER THEORY	3	0	0	3	3	50	50	100	BS
18GE0M3	MATHEMATICAL FINANCE AND QUEUEING THEORY	3	0	0	3	3	50	50	100	BS
ENTREPRENEURSHIP ELECTIVES										
18GE0E1	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	50	50	100	PE
18GE0E2	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	50	50	100	PE

PROFESSIONAL ELECTIVE										
Code No.	**Course Title**	**L**	**T**	**P**	**C**	**Hours / week**	**Maximum marks**			**Category**
							CA	**ES**	**Total**	
21AM001	BIOMEDICAL IMAGE ANALYSIS	3	0	0	3	3	50	50	100	PE
21AM002	DIGITAL MARKETING	3	0	0	3	3	50	50	100	PE
21AM003	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	50	50	100	PE
21AM004	SOFT COMPUTING	3	0	0	3	3	50	50	100	PE
21AM005	SMART PRODUCT DEVELOPMENT	3	0	0	3	3	50	50	100	PE
21AM006	MALWARE ANALYSIS	3	0	0	3	3	50	50	100	PE
21AM007	NEURAL NETWORKS	3	0	0	3	3	50	50	100	PE
21AM008	MOBILE APPLICATION DEVELOPMENT	3	0	0	3	3	50	50	100	PE
21AM009	BLOCK CHAIN TECHNOLOGY	3	0	0	3	3	50	50	100	PE
21AM010	DATA ANALYTICS AND DATA SCIENCE	3	0	0	3	3	50	50	100	PE
21AM011	INTERNET OF THINGS AND ITS APPLICATIONS	3	0	0	3	3	50	50	100	PE
21AM012	COGNITIVE SYSTEMS	3	0	0	3	3	50	50	100	PE
21AM013	CYBER THREAT INTELLIGENCE	3	0	0	3	3	50	50	100	PE
21AM014	BIOINFORMATICS	3	0	0	3	3	50	50	100	PE
21AM015	DATA VISUALIZATION	3	0	0	3	3	50	50	100	PE
21AM016	SOCIAL AND INFORMATION NETWORKS	3	0	0	3	3	50	50	100	PE
21AM017	VIDEO ANALYTICS	3	0	0	3	3	50	50	100	PE
21AM018	INFORMATION STORAGE MANAGEMENT	3	0	0	3	3	50	50	100	PE

SUMMARY OF CREDIT DISTRIBUTION

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDIT	CREDITS in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	10	10	4	4	0	0	0	0	28	16.3	15%	20%
2	ES	6	6	14	7	0	0	0	0	33	19.29	15%	20%
3	HSS	2	5	0	0	0	2	2	0	11	6.43	5%	10%
4	PC	0	0	6	12	17	14	11	0	60	35.08	30%	40%
5	PE	0	0	0	0	6	6	6	9	27	15.7	15%	20%
6	EEC	0	0	0	0	0	0	3	9	12	7.01	5%	10%
Total		18	21	24	23	23	22	22	18	171	100	-	-

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social SciencesPC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course

CA - Continuous Assessment ES - End Semester Examination

21AM101 ENGINEERING MATHEMATICS I

3 1 0 4

Course Objectives

- Understand the concepts of vectors and Eigenvectors for different matrices to describe the stability of the linear systems in engineering fields.
- Exemplify the concepts of differentiation and integration to identify the area of 2D and 3D surfaces in engineering problems.
- Explain the concepts of analytic functions in complex domain to predict the nature of different engineering systems.

Course Outcomes (COs)

1. Represent the different forms of coordinate system in complex plane and characteristics of linear systems by Eigenvalues and Eigenvectors.
2. Analyze various types of functions and their differentiation techniques involved in engineering fields.
3. Implement different methods of integration used in engineering problems.
4. Execute the suitable integration technique to calculate the area and volume of different surfaces.
5. Apply the concept of analytic function to estimate the integral in complex plane.

UNIT I **9 Hours**

COMPLEX NUMBERS, VECTORS AND MATRICES

Complex plane, polar coordinates and polar form of complex numbers, powers and roots, fundamental theorem of algebra. Vector algebra in 2-D and 3-D space, dot product and cross product. Matrices: Eigen values and Eigen vectors, Properties of eigen values and eigen vectors.

UNIT II **9 Hours**

CALCULUS

Limits and Continuity of Functions: Limits of functions, types of limits, evaluation of limits, continuity of functions, properties of continuous functions. Derivatives: Derivatives, differentiability, rules and properties, differentiation of transcendental functions, higher order derivatives, implicit differentiation, and differentiation of hyperbolic functions. Integration: Anti-derivatives, Riemann Sum, indefinite and definite integration, Mean Value Theorem for definite integral, Fundamental Theorem of Calculus.

UNIT III **9 Hours**

INTEGRATION METHODS

Basic integration formulae for algebraic and transcendental functions. Integration by special devices: integration by parts, rationalizing substitution or trigonometric substitution, partial fractions, reduction formulas, improper integrals, convergence tests.

UNIT IV **9 Hours**

APPLICATIONS OF DERIVATIVES AND INTEGRATIONS

Extreme values, points of inflection and curve sketching, Rolles Theorem, Mean Value Theorem, optimization, indeterminate forms, L Hopitals Rule. Area between curves, volume of a general solid by slicing and cylindrical shell methods, volume of a solid of revolution, length of plane curves, area of a surface of revolution.

UNIT V **9 Hours**

COMPLEX ANALYSIS

Analytic Functions- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method. Cauchys Integral Formula - Classification of Singularities - Cauchys Residue Theorem.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2101
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.
3. Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
4. Anton H, Calculus with Analytic Geometry, 5th edition, John Wiley & Sons, 1995.
5. Ayres F Jr and Mendelson E, Schaum s Outline of Theory and Problems of Calculus, 4th edition, McGraw Hill, 1999.
6. S.C. Gupta, Fundamentals of Statistics, 7th Edition, Himalaya Publishing House Pvt. Ltd. 2018.

21AM102 ENGINEERING PHYSICS I

2 0 2 3

Course Objectives

- Illustrate the Newtons laws of motion and wave motion with applications
- Understand the basic properties of electricity, magnetism and optics
- Differentiate the special theory of relativity and quantum physics from classical physics

Course Outcomes (COs)

- Illustrate the Newtons three laws of motion and apply the same to solve the real-world problems involving elevator, atwood machine and acceleration of objects
- Exemplify the physical characteristics of simple harmonic motion, wave motion and find the solutions for wave equations
- Infer the fundamental laws, properties of electricity and magnetism and apply the same to electric and magnetic elements
- Apply the principles of physical and geometrical optics in the mirrors, lenses, microscopes and diffraction gratings
- Outline the importance of special theory of relativity, quantum physics and analyse the wave and particle nature of matter

UNIT I **6 Hours**

MECHANICS

Newtons laws of motion: Concept of force and its nature-Newtons first law and inertial frames- definition of mass -Newtons second law-gravitational force and weight -Newtons third law. Applications of Newtons laws: particle in equilibrium, particle under net force-weighing a mass in an elevator, the at wood machine and acceleration of two objects connected by a cord

UNIT II **6 Hours**

OSCILLATIONS AND WAVES

Fundamentals of simple harmonic motion -energy of simple harmonic oscillator -spring mass system -time period of simple pendulum, compound pendulum and torsional pendulum - Damped oscillations. Travelling wave motion -sinusoidal waves on strings -speed of a wave -reflection and transmission -rate of energy transfer in wave motion

UNIT III **6 Hours**

ELECTRICITY AND MAGNETISM

Point charges-electric fields -Gauss law and its applications -electric potential -capacitance -energy stored in a capacitor. Concept and source of magnetic fields -Amperes theorem -determination of magnetic field due to different current distributions -Faradays law -self-induction and mutual induction -energy stored in an inductor

UNIT IV **6 Hours**

LIGHT AND OPTICS

Nature of light -laws of reflection and refraction -refractive index and Snells law -dispersion of light -total internal reflection -image formation:concave mirrors -convex mirrors -thin lenses -compound microscope -human eye. Conditions of interference -Youngs double slit experiment - intensity distribution of interference -phase change due to reflection -diffraction-narrow slit diffraction -single slit and two slit -intensity distribution -diffraction grating –applications

6 Hours

UNIT V

MODERN PHYSICS

Special theory of relativity -simultaneity and time dilation -twin paradox -length contraction -relativistic mass variation - space time graph. Black body radiation and Planck hypothesis -allowed energy levels -thermal radiation from different objects -photoelectric and Compton effect. Matter waves -de-Broglie hypothesis -wave nature of particles -Davission-Germer experiment

EXPERIMENT 1 **5 Hours**

Determination of resultant of system of concurrent coplanar forces-Parallelogram law of forces

EXPERIMENT 2 **5 Hours**

Determination of moment of inertia-Torsional pendulum

EXPERIMENT 3 **5 Hours**

Determination of wavelength of mercury spectral lines-spectrometer

EXPERIMENT 44 Hours

Determination of refractive index of solid and liquid-travelling microscope

EXPERIMENT 53 Hours

Determination of wavelength of laser-diffraction grating

EXPERIMENT 64 Hours

Determination of frequency of a tuning fork-Meldes apparatus

EXPERIMENT 74 Hours

Thickness of a thin wire using interference of light-Air wedge method

Total: 60 Hours

Reference(s)

1. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2011
2. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011
3. H C Verma, Concepts of Physics (Vol I & II), BharathiBhawan Publishers & Distributors, New Delhi, 2017
4. H D Young and R A Freedman, Sears and Zemanskys University Physics with Modern Physics, Pearson education, 2016
5. R K Gaur and S L Gupta, Engineering Physics, DhanpatRai Publications, 2012

21AM103 ENGINEERING CHEMISTRY I

2 0 2 3

Course Objectives

- Identify the properties and applications of optical materials for smart screen
- Summarize the conducting materials and explain its applications to smart screens
- Classify the materials for data storage in electronic devices
- Outline the applications of organic materials in data storage
- Choose the suitable materials for the fabrications of microprocessors in electronic devices

Course Outcomes (COs)

1. Compare the inorganic and organic materials used for smart screen fabrication
2. Demonstrate the fabrication of smart screen using conducting material
3. Analyse the type of materials for data storage in electronic devices
4. Identify various organic nanoscale materials in data storage
5. Select suitable materials for fabrication of microprocessor

UNIT I **6 Hours**

OPTICAL MATERIAL FOR SMART SCREEN

Types: Inorganic: Rare earth metals [yttrium, lanthanum, cerium, praseodymium, neodymium, europium, terbium and dysprosium] - organic : Organic dielectric material [Polystyrene, PMMA] - organic light emitting diodes [polythiophene]

UNIT II **6 Hours**

CONDUCTING MATERIALS FOR SMART SCREEN

Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive]. Chemical components in glass - alumino silicate - gorilla glass

UNIT III **5 Hours**

MATERIALS FOR DATA STORAGE

Classification - magnetic storage [Iron oxide, cobalt alloy, chromium oxide and barium ferrite] - optical storage [photochromic materials] - solid storage

UNIT IV **5 Hours**

ORGANIC NANOSCALE MATERIAL FOR DATA STORAGE

Data Storage - classification [media, access, information and volatility] - flexible data storage [transistor Structure] - flexible floating gate - flexible charge trap- flexible ferroelectric- flexible resistive memory with organic material

UNIT V **7 Hours**

MATERIALS FOR MICROPROCESSOR FABRICATION

Micro electrical components: Fabrication (CVD method) and use of metal oxide materials. Integrated circuit manufacturing - preparation of silicon wafer - masking - photo-resistant materials - classification. Doping: Atomic diffusion, ion implantation, making successive layers. Microcapacitors: Types - electrochemical capacitors, electrolytic capacitors and supercapacitors. Soldering materials: copper, tin and silver

FURTHER READING

Applications of advanced data storage materials in electronic devices. Conducting materials for smart screen Applications of smart material for microprocessor fabrication

EXPERIMENT 15 Hours

Estimation of copper content in a sample solution prepared from copper doped optical light emitting diodes

EXPERIMENT 2 5 Hours
Determination of conductivity of aluminium chloride, aluminium silicate and tin oxide compounds using conductivity meter

EXPERIMENT 35 Hours
Estimation of barium content in a sample solution prepared from iron alloy used in magnetic storage material

EXPERIMENT 44 Hours
Estimation of iron content in sample solution prepared from ferro electric materials using spectrophotometer

EXPERIMENT 56 Hours
Electroless plating of copper on polymeric material used in IC fabrication

EXPERIMENT 6 **6 Hours**
Electroless plating of nickel on polymeric material used in IC fabrication

Total: 60 Hours

Reference(s)

1. Smart Materials Taxonomy, Victor Goldade, Serge Shil"ko, Aleksander Neverov, CRC publication, 2015
2. https://www.dmccoltd.com/english/museum/touchscreens/technologies/projected.asp
3. Advanced Magnetic and Optical Materials, edited by Ashutosh Tiwari, Parameswar K. Iyer, Vijay Kumar, Hendrik Swart, wiley publication, 2016
4. Recent Advances of Flexible Data Storage Devices Based on Organic Nanoscaled Materials- Li Zhou, Jingyu Mao, Yi Ren, Su-Ting Han, V A. L. Roy and Ye Zhou, Small 1703126, 2018
5. Padma L Nayak, Polymer Science, 1st Edition, Kalyani Publishers, New Delhi, 2005
6. G.M. Crean, R. Stuck, J.A. Woollam . Semiconductor Materials Analysis and Fabrication Process Control Elsevier publication, 2012

21AM104 PROGRAMMING FOR PROBLEM SOLVING IN C

2 0 2 3

Course Objectives

- Understand the basics of C primitives, operators and expressions.
- Gain knowledge about the different primitive and user defined data types.
- Impart knowledge about the structural programming concepts.

Course Outcomes (COs)

1. Explain the basic C programming concepts
2. Implement C programs using control statements
3. Implement the concepts of Arrays and strings in C
4. Implement the concepts of functions and pointers in C
5. Analyze the concepts of structures, unions and files in C

UNIT I **6 Hours**

INTRODUCTORY CONCEPTS

C Primitives: Introduction to C- planning and writing a C program- Character Set - Keywords and Identifiers - Data Types - Variables and Constants - Compiling and executing the C program Operators and Expressions: Arithmetic - Relational - Logical - Increment and decrement - Conditional - Bitwise - Comma - Sizeof() - Assignment - Shift operator - Precedence and order of evaluation TypeConversion-Input and Output Operations: Formatted I/O functions - getchar and putchar function - gets and puts functions

UNIT II **6 Hours**

CONTROL STATEMENTS

Decision Making and Branching: simple if statement - if else statement - nesting of if else Statement - Switch Statement. Decision Making and Looping: while statement - do while statement - for statement - Nested for statement Jump Statements: goto - break - continue - return statement

UNIT III **6 Hours**

ARRAYS AND STRINGS

Arrays: Introduction, one dimensional array, declaration - Initialization of one dimensional array, two-dimensional arrays, initializing two dimensional arrays, multi-dimensional arrays. Strings: Declaring and initializing string variables- Reading strings from terminal - writing string to screen - String handling functions.

UNIT IV **6 Hours**

FUNCTIONS AND POINTERS

User Defined Functions: Elements of user defined functions - Definition of functions - return values and their types - function calls - function declaration - categories of function - call by value and call by reference - recursion - Pre-processor directives and macros. Pointers: Understanding Pointers - accessing the address of the variable - declaring pointer variables - Initialization of pointer variables - Accessing a variable through its pointer

UNIT V **6 Hours**

STRUCTURES AND FILES

Storage Class Specifiers: Auto - registers - static - extern - typedef Structures and Unions: Introduction - defining a structure - declaring structure variables - accessing structure members - structure initialization - Unions - Enumerated data type File Management in C: Defining and opening a file - closing a file - Input/output operations on files - Command line arguments

EXPERIMENT 1 **4 Hours**

Write a C program to perform arithmetic operations on integers and floating point numbers.

EXPERIMENT 2 **4 Hours**

Write a C program to implement ternary operator and relational operators.

EXPERIMENT 3 **2 Hours**

Write a C program to read the values of A, B, C through the keyboard. Add them and after addition check if it is in the range of 100 to 200 or not. Print separate message for each.

EXPERIMENT 4 **2 Hours**

Write a C program to display the roots of a quadratic equation with their types using switch case.

EXPERIMENT 5 **2 Hours**

Write a C program to generate the following triangle.

1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7

EXPERIMENT 6 **4 Hours**

Write a C program to get a matrix of order 3x3 and display a matrix of order of 4x4, with the fourth row and column as the sum of rows and columns respectively.

EXPERIMENT 7 **2 Hours**

Write a c program to remove the occurrence of "the" word from entered string.

EXPERIMENT 8 **2 Hours**

Write a C program to find the factorial of given number.

EXPERIMENT 94 Hours

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student details: rollno, name, branch, year, section, cgpa.

****

NAME:
ROLL NO:
BRANCH:
YEAR:
SECTION:
CGPA:

EXPERIMENT 10 **4 Hours**

Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt

Total: 60 Hours

Reference(s)

1. Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
2. Byron Gottfried, Programming with C, Schaum"s Outlines, Tata Mcgraw-Hill, 2013
3. E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4. Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009
5. Kelley A and I. Pohl, A Book on C: Programming in C, Pearson Education, 1998
6. Ashok.N.Kamthane,Programming in C,Pearson education,2013
7.

21AM105 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

2 0 2 3

Course Objectives

- To understand the basic concepts of electric circuits and magnetic circuits.
- To illustrate the construction and operation of various electrical machines and semiconductor devices.
- To learn the fundamentals of communication systems.

Course Outcomes (COs)

1. Understand the basic concepts of electric and magnetic circuits.
2. Summarize the types of DC machines.
3. Classify the static and dynamic AC machines and explain their operation.
4. Interpret the operation of AC and DC drives
5. Illustrate the characteristics of semiconductor devices and communication systems.

UNIT I **7 Hours**

ELECTRIC CIRCUITS

Definition of Voltage, Current, Electromotive force, Resistance, Power & Energy, Ohms law and Kirchoffs Law & its applications - Series and Parallel circuits - Voltage division and Current division techniques - Generation of alternating emf - RMS value, average value, peak factor and form factor- Definition of real, reactive and apparent power.

UNIT II **5 Hours**

DC MACHINES

Introduction of magnetic circuits - Law of Electromagnetic induction, Flemings Right & Left hand rule- Types of induced emf - Definition of Self and Mutual Inductance - DC Motor- Construction - Working Principle- Applications.

UNIT III **6 Hours**

AC MACHINES

Single Phase Transformer - Alternator - Three phase induction motor - Single phase induction motor - Construction - Working Principle - Applications.

UNIT IV **5 Hours**

ELECTRICAL DRIVES

Speed control of dc shunt motor and series motor - Armature voltage control - Flux control - Construction and operation of DC servo motor - Construction and operation of DC servo motor stepper motor.

UNIT V **7 Hours**

ELECTRON DEVICES AND COMMUNICATION

Characteristics of PN Junction diode and Zener diode - Half wave and Full wave Rectifiers - Bipolar Junction Transistor - Operation of NPN and PNP transistors - Logic gates - Introduction to communication systems.

FOR FURTHER READING

Voltage Regulator - Stepper motor - Energy meter - SMPS, Satellite and Optical communication.

EXPERIMENT 1 **4 Hours**

Analyze the VI characteristics of a fixed resistor and a lamp by varying its temperature.

EXPERIMENT 2 **4 Hours**

Apply the voltage division and current division techniques for series and parallel connections of lamp loads.

EXPERIMENT 3 **4 Hours**

Understand the concept of electromagnetic induction using copper coil.

EXPERIMENT 4 4 Hours
Understand the construction and working principle of DC machines.

EXPERIMENT 5 6 Hours
Determine the VI Characteristics of PN Junction diode and plot the input and output wave shapes of a half wave rectifier.

EXPERIMENT 6 4 Hours
Realize the working of transistor as an electronic switch through experiments.

EXPERIMENT 7 4 Hours
Lighting applications using logic gates principle.

Total: 60 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Smarjith Ghosh, Fundamentals of Electrical and Electronics Engineering, Prentice Hall (India) Pvt. Ltd., 2010.
3. A. Sudhakar, Shyammohan S Palli, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill, 2010
4. R. S. Sedha, A Textbook of Applied Electronics, S.Chand& Company Ltd, 2013

18HS101 COMMUNICATIVE ENGLISH I

1 0 2 2

Course Objectives

- Read and understand the main points on familiar matters regularly encountered in work, school or leisure.
- Listen and respond in most common situations where English is spoken.
- Write simple connected texts on topics which are familiar or of personal interest.
- Describe experiences and events, hopes and ambitions and briefly give reasons and explanations for opinions and plans.

Course Outcomes (COs)

1. Use appropriate grammar & vocabulary that is expected at the BEC Preliminary exam level.
2. Understand the general meaning of non-routine letters within own work area, and short reports of a predictable nature.
3. Write straightforward, routine letters of a factual nature, and make notes on routine matters, such as taking/placing orders.
4. Follow simple presentations/demonstrations.
5. Deal with predictable requests from a visitor, state routine requirements, and offer advice within own job area on simple matters.

UNIT I
GRAMMAR **9 Hours**

Tenses – Future continuous, Past continuous, Past perfect, Past simple, Past tense responses, Present perfect continuous, Present perfect/past simple – Reported speech – Adverbs – intensifiers – Comparatives and superlatives – Conditionals 2nd and 3rd – Connecting words expressing cause and effect, contrast – Phrasal verbs – Prepositions of place – Simple passive - What-questions in the past – Question tags – Will and going to, for prediction – Gender Sensitive Vocabulary.

UNIT II
READING **9 Hours**

Understanding short real-world notices, messages – Detailed comprehension of factual material; skimming and scanning skills - Interpreting visual information – Reading for detailed factual information – Reading for gist and specific information - Grammatical accuracy and understanding of text structure - Reading and information transfer.

UNIT III
WRITING **9 Hours**

Internal communication including note, message, memo or email - arranging / rearranging appointments, asking for permission, giving instructions - Business correspondence including letter, email – apologising and offering compensation, making or altering reservations, dealing with requests, giving information about a product –Hierarchy in Business Correspondence.

UNIT IV
LISTENING **9 Hours**

Listening for specific information – Listening for numbers and letters – Note completion – Listening for gist – listening to monologues (presentations, lectures, announcements and briefings) – listening to interacting speakers (telephone conversations, face-to-face conversations, interviews and discussions).

UNIT V

SPEAKING **9 Hours**

Exchanging personal and factual information – expressing and finding out about attitudes and opinions – organise a larger unit of discourse – Turn-taking, negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, comparing and contrasting, and decision-making.

Total: 45 Hours

Reference(s)

1. Alexander Garrett, Cambridge BEC Preliminary Students Book with Answers, Cambridge University Press, 2016.
2. Lan Wood, Anne Williams and Anna Cowper. Pass Cambridge BEC Preliminary, Second Edition, New Delhi, 2014.
3. Norman Whitby. Cambridge Business Benchmark. Pre-Intermediate to Intermediate, Students Book. South Asian Edition, 2018.

21AM201 ENGINEERING MATHEMATICS II

3 1 0 4

Course Objectives

- Understand the concepts of partial derivatives and multiple integrals to define the area, volume and extreme values of various surfaces in engineering fields.
- Classify the sequences and series in linear systems is convergent or divergent.
- Formulate the real time engineering problem into mathematical model using ordinary differential equation and solve it by appropriate method.

Course Outcomes (COs)

1. Illustrate the various parameters in partial differentiation and characterize the maxima and minima functions for signals and systems.
2. Apply multiple integral concepts to calculate the area and volume by appropriate vector integral theorems.
3. Analyze the convergence and divergence of sequences and series by various tests.
4. Construct first order differential equations from real time phenomena and solve it by suitable method.
5. Execute the appropriate method to solve the second order differential equations.

UNIT I **9 Hours**

PARTIAL DIFFERENTIATION

Functions of several variables, plotting of 2-variable functions, introduction to cylindrical and spherical coordinates, chain rule, total differential, gradient, directional derivatives, normal lines and tangent planes, extreme of functions of two variables, applications.

UNIT II **9 Hours**

MULTIPLE INTEGRALS

Double integrals, regions of integrations, triple integrals, applications (Cartesian coordinates only- Greens theorem and Gauss Divergence theorem).

UNIT III **9 Hours**

SEQUENCES AND SERIES

Sequences and series, convergence and divergence of series, absolute convergence, conditional convergence, test for convergence and divergence. Power series for functions, interval of convergence, Taylor and Maclaurin series, Taylors Theorem with remainder.

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS

Separable differential equations, homogeneous differential equations, exact differential equations, integrating factor, Bernoullis equation, applications

UNIT V **9 Hours**

SECOND ORDER DIFFERENTIAL EQUATIONS

Second order homogeneous and non-homogeneous equations with constant coefficients, variation of parameters, method of undetermined coefficients, series solutions of differential equations, applications.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
3. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
4. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited, 2012.
5. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India, 2014.

21AM202 ENGINEERING PHYSICS II

2 0 2 3

Course Objectives

- Understand the applications of laser and fibre optics in the field of engineering
- Impart knowledge in crystallography and semiconductors
- Differentiate the different types of magnetic materials and their applications

Course Outcomes (COs)

1. Understand the principle, characteristics, different types of lasers and apply the same for optical data storage and retrieval techniques
2. Illustrate the propagation of light through different optical fibers, applications of optical fibers in communication and sensors
3. Identify the seven crystal systems, crystal planes and the stacking sequences in metallic crystal structures
4. Analyse the characteristics of semiconducting materials interms of crystal lattice, charge carriers and energy band diagrams
5. Outline the properties of magnetic materials, domain theory of ferromagnetism and the applications for recording and readout process

UNIT I **7 Hours**

LASER

Principle - interaction of radiation with matter - characteristics of laser radiation - pumping mechanisms - types: CO2 laser -homo junction GaAs laser -applications: optical data storage and retrieval techniques - holography: principle -types - comparison of holography with photography - construction - reconstruction of hologram -applications

UNIT II **7 Hours**

FIBER OPTICS

Principle- conditions to achieve total internal reflection- structure- acceptance angle and numerical aperture (qualitative treatment only)- types- modes of propagation- refractive index profile- block diagram of fiber optic communication system- fiber optic sensors- intensity modulated sensor-endoscopy - merits of fiber cables over conventional communication systems

UNIT III **5 Hours**

CRYSTAL PHYSICS

Crystalline and amorphous materials - lattice -lattice point -basis - unit cell - crystal systems - Bravais lattices - planes in crystals- Miller indices -procedure for finding Miller indices- important features of Miller indices- unit cell characteristics of SC, BCC, FCC and HCP structures

UNIT IV **6 Hours**

SEMICONDUCTING MATERIALS

Characteristics -elemental and compound semiconductors- energy band description and current conduction in intrinsic semiconductors- energy band description of n-type and p-type semiconductors- conductivity of extrinsic semiconductors - variation of Fermi level with temperature and impurity concentration- temperature dependence on carrier concentration - Hall effect-applications - solar cells – photodiodes

UNIT V **5 Hours**

MAGNETIC MATERIALS

Fundamental definitions -Bohr magneton- classification of dia, para and ferromagnetic materials - domain theory - hysteresis curve - soft and hard magnetic materials -energy product and its importance - anti-ferromagnetic materials - ferrites -giant magneto resistance (GMR) effect -application: Principles of Magnetic Recording- Magnetic Digital Recording- Magneto-Optic Recording

EXPERIMENT 1 **2 Hours**

Exposure to Engineering Physics Laboratory and precautionary measures

EXPERIMENT 2 **4 Hours**

Determine the wavelength of given laser source by applying the principle of diffraction

EXPERIMENT 3 **4 Hours**

Determination of acceptance angle and numerical aperture of a given fiber

EXPERIMENT 4 **4 Hours**

Evaluation of bandgap of given material using bandgap kit.

EXPERIMENT 5 **4 Hours**

Determine the V-I characteristics of a solar cell

EXPERIMENT 6 **4 Hours**

Using Hall effect, determine the nature of given material

EXPERIMENT 7 **4 Hours**

Find the refractive index of a transparent solid with the aid of travelling microscope

EXPERIMENT 8 **4 Hours**

Determination of energy loss per cycle of a ferromagnetic material using hysteresis curve

Total: 60 Hours

Reference(s)

1. Balasubramaniam, R. Callisters Materials Science and Engineering Wiley India Pvt.Ltd, 2014
2. Kasap, S.O. Principles of Electronic Materials and Devices McGraw-Hill Education,2017
3. Wahab, M.A. Solid State Physics: Structure and Properties of Materials Alpha Science International Ltd., 2017
4. Donald A. Neamen. Semiconductor Physics and Devices, McGraw-Hill, 2011
5. K. Thiyagarajan and A. K. Ghatak, LASERS: Fundamentals and Applications, Springer, USA, 2015
6. B.D. Cullity, Introduction to Magnetic Materials, Addison-Wesley

21AM203 ENGINEERING CHEMISTRY II

2 0 2 3

Course Objectives

- Classify the traditional and advanced materials used to manage heat developed in electronic devices
- Summarize the terminologies of electrochemistry and explain the applications of energy storage devices for computers
- Indicate the types, properties and applications of nanochips and carbon nanotubes used in electronic devices
- Outline sources of e-wastes and its effects on environment and its management

Course Outcomes (COs)

1. Compare the metals and alloys used as thermal management materials in electronic devices
2. Interpret the advanced thermal management materials for microelectronics and optoelectronics
3. Analyze the importance of primary, secondary batteries and fuel cells used in energy storage devices in computers
4. Identify suitable nanomaterial used for diverse applications in electronic devices
5. Select a suitable technology to manage e-wastes from various electronic devices

UNIT I **6 Hours**

THERMAL MANAGEMENT MATERIALS

Heat generation - purpose - classification of electronic packaging - types of thermal management materials - traditional thermal management materials : Metals [Cu, Al, W and Mo] - compounds [Al2O3, BeO, AlN, SiC and Kovar alloy]

UNIT II **7 Hours**

ADVANCED THERMAL MANAGEMENT MATERIALS

Alloys: W-Cu, Mo-Cu, Cu/MoCu/Cu, AlSiC, Cu/SiC and W85-Cu. Fiber-reinforced material - sandwich structure of composite - thermal management materials for microelectronics and optoelectronics: Carbon nanotubes and aluminium/diamond composites

UNIT III **7 Hours**

ENERGY STORAGE DEVICES FOR COMPUTERS

Cell - cell potential - determination of potential. Batteries - types: Primary battery [Zinc-carbon]. Secondary battery: lead-sulphur. Modern battery: lithium polymer battery and fuel cells

UNIT IV **5 Hours**

NANOMATERIALS

Nano chips - types of material - properties - applications. Carbon nanotubes - fullerene, graphene: Types and applications

UNIT V **5 Hours**

E- WASTE MANAGEMENTS

Sources - toxicity due hazardous substances - impact to environment. E-waste management- Hazardous materials recycling (Gallium and Arsenic)

EXPERIMENT 1 **8 Hours**

General introduction and Determination of thermal stability of aluminium oxide using thermo gravimetric analysis

EXPERIMENT 2 **4 Hours**

Determination of thermal stability of copper alloys using thermo gravimetric analysis

EXPERIMENT 3 **6 Hours**

Determination of single electrode potential of zinc and copper electrodes

EXPERIMENT 4 **6 Hours**

Preparation of cadmium nanoparticles and its characterization

EXPERIMENT 5 **6 Hours**

Estimation of chromium and lead content in sample solution prepared from e-waste [PCB] using spectrophotometer

Total: 60 Hours

Reference(s)

1. Ravi Kandasamy, Arun S. Mujumdar. Thermal Management of Electronic Components. Lap Lambert Academic Publishing GmbH KG, 2010.
2. Guosheng Jiang, Liyong Diao, Ken Kuang. Advanced Thermal Management Materials. Springer Science & Business Media, 2012.
3. Nihal Kularatna. Energy Storage Devices for Electronic Systems: Rechargeable Batteries and Supercapacitors. Academic Press, 2014.
4. Odne Stokke Burheim. Engineering Energy Storage. Academic Press, 2017.
5. M. S. Dresselhaus, G. Dresselhaus, P. C. Eklund. Science of Fullerenes and Carbon Nanotubes: Their Properties and Applications. Elsevier, 1996.
6. Kazuyoshi Tanaka, S. Iijima. Carbon Nanotubes and Graphene. Edition 2, Newnes, 2014.

21AM204 APPLICATION BASED PROGRAMMING IN PYTHON

2 0 2 3

Course Objectives

- Develop a basic understanding Python programming language
- Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs of that language
- Demonstrate significant experience in data structures with the Python program

Course Outcomes (COs)

1. Explain the basic concepts of Python programming
2. Implement Python programs using control statement and functions
3. Develop Python programs for the data structures String, List and Set
4. Implement Python programs for tuples and dictionaries data structures
5. Develop Python programs for files, modules and packages

UNIT I **6 Hours**

BASICS OF PYTHON PROGRAMMING AND CONTROL STATEMENTS

Introduction-Python – Object Oriented Programming –Classes , Object and Instances- Constructor, Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, Break, continue, pass; Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion.

UNIT II **6 Hours**

DATA STRUCTURES: STRINGS, LISTS, SET, TUPLES, DICTIONARIES

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, Sets: creating sets, set operations, Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries, Arrays: operations and methods

UNIT III **6 Hours**

PYTHON AND ITS LIBRARIES

Pandas: Dataframe, Operations, Index, Timeseries, plot; NumPy: Array Creation Routines, Mathematical, Statistical Functions, Arithmetic Operations- Matplotlib- pyplot, Markers, Line, Labels, Grid, Pie Charts; Scikit-learn: Modelling Process, Data Representation, Linear Modelling.

UNIT IV **6 Hours**

DATA PREPROCESSING

Scaling: Standard Scalar, MinMax Scalar, Feature Scaling; Normalization: L1 ,L2 Normalization; Binarization:Image binarization with OpenCV- NumPy, Image binarization without OpenCV, Automatic image thresholding.

UNIT V **6 Hours**

FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator, exception handling, modules, packages

EXPERIMENT 1 **2 Hours**

Programs using expressions and input and output statements.

EXPERIMENT 2 **2 Hours**

Programs using operators and built-in functions.

EXPERIMENT 3 **2 Hours**
Programs using conditional statements.

EXPERIMENT 4 **2 Hours**
Programs performing all string operations.

EXPERIMENT 5 **2 Hours**
Programs using Data Frames

EXPERIMENT 6 **2 Hours**
Programs to process data using Data Pre-processing methods

EXPERIMENT 7 **2 Hours**
Programs to perform Data Visualization

EXPERIMENT 8 **2 Hours**
Programs to perform Image binarization

EXPERIMENT 9 **2 Hours**
Programs using dictionary and set

EXPERIMENT 10 **2 Hours**
Programs to work with Tuples.

EXPERIMENT 11 **2 Hours**
Programs to perform Scaling

EXPERIMENT 12 **2 Hours**
Program to perform Normalization.

EXPERIMENT 13 **2 Hours**
Program to perform file operations

EXPERIMENT 14 **2 Hours**
Program to perform Linear Modelling

EXPERIMENT 15 **2 Hours**
Programs using modules and packages

Total: 60 Hours

Reference(s)

1. Ashok Namdev Kamthane,Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education,2018.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff Reilly Publishers, 2016
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.

21AM205 DIGITAL SYSTEM DESIGN

3 0 2 4

Course Objectives

- Understand the fundamentals of digital logic
- Understand the implementation of logic circuits.
- Analyse and design various combinational and sequential circuits.

Course Outcomes (COs)

1. Understand the boolean algebra and logic gates.
2. Design and analyze combinational circuits.
3. Implement synchronous sequential logic
4. Understand the procedures in Asynchronous sequential logic
5. Implement the design with MSI devices

UNIT I **9 Hours**

BOOLEAN ALGEBRA AND LOGIC GATES

Number systems and conversions - Boolean algebra - Minterm - Maxterm - SOP and POS forms - NAND and NOR implementation - Simplification of Boolean functions: K Map - Don"t care conditions - Five variable K map - Quine Maccluskey method - Logic gates.

UNIT II **9 Hours**

COMBINATIONAL LOGIC

Combinational circuits - Analysis procedures - Design procedures - Adders - Subtractors - Binary adder - Carry Look Ahead Adder - BCD Adder - Magnitude comparator - Code Converters - Multiplexers and Demultiplexers- Function realization using multiplexers - Decoders and encoders.

UNIT III **10 Hours**

SYNCHRONOUS SEQUENTIAL LOGIC

Sequential circuits - Flip flops - Flip Flop Conversion - Analysis procedures - Design procedures - Moore and Mealy models - State reduction and state assignment - Shift Registers - Counters.

UNIT IV **10 Hours**

ASYNCHRONOUS SEQUENTIAL LOGIC

Design of Asynchronous sequential circuits - Analysis procedure: Transition Table - Flow Table - Race Condition- stability, Design Procedure: Primitive Flow Table- Reduction- Transition Table- Race Free State Assignment- Hazards.

UNIT V **7 Hours**

DESIGN WITH MSI DEVICES

Programmable Logic Devices (PLD) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL.

FOR FURTHER READING

Design of a simple CPU - ASM charts - Hardware Description Language - RTL Design

EXPERIMENT 1 **2 Hours**
Implement Boolean Laws using Logic Gates

EXPERIMENT 2 **4 Hours**
Implement arithmetic circuits (Adder, Subtractor)

EXPERIMENT 3 **2 Hours**
Construct Code convertors (BCD, Gray, Excess -3)

EXPERIMENT 4 **4 Hours**
Construct Parity generator and parity checker

EXPERIMENT 5 **2 Hours**
Construct Magnitude comparator

EXPERIMENT 6 **4 Hours**
Demonstrate Multiplexer and Demultiplexers

EXPERIMENT 7 **2 Hours**
Function realization using multiplexers

EXPERIMENT 8 **4 Hours**
Demonstrate Encoder and Decoder

EXPERIMENT 9 **2 Hours**
Construct synchronous and Ripple counter

EXPERIMENT 10 **4 Hours**
Implement shift register (SISO, SIPO, PISO, PIPO)

Total: 75 Hours

Reference(s)

1. M.Morris Mano and Michael D Ciletti, Digital Design with an introduction to the VHDL, Pearson Education, 5th Edition, 2013
2. A Anand Kumar, Fundamentals of Digital Circuits, 3rd Edition,2014
3. Charles H.Roth, Jr., Fundamentals of Logic Design, 4th Edition, Jaico Publishing House, 2000
4. Mandal, Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
5. Donald D.Givone, Digital Principles and Design, Tata McGraw-Hill, 2003.
6. John M.Yarbrough, Digital Logic, Application & Design, Thomson, 2002.

21AM301 PROBABILITY AND STATISTICS

3 1 0 4

Course Objectives

- Understand the basic concepts of probability and the distributions with characteristics and also two-dimensional random variables.
- Apply the basic rules and theorems of probability theory to determine probabilities that help to solve engineering problems.
- Determine the expectation and variance of a random variable from its distribution.
- Learn how to formulate and test hypotheses about means, variances and proportions and to draw conclusions based on the results of statistical tests.

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in their core areas of random phenomena in their core areas.
2. Calculate the relationship of two-dimensional random variables using Correlation techniques and to study the properties of two-dimensional random variables
3. Formulate the testing of hypothesis based on different types of hypothesis.
4. Implement one-way and two-way classifications.
5. Summarize the measurements for statistical quality control.

UNIT I **9 Hours**

PROBABILITY AND RANDOM VARIABLES

Introduction to probability concepts, Types of Events, axioms, theorems, Conditional probability, Multiplication theorem, Applications. Characteristics of random variables - Discrete case, Probability Mass function, Cumulative distribution function, Applications ,Characteristics of random variables - Continuous case, , Probability density function, Cumulative distribution function, Applications, Central and Raw Moments, Expectation, variance, Applications, Moment generating function of discrete and continuous random variable

UNIT II **9 Hours**

TWO - DIMENSIONAL RANDOM VARIABLES

Joint Distributions - Marginal And Conditional Distributions - Covariance - Correlation And Linear Regression - Transformation Of Random Variables - Central Limit Theorem (For Independent And Identically Distributed Random Variables).

UNIT III **9 Hours**

TESTING OF HYPOTHESIS

Sampling Distributions - Estimation Of Parameters - Statistical Hypothesis - Large Sample Test Based On Normal Distribution For Single Mean And Difference Of Means -Tests Based On T, Chi-square And F Distributions For Mean, Variance And Proportion - Contingency Table (Test For Independent) - Goodness Of Fit.

UNIT IV **9 Hours**

DESIGN OF EXPERIMENTS

One Way And Two Way Classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - 22 Factorial Design.

UNIT V **9 Hours**

STATISTICAL QUALITY CONTROL

Control Charts for Measurements (X And R Charts) - Control Charts For Attributes (P, C And NP Charts) - Tolerance Limits - Acceptance Sampling.

Total: 60 Hours

Reference(s)

1. Devore. J.L., Probability and Statistics for Engineering and The Sciences, Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. And Ye. K., Ã¢??Probability And Statistics For Engineers And Scientists, Pearson Education, Asia , 8th Edition, 2007.
3. Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. And Srinivasan. R.A., Schaum S Outline of Theory and Problems Of Probability And Statistics, Tata McGraw Hill Edition, 2004.

21AM302 DATA STRCUTURES USING C++ **3 0 0 3**

Course Objectives

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

Course Outcomes (COs)

1. Identify the basic concept of data structure and identify the need for list data structures and its operations
2. Exemplify the concept of stacks and queues with suitable applications.
3. Classify the types of tree data structures and explain its functionalities.
4. Outline the concept of graph data structures with examples.
5. Design the algorithms for searching and sorting techniques

UNIT I **9 Hours**

OBJECTS AND CLASSES IN C++

Objects and Classes Simple Class - C++ Objects as Physical Objects - C++ Object as Data types- Constructors and Destructors- Polymorphism -Class Hierarchies-Public and Private Inheritance-Levels of Inheritance-Multiple Inheritance.

UNIT II **9 Hours**

LINEAR DATA STRUCTURES - STACKS, QUEUES

Arrays -Abstract Data Types -Stack ADT - Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT - Operations - Circular Queue - Priority Queue- deQueue -applications of queues.

UNIT III **9 Hours**

NON-LINEAR DATA STRUCTURES - TREES

Tree ADT - tree traversals - Binary Tree ADT - expression trees - applications of trees - binary search tree ADT - AVL Trees - B-Tree - Heap - Applications of heap.

UNIT IV **9 Hours**

NON-LINEAR DATA STRUCTURES - GRAPHS

Definition - Representation of Graph - Types of graph - Breadth-first traversal - Depth-first traversal - Topological Sort - Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm Kruskal's Algorithm.

UNIT V **9 Hours**

SEARCHING, SORTING AND HASHING TECHNIQUES

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort- Shell sort - Radix sort. Hashing- Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

FOR FURTHER READING

Applications of list - Red-Black trees - Splay trees- Bucket hashing - Introduction to NP Completeness

Total: 45 Hours

Reference(s)

1. Michael T. Goodrich, Roberto Tamassia, David M. Mount, Data Structures and Algorithms in C++, ISBN 978-0-470-38327-8, February 2011. Paperback, 736 pages.
2. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
3. Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia,2010.
4. Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

21AM303 PRINCIPLES OF OPERATING SYSTEM 3 0 0 3

Course Objectives

- To make the students to learn different types of operating systems along with the components and services provided.
- To understand the concept of process management and implementation of process scheduling in a multi-programming environment using scheduling algorithms.
- To provide knowledge on the structure and operations of memory management and storage management.

Course Outcomes (COs)

1. Describe the evolution of operating systems over time from primitive batch systems to sophisticated multi-user systems and implement the usage of different system calls to manage the resources.
2. Analyze the process scheduling algorithms used in a multi-programming environment and explore interprocess communication using shared memory and message passing.
3. Analyze the activities of process synchronization and deadlock towards increasing the throughput of the system.
4. Select the memory-management method for a specific system depends on the hardware design and explore the various memory management techniques of allocating memory to processes.
5. Suggest an appropriate file system and disk organizations methods for a computing and storage scenario.

UNIT I **10 Hours**

INTRODUCTION

Components of Computer System - Evolution of operating System. Operating System Components& Services: Process management -Memory Management- Storage Management - Protection & Security - Operating System Services. Computing Environments-Open source operating systems -System Calls & System programs

UNIT II **9 Hours**

PROCESS MANAGEMENT

Process Concepts: The process - Process State - Process Control Block. Process Scheduling: Scheduling Queues -Scheduler - Context Switch. Operations on Processes - Process creation - Process Termination - Cooperating Processes. InterposesCommunication.CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms.

UNIT III **9 Hours**

PROCESS SYNCHRONIZATION AND DEADLOCK

Process Synchronization: The Critical-Section Problem - Synchronization Hardware - Semaphores -Classic problems of Synchronization. Deadlock: System Model - Deadlock Characterization - Methods for handling Deadlocks –Deadlock Prevention - Deadlock avoidance - Deadlock detection - Recovery from Deadlocks.

UNIT IV **9 Hours**

MEMORY MANAGEMENT

Address Binding - Logical Versus Physical Address Space - Swapping- Contiguous Memory allocation – Fragmentation- Paging - Segmentation. Virtual Memory: Demand Paging - Page Replacement Algorithms - Allocation of frames-Thrashing.

UNIT V **8 Hours**

STORAGE MANAGEMENT

File Management: File Concept - Access Methods - Directory and Disk Structure - File System Mounting- File Sharing. File System Implementation: File system structure - Directory implementation- Allocation Methods - Free-space Management. Secondary Storage Structure: Disk Structure - Disk Scheduling - Disk Management.

FOR FURTHER READING

Case Studies: The Linux System, Windows 7, Influential Operating Systems

Total:45 Hours

Reference(s)

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. td, 2014
3. William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. Harvey M. DeitelM ,Operating Systems, Pearson Education Pvt. Ltd, 2007

21AM304 COMPUTER ORGANIZATION AND ARCHITECTURE 3 0 0 3

Course Objectives

- Understand of the basic structure and operation of a digital computer
- Impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division.
- Acquire knowledge about the diverse ways of communicating with I/O devices and standard I/O Interfaces

Course Outcomes (COs)

1. Identify the basic structure of a digital computer and instruction sets with addressing modes
2. Comprehend the arithmetic operations of binary number system.
3. Recognize the organization of the basic processing unit and examine the basic concepts of pipe-lining
4. Explicate the standard I/O interfaces and peripheral devices
5. Determine the performance of different types of memory

UNIT I **9 Hours**

STRUCTURE OF COMPUTERS

Functional units-Basic operational concepts-Bus structures-Software-performance-Memory locations and addresses- Memory operations- Instruction and instruction sequencing- Addressing modes- Basic I/O operations

UNIT II **9 Hours**

ARITHMETIC OPERATIONS

Addition and subtraction of signed numbers- Design of fast adders- Multiplication of positive numbers- Signed operand multiplication and fast multiplication-Integer division

UNIT III **11 Hours**

BASIC PROCESSING UNIT

Fundamental concepts-Execution of a complete instruction-Multiple bus organization-Hardwired Control-Microprogrammed Control-Pipelining: Basic Concepts-Data Hazards-Instruction Hazards-Influence on Instruction Sets-Data path and control consideration-Superscalar operation

UNIT IV **8 Hours**

INPUT/OUTPUT ORGANIZATION

Accessing I/O Devices-Interrupts-Memory Access-Buses-Interface circuits- Standard I/O Interfaces - Interfaces(PCI, SCSI, USB)

UNIT V **8 Hours**

MEMORY UNIT

Basic concepts-Semiconductor RAMs-ROM's-Speed-size and cost-Cache Memories-Performance Consideration-Virtual Memory-Memory Management Requirements-Secondary storage.

FOR FURTHER READING

Categories of Instruction Set Architectures (ISA)- Multistage pipelines with variable latencies- branch prediction- Very large Instruction Word (VLIW) architectures- Instruction Level Parallelism (ILP)- Examples of modern processors- Hyper threading (HT)- Simultaneous Multithreading (SMT)- Multicore chips (Chip Multiprocessing).

Total: 45 Hours

Reference(s)

1. CarlHamacher, Zvonko Vranesicand Safwat Zaky,ComputerOrganization, McGraw-Hill,Third Reprint2015
2. WilliamStallings, Computer Organization and Architecture Designing for Performance, Pearson Education,2003
3. DavidA, PattersonandJohnL, Hennessy, Computer Organization and Design: The hardware/ software interface, MorganKaufmann,4th edition, 2014.
4. John P.Hayes, Computer Architecture and Organization, McGraw Hill,3rd edition, 2002.

21AM305 DATABASE MANAGEMENT SYSTEMS 3 0 0 3

Course Objectives

- Understand the data models, conceptualize and depict a database system using E-R diagram.
- Gain knowledge on the design principles of a relational database system and SQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Course Outcomes (COs)

1. Differentiate database systems from file system by understanding the features of database system and design a ER model for a database system.
2. Develop solutions to a broad range of query and data update problems using relational algebra, relational calculus and SQL.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Compare database storage and access techniques for file organizations, indexing methods and query processing.
5. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.

UNIT I **8 Hours**

INTRODUCTION

Introduction: Database system application, purpose of database system View of Data -Database Languages-Data Storage and Querying-Database Architecture - Database design and ER model: Overview of the design process-The ER Model - Constraints - Removing redundant attributes in Entity Sets-ER Diagram - Reduction to Relational Schemas - ER Design Issues.

UNIT II **9 Hours**

RELATIONAL MODEL AND DATABASE DESIGN

Introduction to Relational Model - Formal Relational Query Languages - Introduction to SQL: Data definition-Basic structure of SQL Queries-Additional Basic operations -Set operations-Aggregate functions Nested sub queries-Intermediate SQL: Joins-Views-Integrity Constraints.

UNIT III **8 Hours**

NORMAL FORMS

Functional Dependencies - Normal Forms Based on primary Keys-General Definition of Second and Third Normal Form - Boyce Codd Normal Form - Algorithms for relational database schema design Multi valued dependencies and Fourth Normal Form.

UNIT IV **9 Hours**

DATA STORAGE AND QUERY PROCESSING

Overview of Physical Storage Media - Magnetic disk Flash storage -RAID-File and Record Organization - Indexing and Hashing: Ordered Indices - B+Tree Index File-Static Hashing -Dynamic Hashing-Query Processing: Overview-measures of Query Cost.

UNIT V **11 Hours**

TRANSACTION MANAGEMENT

Transactions: Transaction concept-Transaction Atomicity and Durability-Transaction Isolation Serializability-Transaction Isolation and Atomicity-Transaction Isolation levels-Implementation of Isolation Levels-Concurrency Control: Lock based protocols -Deadlock handling-Multiple Granularity Time stamp based protocols-Recovery system: Failure classification -Storage-Recovery and atomicity Recovery Algorithms.

Total: 45 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw Hill, 2015
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems,Pearson Education, 2008
3. Raghu Ramakrishnan, Database Management System, Tata McGraw-Hill Publishing Company, 2003 4. C.J.Date,An Introduction to Database system, Pearson Education, 2006
4. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management , Thompson Learning Course Technology, 2003

21AM306 JAVA PROGRAMMING **3 1 0 4**

Course Objectives

- Understand the basic features of OOP in Java
- Summarize the types of Inheritance supported by Java
- Recognize the multithreading process supported by Java.

Course Outcomes (COs)

1. Interpret the basic structure of Java program.
2. Implement various types of inheritance and packages under different accessibility
3. Describe the concept of interfaces, exceptions and multithreading nature of Java.
4. Develop applications in Java with database connectivity
5. Design desktop-based java applications using JSP and Spring Framework

UNIT I **9 Hours**

JAVA BASICS

The Genesis of Java - Overview of Java - Data Types, Variables, and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes. I/O Basics - Reading Console Input -Writing Console output. File - The Byte Streams - The Character Streams - Using Stream I/ O - Serialization. String Handling: Special String operations and Methods - String Buffer - Exploring java. lang: Simple type Wrappers - System - Math - Utility Classes: String Tokenizer - Date and Time

UNIT II **9 Hours**

INHERITANCE INTERFACES AND COLLECTION CLASSES

Inheritance: Basics - Using Super - Creating a Multilevel Hierarchy - Method overriding - Using Abstract Classes - Packages and Interfaces: Packages - Access Protection - Importing Packages-
Collection Interfaces -Collection Classes

UNIT III **9 Hours**

ROBUSTNESS AND CONCURRENCY

Interfaces Definitions and Implementations - Exception Handling: Types - Try and Catch - Throw -Multi-threaded Programming: Exception Handling - Exceptions Errors - Types of Exception - Control Flow in Exceptions - Use of try, catch, finally, throw, throws in Exception Handling. Creating Threads - Inter Thread Communication - Multithreading Thread creation sharing the workload among threads synchronization inter thread communication deadlock.

UNIT IV **9 Hours**

DATABASE CONNECTIVITY AND SERVLET

Accessing databases-JDBC connectivity- Introduction to servlet - Servlet life cycle – Developing and Deploying Servlets - Exploring Deployment Descriptor (web.xml) - Handling Request and Response - Session Tracking Management.

UNIT V **9 Hours**

JAVA SERVER PAGES AND SPRING

JSP Tags and Expressions - JSP Expression Language (EL) - JSP with Java Bean. Spring framework- Container concepts - Building a Sample Application

FOR FURTHER READING

JAVA Networking -Client and Server Programming

1 **1 Hour**

TUTORIAL 1

Program on Classes and Method

2 **1 Hour**

TUTORIAL 2

Implementation of Inheritance

3 **1 Hours**

TUTORIAL 3

Implementation of Interfaces and Packages

4 **2 Hours**

TUTORIAL 4

Implementation of Multithreaded Programming

5 **2 Hours**

TUTORIAL 5

Develop a program to implement String Handling Methods

6 **1 Hours**

TUTORIAL 6

Implementation of Exception handling mechanisms

7 **1 Hours**

TUTORIAL 7

Implementation of Collections Interfaces and Classes

8 **2 Hours**

TUTORIAL 8

Implementation of Servlet

9 **2 Hours**

TUTORIAL 9

Write a program to implement Java Database Connectivity

10 **2 Hours**

TUTORIAL 10

Implementation of MVC Architecture

Total: 60 Hours

Reference(s)

1. 1.Herbert Schildt, Java 2-Complete Reference, Tata Mc Graw Hill, 2015
2. Deitel & Deitel, Java How to Program, Prentice Hall of India, 2010
3. 3.Gary Cornell and Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems Press, 2008
4. Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.
5. Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu, Java Development with the Spring Framework, Wiley-India, 2012

21AM307 DATA STRUCTURES LABORATORY 0 0 4 2

Course Objectives

- Understand the principles of linear and non linear data structures.
- Build an applications using sorting and searching.

Course Outcomes (COs)

1. Implement the concept of recursion using C programs.
2. Implement C programs to illustrate linear data structures.
3. Develop C programs to implement nonlinear data structures.

1 **4 Hours**

EXPERIMENT 1

Program to Solve Tower-of-Hanoi Problem using Recursion

2 **4 Hours**

EXPERIMENT 2

a) Write a C program to implement a Stack ADT using array and write the routine for push operation which represent a function PUSH(X, S), Check for the condition whether S-full or not, if yes display the message otherwise insert the elements into the Stack. Perform POP operation which represents a function POP(S), Check for the condition whether S-Empty, if stack is empty, display the message otherwise delete an element from the Stack. Test your program with at least 5 elements and provide the output.

b)Write a C program to implement the Queue ADT using array and write the routine to enqueue an element X into queue, Check for the conditions Q-full, if yes display the message otherwise insert the data into the queue and dequeue an element from queue, check for the conditions Q-empty, if yes display the message otherwise deleting the element from the queue and display the elements from the Queue ADT. Test your program with at least 6 elements and provide the output

3 **6 Hours**

EXPERIMENT 3

Linked List Implementation of stack and queue.

4 **4 Hours**

EXPERIMENT 4

Write a function program to perform the following operations on a singly linked list
i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list iv. Arrange the list as sorted order

v. Display the elements of the list
Write a main method to demonstrate the above functionalities.

5 **4 Hours**

EXPERIMENT 5

Write a function program to perform the following operations on a doubly linked list

i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order

v. Display the elements of the list
vi Write a main method to demonstrate the above functionalities.

6 **4 Hours**

EXPERIMENT 6

Program to sort the elements in ascending order using selection sort and bubble sort

7

EXPERIMENT 7 **4 Hours**

Implementation of quick sort.

8 **4 Hours**

EXPERIMENT 8

Implementation of heap sort.

9 **4 Hours**

EXPERIMENT 9

Implementation of shell sort.

10 **4 Hours**

EXPERIMENT 10

Develop a program to perform linear and binary search.

11 **6 Hours**

EXPERIMENT 11

Program to construct an expression tree for a given expression and perform various tree traversal methods.

12 **6 Hours**

EXPERIMENT 12

Implement Prims algorithm with the following functionalities
i. Read a set of vertices minimum of six from the keyboard

ii. Get the number of edges and form the graph

iii. Find the value of each edge by using distance formula for two points.

iv. Develop a Minimum Spanning Tree for the graph

v. Find the total length of all edges.

vi Write a main method to execute the above functionalities

13 **6 Hours**

EXPERIMENT 13

Implementation of hashing technique

Total: 60 Hours

21AM308 DATABASE MANAGEMENT SYSTEMS LABORATORY

0 0 4 2

Course Objectives

- Understand the DDL, DML, TCL and DCL commands in SQL.
- Understand the design principles of a relational database system and SQL.
- Implement programs using SQL and PL/SQL.

Course Outcomes (COs)

1. Differentiate database systems from file system by understanding the features of database system and design a ER model for a database system.
2. Develop solutions to a broad range of query and data update problems using relational algebra, relational calculus and SQL.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Compare database storage and access techniques for file organization, indexing methods and Query Processing.
5. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes

1 **4 Hours**

EXPERIMENT 1

Working with SQL commands like DDL, DML, TCL, and DCL

2 **8 Hours**

EXPERIMENT 2

Performing Single- row functions and group functions in SQL.

3 **4 Hours**

EXPERIMENT 3

Execute simple queries using joins and Integrity constraints.

4 **8 Hours**

EXPERIMENT 4

Creation and manipulation of database objects.

5 **4 Hours**

EXPERIMENT 5

Simple programs using PL/SQL block.

6 **8 Hours**

EXPERIMENT 6

Implementation of cursor in PL/SQL block.

7 **8 Hours**

EXPERIMENT 7

Generate trigger in PL/SQL block.

8 **8 Hours**

EXPERIMENT 8

Write PL/SQL block Programs using exception handling.

9 **8 Hours**

EXPERIMENT 9

Design a PL/SQL blocks using subprograms namely functions and procedures

Reference(s) **Total: 60 Hours**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw - Hill, 2015
2. C.J.Date,An Introduction to Database system, Pearson Education, 2006

18GE301 SOFT SKILLS - VERBAL ABILITY **0 0 2 0**

Course Objectives

- To help students gain adequate proficiency in vocabulary
- To read and understand unabridged text
- To help students become proficient in basic writing skills related to work place communication

Course Outcomes (COs)

1. Take up verbal ability part of the placement tests with confidence
2. Write with confidence in professional and workplace communication
3. Distinguish fact from opinion by reading passages from a text

UNIT I **15 Hours**

INTRODUCTION

Synonyms - Antonyms - Word Groups - Verbal Analogies - Etymology - Critical Reasoning - Cloze Test - One Word Substitution - Idioms and Phrases - Text & Paragraph Completion.

UNIT II **15 Hours**

BASICS OF VERBAL APTITUDE

Sentence Formation - Paragraph Formation - Change of Voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors -Homophones Homonyms - Commonly Mispronounced/Misspelt Words.

Total: 30 Hours

Reference(s)

1. Murphy, Raymond. English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English. IV Edition. United Kingdom: Cambridge University Press. 2012.
2. Lewis, Norman. Word Power Made Easy. New York: Pocket Books. 1991.
3. Baron"s The Official Guide for New GMAT Review, New Jersey: John Wiley & Sons, Inc. 2015.

21AM401 MATHEMATICS FOR MACHINE LEARNING 3 1 0 4

Course Objectives

- Enhancing the basic understanding of Application of Mathematics in Computer Science.
- Imparting design thinking capability to build ML systems
- Developing design skills of models for machine learning problems

Course Outcomes (COs)

1. Represent the different forms of coordinate system in complex plane and characteristics of linear systems.
2. Analyse various types of functions and their differentiation techniques involved in Machine Learning
3. Implement different types of correlation.
4. Analyse the suitable classical optimization techniques for solving real world problems.
5. Apply the concept of LPP models for optimizing the real scenario.

UNIT I **9 Hours**

VECTOR SPACES

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT II **9 Hours**

LINEAR TRANSFORMATION AND DIAGONALIZATION

Linear transformation – Null spaces and ranges – Dimension theorem – Matrix representation of a linear transformations – Eigenvalues and eigenvectors – Diagonalizability.

UNIT III **9 Hours**

REGRESSION

Correlation and Regression, types of correlation – Pearson's, Spearman's correlations –Ordinary Least Squares, Fitting a regression line, logistic regression, Rank Correlation- Partial and Multiple correlation- Multiple regression, multi-collinearity.

UNIT IV

CLASSICAL OPTIMIZATION USING DIFFERENTIAL CALCULUS **9 Hours**

Single variable and multivariable optimization with & without Constraints, Langrangian theory, Kuhn Tucker conditions.

UNIT V

OPTIMIZATION USING LINEAR PROGRAMMING **9 Hours**

Simplex method, Two phase method and duality in linear programming. Application of linear programming: Transportation and Assignment problems.

Total: 60 Hours

Reference(s)

1. Gilbert Strang, Introduction to linear algebra, Fifth Edition, ANE Books, 2016.
2. Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd Edition, Elsevier, 2004.
3. Kuldeep Singh -Engineering Mathematics Through Applications 2nd ed. Edition,Palgrave macmillan, 2011

4. Ross Baldick -Applied Optimization: Formulation and Algorithms for Engineering Systems 1st Edition,Cambridge University Press,2013
5. Hamdy A . Taha, Operations Research, Eighth Edition, Pearson, Prentice hall of India, 2007

21AM402 DESIGN AND ANALYSIS OF ALGORITHMS

3 1 0 4

Course Objectives

- Identify various algorithm design techniques
- Impart knowledge on runtime analysis of algorithms
- Empathize the limits of computation.

Course Outcomes (COs)

1. Classify the fundamentals of Algorithmic problem solving methods based on Data Structures
2. Analyze the algorithm efficiency by means of mathematical notations
3. Develop different types of sorting and searching algorithms.
4. Analyze the different techniques in the design of Graph Algorithms
5. Differentiate algorithms design techniques of NP complete with NP hard problems

UNIT I **7 Hours**

INTRODUCTION

Introduction Fundamentals of Algorithmic Problem Solving Important Problem types: Sorting problem-searching problems - string processing - graph problems - combinatorial problems- Geometric Problems - Numerical problems Fundamental Data structures-Trees and Graphs.

UNIT II **9 Hours**

FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY

Analysis Framework - Asymptotic notations - Basic Efficiency classes - Mathematical Analysis of Non-recursive Algorithm - Mathematical Analysis of Recursive Algorithm - Example: Fibonacci Numbers - Empirical Analysis of Algorithms-Algorithm visualization

UNIT III **10 Hours**

ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

Brute Force Strategy: Selection Sort and Bubble Sort, Sequential Search and Brute-force string matching - Divide and conquer: Merge sort, Quick Sort, Binary Search, Binary tree Traversal and Related Properties Decrease and Conquer: Insertion Sort, Depth first Search and Breadth First Search-Pair and Convex-Hull

UNIT IV **10 Hours**

ANALYSIS OF GRAPH ALGORITHMS

Transform and conquer: Presorting, Balanced Search trees AVL Trees, Heaps and Heap sort Dynamic Programming: Warshalls and Floyd Algorithm, Optimal Binary Search trees Greedy Technique: Prims Algorithm, Kruskals Algorithm, Dijkstra Algorithm Huffman trees-The Simplex Method-The Maximum-Flow Problem Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V **9 Hours**

ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS

NP Complete problems Backtracking: n-Queens Problem Hamiltonian Circuit problem Subset-Sum problem Branch and bound: Assignment problem, Knapsack problem Traveling salesman problem-Approximation algorithms for NP hard problems: Travelling salesman and knapsack problem-Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations.

Total: 60 Hours

References

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt.Ltd., 2009

21AM403 INTERNET AND WEB PROGRAMMING

3 1 0 4

Course Objectives

- Understand the scripting languages XHTML, JavaScript and PHP.
- Familiar with the different server technologies.
- Gain knowledge in the concepts of web services.

Course Outcomes (COs)

1. Demonstrate the technologies used to create web pages.
2. Design dynamic and interactive web pages by embedding Java Script in XHTML.
3. Implement server side programming and build web applications using PHP.
4. Develop interactive web applications using ASP.Net.
5. Explain web services and its technologies

UNIT I **10 Hours**

INTRODUCTION TO WEB AND XHTML

Introduction - Blogging - Social Networking - Social media - Tagging - Software development - Introduction to XHTML and Editing XHTML Headings - Linking – Images- Special characters and Horizon rules - Lists - Tables - Forms -Internal Linking- Meta Elements- Cascading Style Sheets.

UNIT II **10 Hours**

JAVASCRIPT

Introduction to scripting - Control statements I, II - Functions: Definition - Random Number Generation - Global function - Recursion - Arrays: Declaring and allocating arrays Multidimensional arrays - Objects:Math object - String object - Date object - Boolean, Number object - Document object - Window object- Events.

UNIT III **8 Hours**

INTERNET APPLICATION SERVER TECHNOLOGIES

Web server (IIS and Apache): Multitier Architecture - Client/ Server side scripting - Accessing web services - Microsoft IIS - Apache HTTP server - Database: Relational database - SQL - PHP: Basics - String and Form Processing - connecting to database.

UNIT IV **9 Hours**

ASP .NET AND JSP WEB APPLICATIONS

Introduction - creating and running a simple web form - Web controls - session tracking - case study: Connecting to a database in ASP.NET. - Introduction to AJAX- AJAX XML Http request- AJAX Events- Java web technologies(Servlets, JSP)-creating and running a simple application in Netbeans-JSF components.

UNIT V **8 Hours**

WEB SERVICES

Introduction - Java web services Basics - Creating Publishing, Testing and describing web service - Consuming web service - SOAP - Session Tracking in web services - Consuming a Database driven web service from a web application - Passing an object of a User defined type to a web service

Total: 60 Hours

FOR FURTHER READING

Introduction - Java web technologies - Creating and running a simple application in Netbeans – JSF components - Session tracking: cookies

Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2. Deitel, Deitel and Nieto, Internet and World Wide Web How to Program, Pearson Education,2002.
3. Uttam K.Roy, Web Technologies, Oxford University Press, 2010.
4. Rajkamal, Web Technology, Tata McGraw-Hill, 2009.
5. www.w3schools.com/ajax.

21AM404 COMPUTER NETWORKS

3 0 0 3

Course Objectives

- Understand the concepts of computer networks and to study the functions of different layers.
- Familiarized with different protocols and network components.
- Understand the implementation of network management protocol.

Course Outcomes (COs)

1. Explain the fundamentals of networking.
2. Explore the Data link Layer and Network layer.
3. Elucidate the High Performance Networks.
4. Exemplify the SNMP and Network Management.
5. Illustrate the RMON and Telecommunication Network Management.

UNIT I **9Hours**

FOUNDATIONS OF NETWORKING

Data communication networks - Protocols and standards -OSI model - Layers in OSI -TCP/IP protocol suite Addressing. Physical layer and Media-analog and digital-transmission impairment-data rate limits-performance

UNIT II **9 Hours**

DATA LINK LAYER AND NETWORK LAYER

Wireless LANs-IEEE 802.11- Bluetooth-Connecting Devices-Backbone Networks-Virtual LANs - IPv4 - IPv6- Transition from IPv4 to IPv6 -Address mapping - ICMP-ICMPv6 -Congestion control: open-loop and Closed-loop Congestion control.

UNIT III **9 Hours**

HIGH PERFORMANCE NETWORKS

Optical Networks: Optical links-WDM System-Optical cross connects-Optical LANs-Optical paths and networks-Switching: Switching performance measures-Modular switch design-packet Switching.

UNIT IV **9 Hours**

SNMP AND NETWORK MANAGEMENT

Network Monitoring-Architecture-Performance-Fault-Accounting - Network Control- Network Management concepts- Network Management Information - Standard MIBs - Simple Network Management Protocol

UNIT V **9 Hours**

RMON AND TELECOMMUNICATION NETWORK MANAGEMENT

Remote monitoring - RMON SMI and MIB - RMON1 - RMON2-ATM Remote monitoring- TMN -TMN conceptual model-TMN architecture - TMN management service architecture- TMN integrated view

Total: 45 Hours

Reference(s)

1. Behrouz A. Forouzan, "Data Communication and Networking",Fourth Edition,Tata McGraw Hill,2007.
2. Mani Subramanium , "Network Management Principles and practices",Pearson Education,2010
3. Jean Warland and Pravin Vareya, "High Performance Networks", Morgan Kauffman Publishers,2002
4. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach",MorganKaufman Publishers, 2007
5. 5. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON1 and RMON2", Third Edition,Pearson Education,2002
6. Lakshmi G. Raman, " Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999

21AM405 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

3 0 0 3

Course Objectives

- To impart artificial intelligence principles, techniques and its history
- To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
- To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes (COs)

1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3. Demonstrate knowledge of reasoning and knowledge representation for solving realworld problems
4. Analyze and illustrate how search algorithms play vital role in problem solving
5. Illustrate the construction of learning and expert system 6. Discuss current scope and limitations of AI and societal implications.

UNIT I **9 Hours**

IODUCTION TO ARTIFICIAL INTELLIGENCE

Definitions of AI - Intelligent Agents. Problem solving by searching: Problem-solving agents- Example problems -Search for solutions Uninformed search strategies- Informed search strategies- Heuristic functions.

UNIT II **9 Hours**

OVERVIEW TO PROBLEM SOLVING

Problem solving by Search, Problem space - State space, Blind Search - Types, Performance measurement- Heuristic Search Types, Game playing mini-max algorithm, Alpha-Beta Pruning.

UNIT III

KNOWLEDGE REPRESENTATION AND REASONNG **9 Hours**

Logical systems Knowledge Based systems, Propositional Logic Constraints, Predicate Logic First Order Logic, Inference in First Order Logic, Ontological Representations and applications

UNIT IV

UNCERTAINITY AND KNOWLEDGE REASONING **9 Hours**

Overview Definition of uncertainty, Bayes Rule Inference, Belief Network, Utility Based System, Decision Network

9 Hours

UNIT V

EXPERT SYSTEMS

Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems - Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems

Total: 45 Hours

FOR FURTHER READING

Reinforcement Learning

Reference(s)

1. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw
2. Hill. 2. Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem
3. Solving, 6th edition, Pearson. 3. Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
4. Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition, MIT Press.
5. Sutton R.S. and Barto, A.G. 1998. Reinforcement Learning: An Introduction, MIT Press.

21AM406 APPLIED MACHINE LEARNING

3 0 0 3

Course Objectives:

·To introduce students to the basic concepts and techniques of Machine Learning.
·To have a thorough understanding of the Supervised and Unsupervised learning techniques
· To study the various probability-based learning techniques
· To understand graphical models of machine learning algorithms

Course Outcomes (COs)

1. Recognize the characteristics of machine learning that makes it useful to solve real-world problems.
2. Provide solution for classification and regression approaches in real-world applications.
3. Gain knowledge to combine machine learning models to achieve better results.
4. Choose an appropriate clustering technique to solve real world problems.
5. Realize methods to reduce the dimension of the dataset used in machine learning algorithms.
6. Choose a suitable machine learning model, implement and examine the performance of the chosen model for a given real world problems.
7. Understand cutting edge technologies related to machine learning applications.

UNIT I **9 Hours**

INTRODUCTION

Learning – Types of Machine Learning – Supervised -Unsupervised Learning – Regression basics-Relationship between attributes using Covariance and Correlation-Relationship between multiple variables-Regression -Linear-Multivariate in prediction-Residual Analysis-Identifying significant features-feature reduction using AIC- multi-collinearity- Non-normality and Heteroscedasticity-Hypothesis testing of Regression Model-Confidence intervals of Slope,R-square and goodness of fit,Influential Observations – Leverage

UNIT II **9 Hours**

CLASSIFICATION

Naive Bayes Classifier -Model Assumptions, Probability Estimation-Required data processing- M-estimates, Feature selection- -K-Nearest Neighbor algorithm- Aspects to consider while designing K-Nearest Neighbor-Support Vector Machines-Linear learning machines and Kernel space, Making Kernels and working in feature space-Decision Trees- ID4, C4.5, CART

UNIT III **9 Hours**

CLUSTERING

Distance measures-Different clustering methods -Distance-Density-Hierarchical-Iterative distance-based clustering-Dealing with continuous, categorical values in K-Means-Constructing a hierarchical cluster-K-Medoids, k-Mode and density-based clustering-Measures of quality of clustering

UNIT IV **9 Hours**

ASSOCIATION RULE MINING

The applications of Association Rule Mining- Market Basket, Recommendation Engines-A mathematical model for association analysis for large item set- Association Rules-Apriori- Constructs large item sets with mini sup by iterations-Interestingness of discovered association-rules-Application examples- Association analysis vs. classification-FP-trees

UNIT V **9 Hours**

GRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Total: 45 Hours

Reference(s)

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014
3. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014

21AM407 MACHINE LEARNING LABORATORIES

Course Objectives **0 0 4 2**

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice

Course Outcomes (COs)

1. Implement machine learning algorithms using Python.
2. Solve machine learning and problems relevant to machine learning.

1 **6 Hours**

EXPERIMENT 1

Implement and demonstrate the Liner Regression algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.

2 **6 Hours**

EXPERIMENT 2

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Multivariate Regression algorithm to output a description of the set of all hypotheses consistent with the training examples

3 **6 Hours**

EXPERIMENT 3

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

4 **6 Hours**

EXPERIMENT 4

Write a program to demonstrate the working of the K Nearest Neighbor algorithm. Use an appropriate data set to apply classification technique.

5 **6 Hours**

EXPERIMENT 5

Write a program to demonstrate the working of the Support Vector Machines algorithm. Use an appropriate data set to apply classification technique.

6 **6 Hours**

EXPERIMENT 6

Write a program to demonstrate the working of the K-Means algorithm. Use an appropriate data set to apply clustering technique.

7 **6 Hours**

EXPERIMENT 7

Write a program to demonstrate the working of the K-Medoids algorithm. Use an appropriate data set to apply clustering technique.

8 **6 Hours**

EXPERIMENT 8

Write a program to demonstrate the working of the FP Tree algorithm. Use an appropriate data set to determine association rules.

9 **6 Hours**

EXPERIMENT 9

Write a program to demonstrate the working of the Bayesian Network model. Use an appropriate data set for building the graph model.

10 **6 Hours**

EXPERIMENT 10

Write a program to demonstrate the working of the Markov Model for encoding Joint Probability Distribution. Use an appropriate data set for building the graph model.

Total: 60 Hours

21AM408 ARTIFICIAL INTELLIGENCE LABORATORY

0 0 4 2

Course Objectives

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice

Course Outcomes (COs)

1. Implement the algorithms using C /Java or Python.
2. Solve machine learning and problems relevant to machine learning.

1 **6 Hours**

EXPERIMENT 1

Implement the Logic Programming for solving N-Queen problem

2 **6 Hours**

EXPERIMENT 2

Implement the Logic Programming for solving Zebra puzzle

3 **6 Hours**

EXPERIMENT 3

A magic square is an arrangement of distinct numbers, generally integers, in a square grid, where the numbers in each row, and in each column, and the numbers in the diagonal, all add up to the same number called the "magic constant".

Implement Heuristic Search to generate Magic squares

4 **6 Hours**

EXPERIMENT 4

Build a Bot to Play Tic Tac Toe gaming problem

5 **6 Hours**

EXPERIMENT 5

Implement Bayes Inference Rule to a problem of drug screening (mandatory testing for federal or many other jobs which promise a drug-free work environment). Suppose that a test for using a particular drug is 97% sensitive and 95% specific. That is, the test will produce 97% true positive results for drug users and 95% true negative results for non-drug users. These are the pieces of data that any screening test will have from their history of tests. Bayes' rule allows us to use this kind of data-driven knowledge to calculate the final probability.

6 **6 Hours**

EXPERIMENT 6

Harry installed a new burglar alarm at his home to detect burglary. The alarm reliably responds at detecting a burglary but also responds for minor earthquakes. Harry has two neighbors David and Sophia, who have taken a responsibility to inform Harry at work when they hear the alarm. David always calls Harry when he

hears the alarm, but sometimes he got confused with the phone ringing and calls at that time too. On the other hand, Sophia likes to listen to high music, so sometimes she misses to hear the alarm. Here we would like to compute the probability of Burglary Alarm.

Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called the Harry using Bayes Belief Networks

7 **6 Hours**

EXPERIMENT 7

Text is the most unstructured form of all the available data, various types of noise are present in it and the data is not readily analyzable without any pre-processing. The entire process of cleaning and standardization of text, making it noise-free and ready for analysis is known as text preprocessing.

Implement Noise Removal, Lexicon Normalization and Object Standardization

8 **6 Hours**

EXPERIMENT 8

Count or Density based features can also be used in models and analysis. These features might seem trivial but shows a great impact in learning models. Some of the features are: Word Count, Sentence Count, Punctuation Counts and Industry specific word counts. Other types of measures include readability measures such as syllable counts, smog index and flesch reading ease. Refer to Textstat library to create such features.A. Term Frequency – Inverse Document Frequency .

Implement the concept of determining Term Frequency for a sample data set.

9 **6 Hours**

EXPERIMENT 9

Text classification is one of the classical problem of NLP. Notorious examples include – Email Spam Identification, topic classification of news, sentiment classification and organization of web pages by search engines.

Text classification, in common words is defined as a technique to systematically classify a text object (document or sentence) in one of the fixed category. It is really helpful when the amount of data is too large, especially for organizing, information filtering, and storage purposes.

Implement the concept of Text classification for a sample data set.

10 **6 Hours**

EXPERIMENT 10

Total: 60 Hours

Markov models are a useful class of models for sequential-type of data. Before recurrent neural networks (which can be thought of as an upgraded Markov model) came along, Markov Models and their variants were *the in thing* for processing time series and biological data.
Implement Markov models for a sample data set.

21AM501 INTELLIGENT MULTI AGENT AND EXPERT SYSTEMS

3 0 0 3

Course Objectives

- To explain and describe the concepts central to the creation of knowledge based and expert systems.
- To know methods used to evaluate the performance of an expert system.
- To conduct an in-depth examination of an existing expert system with an emphasis on basic methods of creating a knowledge base.
- To examine properties of existing systems in a case-study manner, comparing differing approaches.

Course Outcomes (COs)

1. Describe the modern view of AI as the study of agents that receive precepts from the Environment and perform actions.
2. Demonstrate awareness of informed search and exploration methods.
3. Explain about AI techniques for knowledge representation, planning and uncertainty Management.
4. Develop knowledge of decision making and learning methods.
5. Describe the use of AI to solve English Communication problems.

UNIT I **9 Hours**

INTRODUCTION TO EXPERT SYSTEMS

Introduction to AI: Intelligent agents – Perception –Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies. Multi-Agent Learning, Meta-learning.

UNIT II **9 Hours**

KNOWLEDGE AND REASONING

Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.

UNIT III **9 Hours**

LOGIC SYSTEMS

Trees, lattices, and graphs, state and problem spaces, AND-OR trees and goals, methods of inference, rules of inference, limitations of propositional logic, logic systems, resolution rule of inference, resolution systems, and deduction, shallow and causal reasoning, applying resolution to first-order predicate logic, forward and backward chaining, additional methods of reference, Meta knowledge, the Markov decision process.

UNIT IV **9 Hours**

PLANNING AND LEARNING

Planning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains – Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.

UNIT V **9 Hours**

EXPERT SYSTEMS

Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.

Total: 45 Hours

Reference(s)

1. J.Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004.
2. Durkin, J., Expert systems Design and Development, Macmillan, 1994 2. Elias M. Awad, Building Expert Systems, West Publishing Company 1996
3. Peter Jackson, Introduction to Expert Systems, Addison Wesley Longman, 1999.ISBN 0- 20187686-8.
4. Gonzalez and D. Dankel, "The Engineering of Knowledge-Based Systems", Prentice Hall, 1994.
5. Nikolopoulos, "Expert Systems", Marcel Dekker Inc. 1997. ISBN 0 8247 9927 5

21AM502 BIG DATA TECHNOLGIES

3 0 0 3

Course Objectives

- Understand the basic ideas of Big Data
- Analyze the data analytics life cycle and methodology.
- Design unstructured data analytics

Course Outcomes (COs)

1. Demonstrate the concepts and applications of big data
2. Create and Manage data using NoSQL databases.
3. Develop the basic idea of the Hadoop and HDFS
4. Implement programs using Map reduce concepts
5. Design machine learning techniques to resolve the issue by Hadoop related tools.

UNIT I **10 Hours**

UNDERSTANDING BIG DATA

Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System ,Grid Computing, Volunteer Computing- unstructured data - industry examples of big data- web analytics- big data and marketing -fraud and big data - risk and big data - credit risk management- big data and algorithmic trading - big data and healthcare - big data in medicine- advertising and big data - big data technologies -introduction to Hadoop - open source technologies

UNIT II **7 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL- aggregate data models- aggregates -key-value and document data models relationships- graph databases-schema less databases-materialized views-distribution models -sharding - version - Map reduce- partitioning and combining -composing map-reduce calculations

UNIT III **8 Hours**

BASICS OF HADOOP

Data format - analyzing data with Hadoop-scaling out-Hadoop streaming- Hadoop pipes- design of Hadoop distributed file system (HDFS)- HDFS concepts-Java interface- data flow-Hadoop I/O -data integrity -compression-serialization

UNIT IV **10 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows - unit tests with MR Unit -test data and local tests - anatomy of MapReduce job run - classic Map-reduce - YARN- failures in classic Map-reduce and YARN - job scheduling -shuffle and sort - task execution - MapReduce types -input formats -output formats

UNIT V **10 Hours**

HADOOP RELATED TOOLS

Hbase- data model and implementations- Hbase clients - Hbase examples -praxis. Cassandra-cassandra data model- cassandra examples- cassandra clients -Hadoop integration. Pig - Grunt - pigdata model- Pig Latin -developing and testing Pig Latin scripts. Hive - data types and file formats -HiveQL data definition- HiveQL data manipulation -HiveQL queries

FOR FURTHER READING

Cloud and big data - mobile business intelligence - Crowd sourcing analytics - inter and Trans firewall analytics

Total: 45 Hours

Reference(s)

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013

21AM503 CLOUD COMPUTING

Course Objectives **3 0 0 3**

- Familiarize students with the practical aspects of IaaS (Infrastructure as a Service) cloud computing model
- Familiarize students with the installation and configuration procedure of compute, storage and networking components of openstack platform for establishing enterprise private cloud
- Familiarize students with python programming environment enable them to analyze openstack source code from github

Course Outcomes (COs)

1. Design the basic environment required for openstack implementation and configure keystone service for authentication and glance service for managing cloud VM images authentication and glance service for managing cloud VM images.
2. Install and configure compute service and neutron service for creating IaaS cloud platform.
3. Manage cloud resources and deliver virtual machines to end users through dashboard and CLI commands.
4. Configure block storage service, object storage service for data storage requirements.
5. Configure metering service for managing private cloud environment metering service for managing private cloud environment.

UNIT I **9 Hours**

BASIC ENVIRONMENT

Introduction to Cloud Computing - Openstack Architecture - Basic Requirements - Configuring Identity service - Configuring keystone and its dataset - Image service - Managing Glance

UNIT II **9 Hours**

COMPUTE AND NETWORK MANAGEMENT

Compute service - Installing Nova with its API - Managing security groups - Networking service - Managing neutron services - VLAN Manager networking

UNIT III **9 Hours**

DASHBOARD MANAGEMENT

Dashboard Service - Horizon Installation - GUI Management and Maintenance - creating network - flavor creation - Resource usage monitoring

UNIT IV **9 Hours**

STORAGE MANAGEMENT

Block Storage vs Object Storage - Installation and configuration of cinder - attach volume to VM instances - Configure booting from volume - Installation and configuration of swift - java api integration

UNIT V **9 Hours**

VM MANAGEMENT

Orchestration service - Telemetry service- Launch VM instances

FURTHER READING

Google File System(GFS)- Hadoop Distributed File System(HDFS)

Total: 45 Hours

Reference(s)

1. Dan Radez, "OpenStack Essentials", PackT publishing, 2015
2. Omar Khedhar, "Mastering Openstack", PackT Publishing, 2015
3. docs.openstack.org
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Alan Gates, "Programming Pig", O'Reilley, 2011.

21AM504 DEEP LEARNING

3 0 0 3

Course Objectives

- To understand the theoretical foundations, algorithms and methodologies of Machine Learning Algorithms
- To design and develop an application using specific deep learning models
- To provide the practical knowledge in handling and analysing real world applications.

Course Outcomes (COs)

1. Apply the Basic fundamentals of Machine Learning Algorithms to solve real world problems
2. Apply the Deep Learning Architectures to classify the unstructured data.
3. Analyze the Convolutional Neural Networks and transfer learning models to obtain an optimal solution
4. Build a Recurrent Neural Networks, Recursive Nets models and classify the given inputs with reduced cost and time
5. Design a model using Autoencoders and Generative models for image generation

UNIT I **10 Hours**

MACHINE LEARNING BASICS

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Basic Machine Learning Algorithms: Naïve Bayes, Support Vector Machine, Decision Tree, Random Forest, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants stochastic gradient decent, Curse of Dimensionality.

UNIT II **9 Hours**

DEEP LEARNING ARCHITECTURES

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

UNIT III **9 Hours**

CONVOLUTIONAL NEURAL NETWORKS AND TRANSFER LEARNING

Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet – Applications-Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

UNIT IV **8 Hours**

SEQUENCE MODELLING – RECURRENT AND RECURSIVE NETS

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short-Term Memory Networks, Neural style transfer in Keras.

UNIT V **9 Hours**

AUTOENCODERS AND DEEP GENERATIVE MODELS

Under complete Auto encoder, Regularized Autoencoder, stochastic Encoders and Decoders, Contractive Encoders - Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversial Networks.

FOR FURTHER READING

Sentiment Analysis using RNN, Image Generation, Digital Twins, Recommendation Systems

Total : 45 Hours

Reference(s)

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
5. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
6. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow".
7. Explore neural networks with Python", Packt Publisher, 2017. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.

21AM507 DEEP LEARNING LABORATORY **0 0 4 2**

Course objectives

- Understand complexity of Deep Learning algorithms and their limitations
- Understand modern notions in data analysis oriented computing;
- Be capable of confidently applying common Deep Learning algorithms in practice and implementing their own;
- Be capable of performing distributed computations;
- Be capable of performing experiments in Deep Learning using real-world data

Course Outcomes (COs)

1. Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline
2. Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
3. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
4. Build deep learning models in TensorFlow and interpret the results
5. Understand the language and fundamental concepts of artificial neural networks

1

EXPERIMENT 1 **4 Hours**

Experiment with Random Forest, Neural Networks Multilayer Perceptron,
Back-propagation algorithm

2 **8 Hours**

EXPERIMENT 2

Experiment with Neural Networks, Activation Functions: RELU, LRELU, ERELU

3 **4 Hours**

EXPERIMENT 3

Experiment with CNN Architectures: ResNet, AlexNet

4 **8 Hours**

EXPERIMENT 4

Experiment with Recurrent Neural Networks

5 **4 Hours**

EXPERIMENT 5

Experiment with Recurrent Neural Networks

6 **8 Hours**

EXPERIMENT 6

Experiment with Long Short-Term Memory Networks.

7 **8 Hours**

EXPERIMENT 7

Experiment with Neural style transfer in Keras

8 **8 Hours**

EXPERIMENT 8

Experiment with Autoencoder, stochastic Encoders and Decoders, Contractive Encoders

9 **8 Hours**

EXPERIMENT 9

Experiment with Deep Belief networks

Reference(s) **Total: 60 Hours**

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
5. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.

21AM508 CLOUD COMPUTING LABORATORY 0 0 4 2

Course Objectives

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

Course Outcomes (COs)

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment.

1 **8 Hours**

EXPERIMENT 1

Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

2 **8 Hours**

EXPERIMENT 2

Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3 **8 Hours**

EXPERIMENT 3

Install Google App Engine. Create hello world app and other simple web applications using python/java.

4 **7 Hours**

EXPERIMENT 4

Use GAE launcher to launch the web applications.

5 **7 Hours**

EXPERIMENT 5

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

6 **7 Hours**

EXPERIMENT 6

Find a procedure to transfer the files from one virtual machine to another virtual machine.

7 **7 Hours**

EXPERIMENT 7

Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

8 **8 Hours**

EXPERIMENT 8

Install Hadoop single node cluster and run simple applications like wordcount.

Total: 60 Hours

Reference(s)

1. Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2009.
2. Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies, Wiley India, 2009.
3. Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.

21AM601 COMPUTER VISION

Course Objectives **3 0 0 3**

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To understand motion analysis.
- To study some applications of computer vision algorithms.

Course Outcomes (COs)

1. Implement fundamental image processing techniques required for computer vision.
2. Perform shape analysis.
3. Implement boundary tracking techniques.
4. Apply chain codes and other region descriptors.
5. Apply Hough Transform for line, circle, and ellipse detections.
6. Apply 3D vision techniques.
7. Implement motion related techniques.
8. Develop applications using computer vision techniques

UNIT I **9 Hours**

IMAGE PROCESSING FOUNDATIONS

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II **9 Hours**

SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

UNIT III **9 Hours**

HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

UNIT IV **9 Hours**

3D VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V **9 Hours**

APPLICATIONS

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Total: 45 Hours

Reference(s)

1. E. H. Adelson, E. P. Simoncelli, and W. T. Freeman, Pyramids and Multiscale Representations. In Representations of Vision , pp. 3-16, 1991.
2. K. Mikolajczyk and C. Schmid, A performance evaluation of local descriptors. In IEEE Conference on Computer Vision and Pattern Recognition, pp. 257-263, 2003.
3. J. Shi and C. Tomasi, Good Features to Track. In IEEE Conference on Computer Vision and Pattern Recognition, 1994.
4. D. G. Lowe, Distinctive Image Features from Scale-Invariant Keypoints. In International Journal of Computer Vision , 2004.
5. D. Comaniciu and P.Meer, Robust analysis of feature spaces: Color image segmentation. IEEE Conference on Computer Vision and Pattern Recognition, June 1997, 750-755.

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21AM602 REINFORCEMENT LEARNING

3 0 0 3

Course Objectives

- To acquire knowledge of basic and advanced reinforcement learning techniques.
- To Identify suitable reinforcement learning tasks
- To evaluate the current limitations of reinforcement learning techniques.
- To Formulate decision problems, set up and run computational experiments, evaluation of results from experiments.

Course Outcomes (COs)

1. Build a Reinforcement Learning system for sequential decision making.
2. Understand the space of RL algorithms
3. Understand how to formalize your task as a Reinforcement Learning problem, and how to begin implementing a solution.
4. Understand how RL fits under the broader umbrella of machine learning, and how it complements deep learning, supervised and unsupervised learning

UNIT I **9 Hours**

INTRODUCTION AND PROBABILITY PRIMER

Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT II **9 Hours**

MARKOV DECISION PROCESS

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

UNIT III **9 Hours**

PREDICTION AND CONTROL BY DYNAMIC PROGRAMING

Overiew of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evalutation and value iteration algorithms, DP extensions.

UNIT IV **9 Hours**

MONTE CARLO METHODS FOR MODEL FREE PREDICTION AND CONTROL

Overiew of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

UNIT V **9 Hours**

FUNCTION APPROXIMATION METHODS AND POLICY GRADIENTS

Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, Afterstates, Control with function approximation, Least squares, Experience replay in deep

Q-Networks.Policy Gradients-Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

Total: 45 Hours

Reference(s)

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012)
4. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach."Pearson Education Limited, 2016.

21AM603 INTELLIGENT ROBOTS AND DRONE TECHNOLOGY 3 0 0 3

Course Objectives

- To introduce basic concepts, parts of robots and types of robots
- To make the students familiar with various drive systems of robots, sensors and their applications in programming of robots
- To discuss the applications of robots, and implementations of robots

Course Outcomes (COs)

1. Explain the basic concepts of working of robot
2. Analyze the function of sensor in robot and design the robotic arm with various tools
3. Program the robot for a typical application and path planning using robotic vision
4. Understand the various robot programming languages
5. Conduct and design the experiments for various robot operations
6. Use the advanced techniques for robot processing

UNIT I **9 Hours**

INTRODUCTION

Introduction, brief history, types, classification and usage, science and technology of robots, Artificial Intelligence in Robotics, some useful websites, textbooks and research journals

UNIT II **9 Hours**

ELEMENTS OF ROBOTS-JOINTS, LINKS, ACTUATORS, AND SENSORS

Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kind of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders-tachometers-strain gauge-based force torque sensor-proximity and distance measuring sensors-and vision

UNIT III **9 Hours**

PLANNING, NAVIGATION AND VISION SYSTEM

Introduction, path planning-overview-road map path planning-cell decomposition path planning- potential field path planning-obstacle avoidance-case studies,Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations

UNIT IV **9 Hours**

ROBOT PROGRAMMING

Introduction to robot languages-VAL-RAPID-language-basic commands-motion instructions- pick and place operation using industrial robot manual mode-automatic mode-subroutine command-based programming-move master command language-introduction-syntax-simple problems

UNIT V **9 Hours**

DRONE TECHNOLOGY

Introduction to UAVs/Drones, Drone Applications, Working Principle and Design, Inertial Measurement Unit, Sensors and Calibration, PID - Implementation and Tuning, Flight controller, Remote Controller, Quadcopter dynamics-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning.

Total: 45 Hours

Reference(s)

1. Saeed B.Nikku, Introduction to Robotics, analysis, control and applications Wiley-India 2nd edition-2011
2. Industrial robotic technology-programming and application by M.P.Groover et al, McGrawhill 2008
3. Robotics technology and flexible automation by S.R. Deb, TMH2009

21AM604 NATURAL LANGUAGE PROCESSING

3 0 0 3

Course Objectives

- Understand the representation and processing of Morphology and Part-of Speech Taggers
- Express different aspects of natural language syntax and the various methods used for processing syntax
- To know about various applications of natural language processing

Course Outcomes (COs)

1. Identify the different linguistic components of given sentences.
2. Design a morphological analyzer for a language using finite state automata concepts
3. Implement a parser by providing suitable grammar and words
4. Recognize the semantic role of the sentence and implement the semantic parsing
5. Apply the machine translation and statistical translation to extract the information from the sentence

UNIT I **8 Hours**

INTRODUCTION

Natural Language Processing tasks in syntax, semantics, and pragmatics -Issues - Applications - The role of machine learning - Probability Basics -Information theory - Collocations -N-gram Language Models - Estimating parameters and smoothing - Evaluating language models

UNIT II **9 Hours**

MORPHOLOGY AND PART OF SPEECH TAGGING

Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models - Transformation based Models - Maximum Entropy Models. Conditional Random Fields

UNIT III **10 Hours**

SYNTAX PARSING

Syntax Parsing - Grammar formalisms and treebanks - Parsing with Context Free Grammars - Features and Unification -Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs

UNIT IV **10 Hours**

SEMANTIC ANALYSIS

Representing Meaning - Semantic Analysis - Lexical semantics - Word-sense disambiguation - Supervised - Dictionary based and Unsupervised Approaches - Compositional semantics- Semantic Role Labeling and Semantic Parsing - Discourse Analysis.

UNIT V **8 Hours**

APPLICATIONS

Named entity recognition and relation extraction- Information Extraction (IE) using sequence labeling- Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment- phrase-based translation - Question Answering- VXML Applications

FOR FURTHER READING

Word sense disambiguation-discourse analysis and lexical resources

Total: 45 Hours

Reference(s)

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing", Second Edition, Prentice Hall, 2014
2. Christopher D. Manning and Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", MIT Press, 2014.
3. Roland R. Hausser, "Foundations of Computational Linguistics Human- Computer Communication in Natural Language", Springer, 2014.

21AM607 NATURAL LANGUAGE PROCESSING LABORATORY

Course Objectives **0 0 4 2**

- To develop Natural Language Processing tasks
- To learn the Estimating parameters and smoothing - Evaluating language models
- To learn to implement Lexical semantics, Word-sense disambiguation, Supervised, Dictionary based and Unsupervised Approaches

Course Outcomes (COs)

1. Identify the different linguistic components of given sentences.
2. Design a morphological analyzer for a language using finite state automata concepts
3. Implement a parser by providing suitable grammar and words
4. Recognize the semantic role of the sentence and implement the semantic parsing
5. Apply the machine translation and statistical translation to extract the information from the sentence

1 **8 Hours**

EXPERIMENT 1

Experiment in semantics, and pragmatics -Issues - Applications - The role of machine learning - Probability Basics -Information theory using NLTK libary

2

EXPERIMENT 2 **8 Hours**

Experiment in Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers

3 **8 Hours**

EXPERIMENT 3

Experiment in Rule-Based Part of Speech Tagging

4 **7 Hours**

EXPERIMENT 4

Experiment in Syntax Parsing - Grammar formalisms and treebanks

5 **7 Hours**

EXPERIMENT 5

Experiment in Representing Meaning - Semantic Analysis

6 **7 Hours**

EXPERIMENT 6

Experiment in Dictionary based and Unsupervised Approaches

7 **7 Hours**

EXPERIMENT 7

Experiment in Named entity recognition and relation extraction

8 **8 Hours**

EXPERIMENT 8

Experiment in VXML Applications

Total: 60 Hours

Reference(s)

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing", Second Edition, Prentice Hall, 2014
2. Christopher D. Manning and Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", MIT Press, 2014.
3. Roland R. Hausser, "Foundations of Computational Linguistics Human- Computer Communication in Natural Language", Springer, 2014.

21AM608 COMPUTER VISION LABORATORY

0 0 4 2

Course Objectives

- To review image processing techniques for computer vision.
- To understand shape and region analysis.
- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To understand motion analysis.

Course Outcomes (COs)

1. Implement fundamental image processing techniques required for computer vision.
2. Perform shape analysis.
3. Implement boundary tracking techniques.
4. Apply chain codes and other region descriptors.
5. Apply Hough Transform for line, circle, and ellipse detections.
6. Apply 3D vision techniques.
7. Implement motion related techniques.
8. Develop applications using computer vision techniques

EXPERIMENT 1 **8 Hours**
Experiment in image processing techniques – classical filtering operations

EXPERIMENT 2 **8 Hours**
Experiment in thresholding techniques

EXPERIMENT 3 **8 Hours**
Experiment in edge detection techniques

EXPERIMENT 4 **7 Hours**
Experiment in mathematical morphology

EXPERIMENT 5 **7 Hours**
Experiment in shape models and shape recognition

EXPERIMENT 6 **7 Hours**
Experiment in Line detection

EXPERIMENT 7 **7 Hours**
Experiment in GHT for feature collation

EXPERIMENT 8 **8 Hours**
Experiment in 3D vision – projection schemes

Total: 60 Hours

Reference(s)

1. E. H. Adelson, E. P. Simoncelli, and W. T. Freeman, Pyramids and Multiscale Representations. In Representations of Vision , pp. 3-16, 1991.
2. K. Mikolajczyk and C. Schmid, A performance evaluation of local descriptors. In IEEE Conference on Computer Vision and Pattern Recognition, pp. 257-263, 2003.

3. J. Shi and C. Tomasi, Good Features to Track. In IEEE Conference on Computer Vision and Pattern Recognition, 1994.

18HS002 PROFESSIONAL ETHICS IN ENGINEERING

Course Objectives **2 0 0 2**

- To understand Human Values and ethical theory.
- To understand codes of ethics, work place responsibilities, rights, engineering experimentation, global issues and contemporary ethical issues.
- To understand personal ethics, legal ethics, cultural ethics and engineers responsibility.

Course Outcomes (COs)

1. Articulate engineering ethics theory with sustained lifelong learning.
2. Adopt a good character and follow high professional ethical life.
3. Contribute to shape a better character by following ethical actions.
4. Confront and resolve moral issues occurred during technological activities.
5. Resolve moral and ethical problems through exploration and assessment by established experiments.

UNIT I **6 Hours**

HUMAN VALUES

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others – Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment - Empathy

UNIT II **6 Hours**

ENGINEERING ETHICS AND PROFESSIONALISM

Scope of Engineering Ethics- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlbergs and Gilligan""s theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse

UNIT III **6 Hours**

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study- Bhopal Gas Tragedy - The Three Mile Island and Chernobyl

UNIT IV **6 Hours**

WORKPLACE RESPONSIBILITIES AND RIGHTS

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate Climat - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality Conflicts of interest - Occupational crime - Professional rights - Employee rights

UNIT V **6 Hours**

GLOBAL ISSUES

Multinational corporations: Technology transfer and appropriate technology - International rights romoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership

FOR FURTHER READING

Sample code of ethics like IETE,ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management.

Total: 30 Hours

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international (P)limited, New Delhi,2006.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
5. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
6. http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics

21AM702 PATTERN AND ANOMALY DETECTION

3 0 0 3

Course Objectives

- To know the fundamental algorithms for pattern recognition
- To instigate the various classification techniques
- To originate the various structural pattern recognition and feature extraction techniques

Course Outcomes (COs)

1. Apply various algorithms for pattern classifier and recognition
2. Implement the concepts of Unsupervised classification in pattern recognition
3. Analyze the structural pattern recognition and feature extraction techniques
4. Apply the feature selection and extraction in pattern recognition
5. Create the recent advances of neural network in pattern recognition

UNIT I **9 Hours**

PATTERN CLASSIFIER

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perception algorithm - LMSE algorithm - Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

UNIT II **9 Hours**

UNSUPERVISED CLASSIFICATION

Discrete and Binary classification -Techniques to directly obtain linear classifiers - Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm -Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT III **9 Hours**

STRUCTURAL PATTERN RECOGNITION

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation.

UNIT IV **9 Hours**

FEATURE EXTRACTION AND SELECTION

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation - Binary feature selection.

UNIT V **9 Hours**

RECENT ADVANCES

Neural network structures for pattern recognition - Neural network based pattern associators -Unsupervised learning in neural pattern recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers - Pattern classification using Genetic Algorithms.

FOR FURTHER READING

Multilayer, Feed forward Network Structure -Delta Rule -Generalized data rule.

Total: 45 Hours

Reference(s)

1. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O. and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

21AM703 BUSINESS ANALYTICS

3 0 0 3

Course Objectives

- Understand the role of business analytics within an organization
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making
- To become familiar with processes needed to develop, report, and analyze business data
- Use decision-making tools/Operations research techniques and Manage business process using analytical and management tools

Course Outcomes (COs)

1. Implement the knowledge of data analytics
2. Apply the ability of think critically in making decisions based on data and deep analytics.
3. Analyze the ability to use technical skills in predicative and prescriptive modeling to support business decision-making
4. Determine the ability to translate data into clear, actionable insights
5. Analyze the decision problems in business analytics

UNIT I **9 Hours**

BUSINESS ANALYTICS AND STATISTICAL TOOLS

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics-Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview

UNIT II **9 Hours**

TRENDINESS AND REGRESSION ANALYSIS

Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology

UNIT III **9 Hours**

ORGANIZATION STRUCTURES OF BUSINESS ANALYTICS

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization

UNIT IV **9 Hours**

FORECATING TECHNIQUES

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

UNIT V **9 Hours**

DECISION ANALYSIS

Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

FOR FURTHER READING

Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

Total: 45 Hours

Reference(s)

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

21AM704 KNOWLEDGE REPRESENTATION

3 0 0 3

Course Objectives

- To conceptualize the working of human brain using neural networks
- Summarize and apply the methodologies involved in solving problems related to Fuzzy Logic, Various fuzzy systems and Rough sets
- Provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation
- Develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project

Course Outcomes (COs)

1. Identify the components of soft computing and apply its technology for real time applications.
2. Use Fuzzy logic & Rough set theory for developing expert system.
3. Design of various neural networks based on supervised and unsupervised learning network.
4. Implement the concept and applications of Genetic Algorithms for real life problem.
5. Integrate the Hybrid Soft Computing Techniques for getting optimized solution.

UNIT I **9 Hours**

INTRODUCTION

Introduction to Soft Computing - Components of Soft Computing - Various types of soft computing technique, Differentiate Hard and Soft Computing, Soft Computing Constituents, Neuro Fuzzy and Soft Computing Characteristics, Evolution of neural networks- basic models important technologies application

UNIT II **9 Hours**

FUZZY LOGIC

Fuzzy set theory crisp sets fuzzy sets crisp relations Fuzzy relations Fuzzy systems- Crisp logic predicate logic fuzzy logic- fuzzy based systems-Membership functions features, fuzzification, methods of membership value assignments - Defuzzification methods applications-Fuzzy Inference Systems -Design of Fuzzy Controller- Introduction to Rough Sets-Comparisons of Fuzzy sets and rough sets

UNIT III **9 Hours**

NEURAL NETWORKS

McCulloch-Pitts neuron linear separability hebb network supervised learning network perceptron networks adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network unsupervised learning networks Kohonen self organizing feature maps, LVQ CP networks, ART network

UNIT IV **9 Hour**

GENETIC ALGORITHMS

Genetic algorithm and search space general genetic algorithm operators Generational cycle stopping condition constraints classification genetic programming multilevel optimization real life problem- advances in GA

UNIT V **9 Hours**

HYBRID SOFT COMPUTING TECHNIQUES

Neuro-fuzzy hybrid systems genetic neuro hybrid systems genetic fuzzy hybrid and fuzzy genetic hybrid systems simplified fuzzy ARTMAP Applications A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers

FOR FURTHER READING

LR type Fuzzy numbers-Fuzzy Neuron-Fuzzy BP Architecture-Learning in Fuzzy BP-Application of Fuzzy BP Networks.

Total: 45 Hours

Reference(s)

1. S.Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis & Applications, Prentice-Hall of India Pvt. Ltd., 2017.
2. S.N. Sivanandam, S.N. Deepa. Principles Of Soft Computing, 2nd Edition,Wiley Publisher,2011.
3. David E. Goldberg,Genetic Algorithm in Search Optimization and Machine Learning,Pearson Education India, 2013.
4. J.S.R.Jang, C.T. Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI / Pearson Education 2008.
5. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, 2013.

21AM707 PATTERN AND ANOMALY DETECTION LABORATORY

0 0 4 2

Course Objectives

- To know the fundamental algorithms for pattern recognition
- To instigate the various classification techniques
- To originate the various structural pattern recognition and feature extraction techniques

Course Outcomes (COs)

1. Apply various algorithms for pattern classifier and recognition
2. Implement the concepts of Unsupervised classification in pattern recognition
3. Analyze the structural pattern recognition and feature extraction techniques
4. Apply the feature selection and extraction in pattern recognition
5. Create the recent advances of neural network in pattern recognition

EXPERIMENT 1
Experiment in pattern recognition - Discriminant functions
8 Hours

EXPERIMENT 2
Experiment in Bayesian parameter estimation
8 Hours

EXPERIMENT 3
Experiment in Discrete and Binary classification
7 Hours

EXPERIMENT 4
Experiment in C-means algorithm
7 Hours

EXPERIMENT 5
Experiment in String generation as pattern description
7 Hours

EXPERIMENT 6
Experiment in Entropy minimization - Karhunen - Loeve transformation
7 Hours

EXPERIMENT 7
Experiment in Feature selection through functions approximation - Binary feature selection.
8 Hours

EXPERIMENT 8
Experiment in Neural network structures for pattern recognition

Total: 60 Hours

Reference(s)

1. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O. and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

LIST OF ELECTIVES

18HS201 COMMUNICATIVE ENGLISH II 1 0 2 2

Course Objectives

- Read and understand ideas of complex text on both concrete and abstract topics
- Listen and understand technical discussions in his/her field of specialisation
- Produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options
- Interact with a degree of fluency and spontaneity that makes regular interaction without strain

Course Outcomes (COs)

1. Use appropriate grammar and vocabulary that is expected at the BEC Vantage exam level.
2. Understand the general meaning of non-routine letters, and of a report of predictable / unpredictable topic
3. Write simple reports of factual nature and factual non-routine letters
4. Ask for factual information and understand the answer; and take/pass on workplace messages
5. Express opinions and present arguments to a limited extent; and give simple, prepared presentations on familiar topics

UNIT I **9 Hours**

GRAMMAR3

Tenses - Future continuous, Future perfect, Future perfect continuous, Past perfect, Past perfect continuous - Adjectives and adverbs - Mixed conditionals - Modals - can't have, needn't have - Modals of deduction and speculation - Narrative tenses - Passives - Phrasal verbs, extended - Relative clauses - Reported speech - Will and going to, for prediction - Wish - Would expressing habits, in the past.

UNIT II **9 Hours**

READING

Scanning and reading for gist - Understanding text structure - Reading for gist and specific information - Vocabulary and structure - Understanding sentence structure and error identification

UNIT III **9 Hours**

WRITING

A message, memo or email, Giving instructions, explaining a development, asking for comments, requesting information, agreeing to requests - Business correspondence: explaining, apologising, reassuring, complaining, short report: describing, summarising - proposal: describing, summarising, recommending, persuading.

UNIT IV **9 Hours**

LISTENING

Listening for and noting specific information - Listening to identify topic, context, Function - Following the main points and retrieving specific information from the text.

UNIT V **9 Hours**

SPEAKING

Giving personal information: Talking about present circumstances, past experiences and future plans, expressing opinions, speculating - Organising a larger unit of discourse: Giving information and expressing and justifying opinions - Turn-taking: negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing/disagreeing, suggesting, speculating, comparing and contrasting, and decision-aking. 1.A Horse and Two Goats - R K Narayan 2.My Lord the Baby - Rabindranath Tagore 3.Twist in the Tale - Jeffery Archer.4.The Third and Final Continent - Jhumpa Lahiri 5.The Gift of the Magi - O Henry

Total: 45 Hours

Reference(s)

1. Guy Brook-Hart, "BEC Vantage: Business Benchmark Upper-Intermediate- Student's Books" 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Ian Wood, Paul Sanderson, Anne Williams with Marjorie Rosenberg, "Pass Cambridge BEC Vantage- Student's Book" 2nd Edition, Cengage Learning, New Delhi, 2014
3. Michael Handford, Martin Lisboa, Almut Koester, Angela Pitt, "Business Advantage - Student's Book Upper-Intermediate" Cambridge University Press, New Delhi, 2014.
4. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE - Self-study Edition", Cambridge University Press, UK, 2005.

18HSH01 HINDI 1 0 2 2

Course Objectives

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day-to-day situations
- To help students acquire the ability to understand a simple technical text in Hindi

Course Outcomes (COs)

1. Construct simple sentences and use vocabulary required for day-to-day conversation.
2. Distinguish and understand the basic sounds of Hindi language.
3. Appear for Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha.

UNIT I **9 Hours**

Hindi Alphabet: Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

Nouns: Genders (Masculine & Feminine Nouns long vowels and short vowels - -Masculine & Feminine - Reading Exercises.

UNIT III **9 Hours**

Pronouns and Tenses: Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV **9 Hours**

Classified Vocabulary: Parts of body - Relatives - Spices - Eatables - Fruit & Vegetables - Clothes - Directions - Seasons - Professions.

UNIT V **9 Hours**

Speaking: Model Sentences and Rhymes - Speaking practice for various occasions.

Total: 45 Hours

Reference(s)

1. Hindi Prachar Vahini-1 by Dakshin Bharat Hindi Prachar Sabha Chennai
2. B.R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People,Vee Kumar Publications(P)Ltd., New Delhi,2009
3. Videos, Stories, Rhymes and Songs

18HSG01 GERMAN **1 0 2 2**

Course Objectives

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

Course Outcomes (COs)

1. listen and identify individual sounds of German
2. use basic sounds and words while speaking
3. read and understand short passages on familiar topics
4. use basic sentence structures while writing
5. understand and use basic grammar and appropriate vocabulary in completing language tasks

UNIT I **9 Hours**

Introduction to German language: Alphabet - Numbers - Greetings - Days and Seasons- Working with Dictionary.

UNIT II **9 Hours**

Nouns - articles - Speaking about one self - Listening to CD supplied with the books, paying special attention to pronunciation

UNIT III **9 Hours**

Regular & Irregular verbs - Personal pronouns - family - Introduction to types of sentences

UNIT IV **9 Hours**

Question words-Types of Questions - Nominative case- Verb Conjugation - country - nationalities

UNIT V **9 Hours**

Verbs - to be & to have - conjugation - Hobbys - Framing basic Questions and answers

Total: 45 Hours

Reference(s)

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2015

2. Langenscheidt Eurodictionary - German - English / English - German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009
3. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.

18HSJ01 JAPANESE **1 0 2 2**

Course Objectives

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquettes

Course Outcomes (COs)

1. Recognise and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

UNIT I **9 Hours**

Introduction to Japanese - Japanese script- Pronunciation of Japanese(Hiragana)- (Katakana) Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 wa N2 desu - N1 wa N2 ja arimasen - S ka N1 mo - N1 no N2 - san - Kore - Sore - Are - Kono N - Sono N - Ano N - Sou desu - Sou ja Arimasen - S1 ka - S2 ka - N1 no N2 - Sou desu ka - Koko - Soko - Asoko - Kochira - Sochira Achira - N1 wa N2 (place) desu - Doko - Dochira - N1 no N2 - Ko - So - A - Do (Demonstrative words) - O kuni Kanji10 - Technical Japanese Vocabulary (30 Numbers)

UNIT II **9 Hours**

Introduction to time - Ji - Fun - Pun - Introduction of verbs - V Masu - V Masen - V Mashita - V Masendeshita N (Time) Ni V - N1 Kara - N2 Made - N1 to N2 - S Ne - N (Place) e Ikimasu - Kimasu - Kaerimasu - Doko (e) Mo Ikimasen - Ikimasendeshita - N (Vechile) de Ikimasu - Kimasu - Kaerimasu - N (Person / Animal) to V - Itsu - S Yo N o (transitive) - N o Shimasu - Nani o Shimasuka - Nan and Nani - N (place) de V - V Masenka - V Mashou - o - Kanji 10 - Technical Japanese Vocabulary (30 Numbers) .

UNIT III **9 Hours**

N (tool/means) de V - Word/Sentence wa Go de Nani desu ka - N (person) Ni Agemasu, etc - N (person) Ni Moraimasu etc - Mou V Mashita - Introduction to Adjectives - N wa Na adj (Na) desu - N wa II adj (II) desu - Na adj Na n - II adj (II) N - Totemo - Amari - N wa Dou desuka - N1 wa Donna N2 desuka - S1 Ga S2 - Dore N ga Arimasu - Wakarimasu - N Ga Sukidesu - Kiraidesu - Jozu desu - Heta desu - Donna N - Yoku - Daitai - Takusan - Sukoshi - Amari - Zenzen - S1 kara S2 - Doushite - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT IV **9 Hours**

N ga Arimasu - Imasu - N1 (place) Ni N2 ga Arimasu - Imasu - N1 (thing/person/place) no N2 (position) - N1 ya N2 - Word (s) desuka - Chirisosu wa Arimasuka - Saying numbers - Quantifier (period) Ni kai V - Quantifier Dake - N dake - Past tense of Noun sentences and Na adjective sentences - Past tense of ii

adjective sentences - N1 wa N2 yori adjective desu - N1 to N2 to dochira ga adjective desu ka - N1/N2 no houga adjective desu - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT V **9 Hours**

N ga hoshi desu - V masu form tai desu - N (place) e V masu form - N Ni - ikimasu - kimasu - kaerimasu N ni V - N o V - dou ko ka - nani ka - go chuu mon - Verb conjugation - Verb groups - Verb te form - V te form kudasai - V te form imasu - V masu from mashouka - S1 ga S2 - N ga V - V te form mo ii desu - V te form wa ikemasen - V te form imasu Shrimasen - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

Total: 45 Hours

Text Book(s)

1. Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

Reference(s)

1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

18HSC01 CHINESE **1 0 2 2**

Course Objectives

- To help students appear for HSK Level 1 Exam
- To help students acquire the basics of Chinese language
- To teach the students how to converse in Chinese in various situations

Course Outcomes (COs)

1. listen and identify individual sounds of Chinese
2. use basic sounds and words while speaking
3. read and understand short passages on familiar topics
4. use basic sentence structures while writing
5. understand and use basic grammar and appropriate vocabulary in completing language tasks

UNIT I **9 Hours**

Hello | 1.Initials and Finals of Chinese | b,p,m,f,d,,n,l,g,k,h,j,q,x | 2. Tones Four | 3.Chinese Syllables | 4.Tone S

UNIT II **9 Hours**

Thank you | Initials and Finals of Chinese | The Neutral Tone | Rules of Tone Marking and Abbreviation

UNIT III **9 Hours**

1. What""s your name - In the school; -In the classroom; -In the school | The Interrogative Pronoun | 2 The Sentence | 3 Interrogative Sentences with

UNIT IV **9 Hours**

She is my Chinese teacher | In the library | The Interrogative Pronouns | The Structural Particle | The interrogative Particle

UNIT V **9 Hours**

Her daughter is 20 years old this year | 1.The Interrogative Pronoun | 2. Numbers below 100 | 3.Indicating a Change | The Interrogative Phrase

Total: 45 Hours

18HSF01 FRENCH **1 0 2 2**

Course Objectives

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Course Outcomes (COs)

1. To help students acquire familiarity in the French alphabet & basic vocabulary
2. listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

UNIT I **9 Hours**

ENTRER EN CONTACT

La langue francaise, alphabets, les numeros, les jours, les mois.| Grammaire Les verbes s appeler,etre, avoir, les articles definis, indefinis | Communication - Saluer, s informer sur quelquun, demander de se presenter | Lexique - Les alphabets, les nationalites, age, les pays, les couleurs, les jours de la semaine, les mois de l annee, les professions

UNIT II **9 Hours**

PARTAGER SON LIEU DE VIE

Les francais et leur habitat, des habitations insolites | Grammaire - Verbes - Conjugaison : Present (Avoir / etre / ER, IR, RE : Regulier et Irregulier) - Adjectifs les propositions de lieu | Communication - Chercher un logement, d ecrire son voisin, s informer sur un logement | Lexique - L habitat, les pieces, l equipement, la description physique

UNIT III **9 Hours**

VIVRE AU QUOTIDIEN

Grammaire - Articles contractes, verbes vouloir, pouvoir, devoir, adjective interrogative, future proche | Communication- Exprimer ses gouts, parler de ses loisirs, justifier un choix, exprimer une envie | Lexique - le temps libre et les loisirs, les saisons, les activites quotidiennes, le temps (le matin, le soir, la nuit)

UNIT IV **9 Hours**

COMPRENDRE SON ENVIRONNEMENT - OUVRIR -Ãƒ?Ã‚Â LA CULTURE

Grammaire - Verbes - Finir, Sortir, les adjectifs demonstratifs, le passe compose, l imparfait | Communication - Propose quelqu un de faire quelque chose, raconteur une sortie au passe parler un film | Lexique - Les sorties, la famille, art, les vetements et les accessories

UNIT V **9 Hours**

GOUTER A LA CAMPAGNE

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantite | Communication Accepter et refuse rune invitation, donner des instructions, commander au restaurant | Lexique Les services et les commerces, les aliments, les ustensiles, argent

Total: 45 Hours

Reference(s)

1. Saison A1, Methode de francais
2. Hachette FLE

18GE0P1 NANOMATERIALS SCIENCE **3 0 0 3**

Course Objectives

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

Course Outcomes (COs)

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

UNIT I **9 Hours**

NANO SCALE MATERIALS

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future -classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties -differences between bulk and nanomaterials and their physical properties.

UNIT II **9 Hours**

NANOMATERIALS SYNTHESIS METHODS

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

UNIT III **9 Hours**

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV **9 Hours**

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes-

structure, synthesis and electrical properties -applications- quantum cascade laser - quantum efficiency of semiconductor nanomaterials

UNIT V **9 Hours**

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-HEMT devices: structure, fabrication, principle, types and applications - organic LED: basic processes, carrier injection, excitons, optimization - organic photovoltaic cells- single electron transistor - particulate and geometrical nanomagnets - spintronics

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W.Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, Aulice Scibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

18GE0P2 SEMICONDUCTOR PHYSICS AND DEVICES

Course Objectives **3 0 0 3**

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Course Outcomes (COs)

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

UNIT I **9 Hours**

ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-drift current density - conductivity- diffusion current density - total current density

9 Hours

UNIT II

P-N JUNCTION

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

UNIT III **9 Hours**

BIPOLAR JUNCTION TRANSISTOR

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor.

UNIT IV **9 Hours**

MOSFET

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

UNIT V **9 Hours**

PHOTONIC DEVICES

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

Total: 45 Hours

Reference(s)

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee , "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006
7.

18GE0P3 APPLIED LASER SCIENCE **3 0 0 3**

Course Objectives

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

UNIT I **9 Hours**

LASER FUNDAMENTALS

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein"s prediction - Einstein"s relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

UNIT II **9 Hours**

LASER BEAM CHARACTERISTICS AND TYPES

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO2 laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

UNIT III **9 Hours**

LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

UNIT IV **9 Hours**

LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

UNIT V **9 Hours**

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting- Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006.

3 0 0 3

18GE0P4 BIO-PHOTONICS

Course Objectives

- To understand the light-matter interaction in biological cells or tissues by using the principles of optics and lasers
- To apply the properties of biological cells or tissues in biomedical applications by various optical imaging, sensing and activation techniques
- To analyze the concepts of Modern optical measurement techniques and devices in early detection of disease and cure them

Course Outcomes (COs)

1. Infer the laws of optics and lasers to interpret the biological cells and tissues
2. Identify the properties of different optical instruments in biological systems to represent their behavior in structure and design of detection engineering instruments
3. Use laser tweezers techniques to infer the activities of cells (tissues) and explain the single molecule detection processes in medical diagnosis
4. Outline the properties of ultra short laser pulses and tissue engineering to rectify the affecting factors in biological cells
5. Compare the various types of bio-imaging methods to detect the infected cells and molecules in biological science

UNIT I **9 Hours**

INTRODUCTION TO BIOPHOTONICS

Light as Photon Particles - Coherence of light - lasers classification of lasers - Mechanisms of Non linear Optics (NLO) processes associated with Biophotonics - Light scattering mechanisms: Rayleigh scattering, Miescattering, Brillouin Scattering, Raman Scattering - Different light sources - Quantitative description of light: Radiometry.

UNIT II **9 Hours**

PHOTOBIOLOGY

Interaction of light with cells and tissues - Light - Tissue Interaction Variables - Light Tissue Interaction Theory: Radiative Transport Theory - Photo process in biopolymers - In Vivo Photoexcitation - photo-induced physical, chemical, thermal and mechanical effects in biological systems - Optical biopsy - Single molecule detection

UNIT III **9 Hours**

BIONANOPHOTONICS

Laser Microtools, Semiconductor quantum dots for bioimaging, Metallic nanoparticles and nanorods for biosensing - Optical biosensors: Fibre-Optic, evanescent wave, surface Plasmon resonance (SPR) based biosensors - biomaterials for photonics - Principle and design of laser tweezers - laser trapping and dissection for biological manipulation

UNIT IV **9 Hours**

TISSUE ENGINEERING WITH LIGHT

Basics of tissue optics: Light absorption and scattering in tissues, Wavelength effects and spectra - the therapeutic window, Light penetration in tissues - Absorbing agents in tissues and blood - Skinoptics response to the UV radiation, Optical parameters of tissues - tissue welding - tissue contouring - tissue regeneration - Femto laser surgery - low level light therapy and photo dynamic therapy

UNIT V **9 Hours**

BIO-IMAGING TECHNIQUES AND ITS APPLICATIONS

An overview of optical imaging - Fluorescence Microscopy - Scanning Microscopy - In vivo Confocal Microscopy - Multi photon Microscopy - Optical Coherence Tomography (OCT) - Fluorescence Resonance Energy Transfer (FRET) imaging fluorescence lifetime imaging Microscopy (FLIM) - Nonlinear optical imaging - Coherent Anti-stokes Raman Scattering - Bioimaging Applications

Total: 45 Hours

Text Book(s)

1. Introduction to Biophotonics, ParasN.Prasad, WileyInter-science, AJohnWiley & Sons, Inc., Publication

Reference(s)

1. Introduction to Biomedical Imaging, Andrew G.Webb, 2002, IEEE Press
2. Biomedical Optics: Principles and Imaging, Lihong.V.Wang, Hsin.-I.Wu, 2007, Wiley Interscience 2007. & "An Introduction to Biomedical Optics", R.Splinterand B.A.Hooper, Taylor & Francis
3. "Bioimaging Current Concepts in Light and Electron Microscopy", DouglasE.Chandler & Robert W.Roberson, Jones and Bartlett publishers
4. Optical Imaging and Microscopy : Techniques and Advanced Systems, Peter and Fu-JenKao, 2004, Springer

18GE0P5 PHYSICS OF SOFT MATTER 3 0 0 3

Course Objectives

- To recognize the properties of soft matter and hard matter
- To understand the fundamental interactions of colloids and gels
- To explain the structure and phase behavior of liquid crystals and supramolecules
- To summarize the soft matter proprties of structures and components of life

Course Outcomes (COs)

1. Identify the salient features of soft matter and hard matter
2. Exemplify the fundamental interactions and stability of colloids and gels
3. Illustrate the structure and properties of liquid crystals
4. Outline the aggregation and phase behavior of surfactants, polymers, copolymers and block copolymers
5. Analyze the soft matter behavior of nucleic acids, proteins, polysaccharides and membranes

UNIT I **9 Hours**

CONDENSED MATTER

Intermolecular forces-Condensation and freezing-mechanical response: Hookean solid-Newtonian liquid-viscoelasticity. Glasses: relaxation time-viscosity- glass forming liquids. Soft matter: length scales-fluctuations and Brownian motion

UNIT II **9 Hours**

COLLOIDAL DISPERSIONS

Forces between colloidal particles: vander Waals forces-electrostatic double layer forces-steric hindrance-depletion interactions. Stability and phase behaviour: Crystallisation-strong colloids-weak colloids.Physical and chemical gels-classical theory of gelation-elasticity of gels

UNIT III **9 Hours**

LIQUID CRYSTALS

Liquid crystal phases-distortions and topological defects-electrical and magnetic properties-polymer liquid crystals-Fredricks transition and liquid crystal displays

UNIT IV **9 Hours**

SUPRAMOLECULAR SELF ASSEMBLY

Aggragation and phase separation-types of micelles- bilayers and vesicles. Phase behaviour of concentrated surfactant solutions-phase separation in polymers, copolymers and block copolymers

UNIT V **9 Hours**

SOFT MATTER IN NATURE

Components and structures of life-Nucleic acids-proteins-interaction between proteins-polysaccharides-membranes

Total: 45 Hours

Reference(s)

1. Richard A L Jones, Soft Condensd Matter, Oxford University Press, UK, 2002
2. Masao Doi, Soft Matter Physics,Oxford University Press, UK, 2013
3. Ian W. Hamley, Introduction to Soft Matter, John Wiley & Sons, 2007
4. A. Fernandez-Nieves, A M Puertas, Fluids, Colloids and Soft materials: An Introduction to Soft Matter Physics, John Wiley & Sons, 2016
5. Maurice Kleman, Oleg D. Lavrentovich, Soft Matter Physics: An Introduction, Springer-Verlag, New York, 2003

18GE0C1 CORROSION SCIENCE AND ENGINEERING

Course Objectives **3 0 0 3**

- Analyse the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

Course Outcomes (COs)

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

UNIT I **9 Hours**

CORROSION

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix digrams of Mg, Al and Fe and their advantages and disadvantages

UNIT II **7 Hours**

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

UNIT III **9 Hours**

MECHANISM OF CORROSION

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

UNIT IV **10 Hours**

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing - Ultrasonic monitoring, Quantitative testing , Quantitative testing and eddy current testing

UNIT V **10 Hours**

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection(sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

FOR FURTHER READING

Corrosion issues in supercritical water reactor (SCWR) systems

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. http://corrosion-doctors.org/Corrosion-History/Eight.htm

18GE0C2 ENERGY STORING DEVICES 3 0 0 3

Course Objectives

- Understand the concept, working of different types of batteries and analyze batteries used in electric vehicles
- Identify the types of fuel cells and to relate the factors of energy and environment
- Analyze various energy storage devices and fuel cells

Course Outcomes (COs)

1. Explain the parameters required for operation of a cell to evaluate the capacity of energy storage devices
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications
3. Differentiate fuel cells based on its construction, production of current and applications
4. Compare different methods of storing hydrogen fuel and its environmental applications
5. Relate energy and environmental based on the importance and types of renewable energy for sustainable development

UNIT I **6 Hours**

BASICS OF CELLS AND BATTERIES

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage, open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

UNIT II **10 Hours**

BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES

Primary batteries - zinc-carbon, magnesium, and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries - introduction, cell reactions, cell representations and applications - lead acid, nickel-cadmium and lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide, lithium anode cell, photogalvanic cells. Battery specifications for cars and automobiles.

UNIT III **10 Hours**

TYPES OF FUEL CELLS

Importance and classification of fuel cells - description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate and direct methanol fuel cells

UNIT IV **10 Hours**

HYDROGEN AS A FUEL

Sources and production of hydrogen - electrolysis - photocatalytic water splitting - methods of hydrogen storage- high pressurized gas - liquid hydrogen type - metal hydride - hydrogen as engine fuel - features, application of hydrogen technologies in the future - limitations

UNIT V **9 Hours**

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell

Total: 45 Hours

Reference(s)

1. M. Aulice Scibioh and B. Viswanathan, Fuel Cells: Principles and Applications, University Press, India, 2009
2. F. Barbir,PEM fuel cells: Theory and practice, Elsevier, Burlington, MA, Academic Press, 2013
3. M. R. Dell Ronald and A. J. David, Understanding Batteries, Royal Society of Chemistry, 2001
4. J. S. Newman and K. E. Thomas-Alyea, Electrochemical Systems, Wiley, Hoboken, NJ, 2012
5. Shripad T. Revankar, Pradip Majumdar, Fuel Cells: Principles, Design, and Analysis, CRC Press, 2016
6. Thomas B. Reddy, Linden's Handbook of Batteries, 4th Edition, McGraw Hill Professional, 2010

18GE0C3 POLYMER SCIENCE **3 0 0 3**

Course Objectives

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers and its processing
- Identify suitable polymers for various industrial applications

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Characterize the polymers to identify the structural, thermal ,mechanical and electrical features for specific applications
4. Apply the polymer processing methods to design polymer products
5. Identify and analyze the polymers used in electronic and biomedical applications

UNIT I **10 Hours**

POLYMERS AND ELASTOMERS

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) - ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene -butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

UNIT II **8 Hours**

POLYMERIZATION TECHNIQUES

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

UNIT III **8 Hours**

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength - Rockwell hardness - Vicot softening point. Test for electrical resistance, dielectric constant, dissipation factor, arc resistance and dielectric strength - water absorption

UNIT IV **9 Hours**

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

UNIT V **10 Hours**

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers. Polymer for biomedical applications: artificial organs, controlled drug delivery, hemodialysis and hemofiltration - Scaffolds in tissue Engineering.

FOR FURTHER READING

Biodegradable polymers

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2015
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer,"Text Book of Polymer Science", John Wiley & Sons, New York, 2007
4. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
5. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011

18GE0M1 GRAPH THEORY AND COMBINATORICS

Course Objectives **3 0 0 3**

- This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering
- It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.

Course Outcomes (COs)

1. Recognize the basic ideas of Graph and its characteristics.
2. Assess the characteristics of trees and its properties.
3. Predict the coloring of graphs and its applications in the respective areas of engineering.
4. Compute the permutations and combinations in the engineering field.
5. Demonstrate the types of generating functions and their applications in engineering.

UNIT I **9 Hours**

INTRODUCTION

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits - Connectedness - Components - Euler graphs - Hamiltonian paths and circuits - Trees - Properties of trees - Distance and centers in tree - Rooted and binary trees.

UNIT II **9 Hours**

TREES, CONNECTIVITY

Spanning trees - Fundamental circuits - Spanning trees in a weighted graph - cut sets - Properties of cut set - All cut sets - Fundamental circuits and cut sets - Connectivity and separability - Network flows - 1-Isomorphism - 2-Isomorphism - Combinational and geometric graphs - Planer graphs - Different representation of a planer graph.

UNIT III **9 Hours**

MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number - Chromatic partitioning - Chromatic polynomial - Matching - Covering - Four color problem - Directed graphs - Types of directed graphs - Digraphs and binary relations - Directed paths and connectedness - Euler graphs.

UNIT IV **9 Hours**

PERMUTATIONS

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

UNIT V **9 Hours**

GENERATING FUNCTIONS

Generating functions - Partitions of integers - Exponential generating function - Summation operator - Recurrence relations - First order and second order - Non-homogeneous recurrence relations - Method of generating functions.

Total: 45 Hours

Reference(s)

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003
2. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Addison Wesley, 1994.
3. Rosen K.H., Discrete Mathematics And Its Applications, McGraw Hil, 2007
4. Clark J. & Holton D.A., A First Look at Graph Theory, Allied Publishers, 1995.
5. Mott J.L., Kandel A. & Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, 1996.
6. Liu C.L., Elements of Discrete Mathematics, McGraw Hill, 1985.

18GE0M2 ALGEBRA AND NUMBER THEORY 3 0 0 3

Course Objectives

- Understand the basic notions of groups, rings, fields which will then be used to solve related problems.
- Examine the key questions in the Theory of Numbers.
- Implement the integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

Course Outcomes (COs)

1. Exemplify the concepts of groups and fields in the areas of Engineering.
2. Classify the different types of fields.
3. Organize the divisibility in number theory in various areas of Engineering.
4. Identify the solution of some kinds of equations.
5. Demonstrate the theorems in number theory.

UNIT I **9 Hours**

FIELDS

Group Theory - Rings and Polynomials - Fields.

UNIT II **9 Hours**

FINITE FIELDS AND POLYNOMIALS

Finite Fields - Irreducible Polynomials over Finite fields - Factorization of Polynomials over Finite Fields.

UNIT III **9 Hours**

DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS

Division algorithm- Base-b representations - number patterns - Prime and composite numbers - Fibonacci and Lucas numbers - Fermat numbers - GCD - Euclidean Algorithm - Fundamental theorem of Arithmetic - LCM.

UNIT IV **8 Hours**

DIOPHANTINE EQUATIONS AND CONGRUENCES

Linear Diophantine equations - Congruence s - Linear Congruence s - Applications: Divisibility tests - Modular Designs - Chinese remainder theorem - 2x2 linear systems.

UNIT V **10 Hours**

CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS

Wilson s theorem - Fermat s Little theorem - Euler s theorem - Euler s Phi functions - Tau and Sigma functions - Perfect numbers - Mersenne Primes - Mobius Function.

Total: 45 Hours

Reference(s)

1. Lidl.R., and Pilz. G., Applied Abstract Algebra, Springer-Verlag, New Delhi, 2nd Edition, 2006.
2. Thomas Koshy, Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.
3. San Ling and Chaoping Xing, Coding Theory: A first Course, Cambridge Publications, Cambridge, 2004.
4. Niven.I, Zuckerman.H.S., and Montgomery, H.L., An Introduction to Theory of Numbers, John Wiley and Sons, Singapore, 2004.

18GE0M3 MATHEMATICAL FINANCE AND QUEUEING THEORY

Course Objectives **3 0 0 3**

- To provide the required fundamental concepts in probability and queueing models and apply these techniques in networks, image processing etc.
- Acquire skills in analyzing queueing models.

Course Outcomes (COs)

1. Identify the properties of stochastic process in finance
2. Interpret the concept and applications of Statistics in finance.
3. Demonstrate the basics of finance using the notions of statistics.
4. Assess the classifications and the properties of queues.
5. Implement the concepts of queue in open and closed networks.

UNIT I **9 Hours**

APPLIED STOCHASTIC CALCULUS

Brownian motion - Constructions - Non differentiability - Quadratic variation - Stochastic integration - Construction of Ito integral and properties ,the Ito formula - Feynman-Kac formula

UNIT II **9 Hours**

STATISTICS

Basic parameter estimation - Maximum likelihood estimation - Distributions - Regression techniques - Tests for normality - QQ plots - Hypothesis testing - Numerical examples in R.

UNIT III **9 Hours**

CONTINUOUS-TIME FINANCE

Black-Scholes-Merton model of stock prices as geometric Brownian motion, derivation of the Black-Scholes-Merton partial differential equation, the Black-Scholes formula and simple extensions of the model, self-financing strategies and model completeness, risk neutral measures, the fundamental theorems of asset pricing, continuous time optimal stopping and pricing of American options, forwards and futures in Black-Scholes-Merton model.

UNIT IV **9 Hours**

QUEUEING THEORY

Markovian queues - Birth and Death processes - Single and multiple server queueing models - Little s formula - Queues with finite waiting rooms - Finite source models.

UNIT V **9 Hours**

NON-MARKOVIAN QUEUES AND QUEUEING NETWORKS

M/G/1 queue - Pollaczek Khinchin formula - M/D/1 and M/EK/1 as special cases - Series queues - Open and closed Jackson networks.

Total: 45 Hours

Reference(s)

1. M. Capinski and T. Zastawniak, Mathematics for Finance: An Introduction to Financial Engineering, Springer, 2005.
2. S. Shreve, Stochastic Calculus for Finance, Vol. 1 and Vol. 2, Springer, 2004.
3. G. R. Grimmett and D. R. Stirzaker, Probability and Random Processes, 3rd Edition, Oxford University Press, 2001.
4. Taha, H.A., Operations Research, Pearson Education, Asia, 8th Edition, 2007.

18GE0E1 ENTREPRENEURSHIP DEVELOPMENT I I

Course Objectives **3 0 0 3**

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc

Course Outcomes (COs)

1. Analyze the role of entrepreneurship in economic development.
2. Explain the types of ideas that to be used for entrepreneurship development.
3. Examine the legal aspects of business and its association.
4. Examine the sources of business and its analysis.
5. Analyse the different modes of operation management.

UNIT I **9 Hours**

BASICS OF ENTREPRENEURSHIP

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

UNIT II **9 Hours**

GENERATION OF IDEAS

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

UNIT III **9 Hours**

LEGAL ASPECTS OF BUSINESS

Contract act-Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments- promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

UNIT IV **9 Hours**

BUSINESS FINANCE

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

UNIT V **9 Hours**

OPERATIONS MANAGEMENT

Importance- functions-deciding on the production system- facility decisions: plant location, plant layout (cases), capacity requirement planning- inventory management (cases)-lean manufacturing, Six sigma.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006

18GE0E2 ENTREPRENEURSHIP DEVELOPMENT II

Course Objectives **3 0 0 3**

- Evolve the marketing mix for promoting the product / services
- Handle the human resources and taxation
- Understand Government industrial policies / support provided and prepare a business plan

Course Outcomes (COs)

1. Examine the strategies and plans in marketing management.
2. Analyse the cases involved in human resource management.
3. Classify the direct and indirect taxes in business.
4. Analyze the supports given by government for improving the business.
5. Examine the various steps involved in preparing the business plan.

UNIT I **9 Hours**

MARKETING MANAGEMENT

Marketing environment, Segmentation, Targeting and positioning, Formulating marketing strategies, Marketing research, marketing plan, marketing mix (cases)

UNIT II **9 Hours**

HUMAN RESOURCE MANAGEMENT

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, Factories Act 1948 (an over view)

UNIT III **9 Hours**

BUSINESS TAXATION

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional tax (Cases).Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST

UNIT IV **9 Hours**

GOVERNMENT SUPPORT

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State Level Institutions-TIIC, CED, MSME, Financial Institutions

UNIT V **9 Hours**

BUSINESS PLAN PREPARATION

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Market survey and Marketing plan, Financial plan and Viability, Government approvals, SWOT analysis.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi: 2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill: 2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi: 2002.

21AM001 BIOMEDICAL IMAGE ANALYSIS

Course Objectives **3 0 0 3**

- Understand Nature of Biomedical Images, Image Enhancement and Filtering for removal of artifacts
- Understand the image segmentation and analysis of Image shape and Texture
- Understand the pattern classification and diagnostic decision.

Course Outcomes (COs)

1. Capable of survey image processing techniques.
2. Apply the theoretical background of Image processing to solve biomedical imaging problems
3. Represent and recognize objects through patterns in application.
4. Analyse various techniques involved in biomedical systems.
5. Modelling biomedical systems.

UNIT I **9 Hours**

THE NATURE OF BIOMEDICAL IMAGES

The Nature of Biomedical Images: Objectives of Biomedical Image Analysis, Computer aided Diagnosis. Image Quality and Information Content: Acquisition and Analysis, The Fourier Transform and Spectral Content.

UNIT II **9 Hours**

REMOVAL OF ARTIFACTS

Removal of Artifacts: Random noise, Signal dependent noise, Space domain Local statistics based Filters, Frequency domain Filters. Image Enhancement: Greyscale Transforms, Histogram Transformation, Convolution Mask Operators, Homomorphism Filtering for Enhancement. Detection of Regions of Interest

UNIT III **9 Hours**

ANALYSIS OF SHAPE

Analysis of Shape: Representation of Shapes and Contours, Shape Factors, Fourier Descriptors
Analysis of Texture: Texture in Biomedical Images, Statistical Analysis of Texture, Fourier domain Analysis of Texture.

UNIT IV **9 Hours**

ANALYSIS OF ORIENTED PATTERNS

Analysis of Oriented Patterns: Oriented Patterns in Images, Measures of Directional Distribution, Directional Filtering, Gabor Filters, Directional Analysis via Multiscale Edge Detection

UNIT V **9 Hours**

PATTERNS ANALYSIS DECISION

Pattern Classification and Diagnostic Decision: Pattern Classification, Probabilistic Models and Statistical Decision, Logistic Regression, Neural Networks, Measures of Diagnostic Accuracy, Reliability of Features, Classifiers and Decisions.

Total:45 Hours

Reference(s)

1. Rangaraj M Rangayyan, R. M. Biomedical Image Analysis, CRC Press, 2005.
2. Gonzalez, Rafael C. and Woods, Richard E. Digital Image Processing, Addison Wesley, 3rd Edition, reprint 2008.
3. Jain, Anil K. Fundamentals of digital image processing, PHI, 2002.

4. Chanda and Majumder,D. Dutta. Digital image processing and Analysis, PHI, 2002.
5. M. A. Joshi, Digital Image Processing: An algorithmic approach, 2nd Edition. PHI 2009
6. John C.Russ, The Image Processing Handbook, CRC Press,2007.
7. Mark Nixon, Alberto Aguado, Feature Extraction and Image Processing, Academic Press, 2008.

21AM002 DIGITAL MARKETING

3 0 0 3

Course Objectives

- Understand the Digital marketing platforms.
- Understand the theoretical aspects of creating a website.
- Understand the role of digital marketing in business administration.
- Familiarize with search engine optimization.
- Understand MISC tools.

Course Outcomes (COs)

1. Explain the concept of digital marketing and the role of a digital manager
2. Administer the website and identifies the search engines
3. Discuss the various MISC tools
4. Describe the concepts of lead management and digital marketing
5. Explain the various trending digital marketing skills

UNIT I **9 Hours**

INTRODUCTION TO DIGITAL MARKETING

Introduction - Needs of Digital Marketing-Digital Marketing Platforms- Organic and Paid Digital Marketing-Traditional Marketing and digital Marketing- Advantage of Digital Marketing

UNIT II **9 Hours**

WEBSITE & SEARCH ENGINE

Design a website –Hosting and Domain– Different platforms for website creation- Search engine-Campaign - Digital media channels.

UNIT III **9 Hours**

MISC TOOLS

Google Webmaster Tools- Sitemap Creators- Browser-based analysis tools-Page Rank tools- ranking & indexing tools-Dead links identification tools- Open site explorer Domain information who is tools- Quick sprout.

UNIT IV **9 Hours**

LEAD MANAGEMENT & DIGITAL MARKETING

Lead forms- Case forms- Lead generation techniques-needs of Leads - social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker- CPC reduction -Group posting on Social Media platforms.

UNIT V **9 Hours**

TRENDING DIGITAL MARKETING SKILLS

SEO – Search Engine Optimization- SEM – Search Engine Marketing -Social Media Marketing/Optimization- Email Marketing. Website Designing and Development- Product Marketing- Content Writing. Marketing the created content online Copywriting- Blogging- Local Marketing. Google AdWords Campaign Management- PPC Advertising- Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking.

Total:45 Hours

Reference(s)

1. Chaffey, D. (2019). Digital marketing. Pearson UK.
2. Chaffey, D., & Smith, P. R. (2017). Digital marketing excellence: planning, optimizing and integrating online marketing. Taylor & Francis.
3. Dodson, I. (2016). The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns. John Wiley & Sons.
4. Kaufman, I., & Horton, C. (2014). Digital marketing: Integrating strategy and tactics with values, a guidebook for executives, managers, and students. Routledge.
5. Royle, J., & Laing, A. (2014). The digital marketing skills gap: Developing a Digital Marketer Model for the communication industries.
6. Stokes, R. (2011). E-Marketing: The essential guide to digital marketing. Quirk eMarketing

21AM003 AGILE SOFTWARE DEVELOPMENT

Course Objectives **3 0 0 3**

- Understand the principles and practices used in agile software development.
- Understand the software designing and developing software systems using agile methodologies.
- Understand various agile software development methods, practices, and their appropriate application the pattern classification and diagnostic decision.

Course Outcomes (COs)

1. Analyse various agile software development methods, practices, and their appropriate application.
2. Plan iterations based on relative effort and business value.
3. Create backlogs and burn-down charts to monitor progress of a project.
4. Increase quality with test-driven development.
5. Design an interface by applying usability guidelines and standards for given system development problems.

UNIT I
AGILE SOFTWARE DEVELOPMENT **9 Hours**
Agile Vs Traditional models, Agile manifesto, Agile methodologies- DSDM, FDD, Crystal, Scrum, Agile Modelling, Extreme Programming, Lean Software Development, Unified Process (UP).

9 Hours
UNIT II
AGILITY AND KNOWLEDGE MANAGEMENT
Agile information systems – agile decision making - Earl's schools of KM –institutional knowledge evolution cycle – development, acquisition, refinement, distribution, deployment, leveraging – KM in software engineering – managing software knowledge – challenges of migrating to agile methodologies – agile knowledge sharing – role of story cards – Story card Maturity Model (SMM).

UNIT III
MANAGING AGILE PROJECTS **9 Hours**
Gathering software requirements -Eliciting requirements from users, Adopting Agile values, writing user stories. Planning Agile Projects- Prioritizing and estimating work, organizing projects by features, dividing features into tasks. Reporting Team Progress- Documenting work completed with backlogs, tracking progress with burn down charts, Projecting project costs and completion dates, Monitoring work in progress with task boards.

UNIT IV
TEST-DRIVEN DEVELOPMENT **9 Hours**
Test-Driven Development- unit, integration, system and Acceptance testing, exploratory testing, automated and manual testing, exercising boundary conditions, driving development through constant testing.

UNIT **V**
USABILITY ENGINEERING AND AGILE SOFTWARE DEVELOPMENT **9 Hours**
Usability engineering and agile software development - Need for usability, Agile Usability Processes, Customer Focus Vs End-User, Working Software Vs Usable Software, Up-front User design - Lightweight Usage Centered Design, Usability Testing. Usability across interface types: Web, Desktop, Mobile, touch and video games.

Total:45Hours

Reference(s)

1. Mike Holcombe, "Running an Agile Software Development Project" Wiley, 2008
2. Laura M. Leventhal, Julie A. Barnes "Usability Engineering: Process, Products, and Examples,", Pearson/Prentice Hall, 2008
3. Orit Hazzan, Yael Dubinsky, "Agile software engineering", Springer,2014
4. Jakob Nielsen, "Usability Engineering", Academic Press, 1993

21AM004 SOFT COMPUTING

3 0 0 3

Course Objectives

- Understand the advantages of soft computing over hard computing.
- Familiarize with the basic techniques of soft computing such as Neural Networks, Fuzzy Systems and Evolutionary algorithms.
- Understand how evolutionary algorithms help in optimization and solving real-time problems.
- Understand how fuzzy decision making helps to deal with uncertainty.
- Understand the architecture and training aspects of Neural Networks
- Illustrate the applications of soft computing in medical diagnosis

Course Outcomes (COs)

1. Implement evolutionary algorithms to optimize and solve real-time problems.
2. Demonstrate how fuzzy decision making helps to deal with uncertainty.
3. Apply soft computing techniques for medical image processing and medical diagnosis.

UNIT I **9 Hours**

BASICS OF SOFT COMPUTING AND EVOLUTIONARY ALGORITHMS

Introduction to Soft Computing, Difference between Hard and Soft computing, Requirement of Soft computing, Major Applications of Soft Computing. Genesis behind evolutionary algorithms, Genetic Algorithms (GA) and its variants, Particle Swarm Optimization, Artificial Bee Colony Algorithm, Multi-objective optimization.

UNIT II **9 Hours**

FUZZY SYSTEMS AND FUZZY METHODS FOR MEDICAL IMAGE PROCESSING

Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Fuzzy Decision Making

UNIT III **9 Hours**

NEURAL NETWORKS

Review on Neural Networks, Radial Basis Function Networks, Associative Memory Networks, Adaptive Resonance theory and Self Organizing Map, Hybrid Neural Networks: Evolutionary Neural Networks: GA + ANN, FUZZY+ ANN.

UNIT IV **9 Hours**

SOFT COMPUTING FOR MEDICAL DIAGNOSIS

Artificial neural networks in medical diagnosis, Clinical Decision Support Systems, Genetic Algorithms for feature selection in computer-aided diagnosis.

UNIT V **9 Hours**

HYBRID METHODS AND CONTEMPORARY ISSUES

Fuzzy-neural networks for medical diagnosis and disease classification, Combining Evolutionary and Fuzzy techniques in medical diagnosis and disease classification. Contemporary Issues

Reference(s) **Total: 45 Hours**

1. S.N. Sivanandam, S.N. Deepa "Principles of Soft Computing", 3 rd Edition, Wiley, 2018.
2. Timothy J. Ross "Fuzzy Logic with Engineering Applications", 4th edition, Wiley, 2016.
3. Andries P. Engelbrecht,"Computational Intelligence: An Introduction", 2nd Edition, John Wiley & Sons, 2007.
4. Leszek Rutkowski,"Computational Intelligence Methods and Techniques", Springer, 2008.
5. Tamalika Chaira,"Medical Image Processing: Advanced Fuzzy Set Theoretic Techniques", CRC Press, 2015.
6. Manfred Schmitt, Horia-Nicolai TEODORESCU, Ashlesha Jain, Ajita Jain, Sandhya Jain."Computational Intelligence Processing in Medical Diagnosis", Springer Science & Business Media, 2002.
7. Stephen L. Smith, Stefano Cagnoni "Genetic and Evolutionary Computation: Medical Applications", John Wiley & Sons, 2011.

21AM005 SMART PRODUCT DEVELOPMENT

3 0 0 3

Course Objectives

- Understand the fundamentals of Product development and its processes.
- Understand how smart system processes and its functional elements.
- Learn the mapping for smart systems in Industry 4.0
- Understand the processes in product design & development
- Understand how Smart Product Development helps multidisciplinary Engineering

Course Outcomes (COs)

1. Identify the key elements in smart product technologies in Industry
2. Compare the existing smart systems and products in the industry
3. Design a Smart Expert System
4. Develop a Smart Expert System

UNIT I **9 Hours**

PRODUCT DEVELOPMENT PROCESSES AND SMART PROCESS ELEMENTS

Product Development Life Cycle, Process Models - Prototyping - Agile Models New Product Development Processes – Knowledge based/driven development – Principal Issues and Challenges. User and Customer Research – User observation – Customer interviews-Competitor landscape, Cost Analysis – Product teardown-Analysis input mapping, Concept generation – Analysis wrap up –idea generation-idea evaluation-concept formulation, Prototype Testing.

UNIT II **9 Hours**

SMART TECHNOLOGIES 4.0 AND KNOWLEDGE BASED SYSTEM DEVELOPMENT

Cloud Services, Big data & Analytics, Engineering Simulation, 3D printing, Additive Manufacturing. Knowledge Discovery, Knowledge Representation, Knowledge Catalogue, Knowledge Graphs, Knowledge Visualization.

UNIT III **9 Hours**

DEEP QA PROCESSES

Deep QA Architecture, Exploring Deep QA – Question Analysis-Primary Search-Hypothesis Generation-Merging and Ranking, Micro services and Robust Tooling in Deep QA.

9 Hours

UNIT IV

WATSON

Watson Community Services and Watson Discovery Services, Watson Deep Learning, Chatbot, Natural Language Classifier, Concept Expansion, Concept Insights, Language Identifications and Translations, Visualization and Rendering.

UNIT V **9 Hours**

DESIGN OF AN EXPERT SYSTEM

Expert System Architectures, An analysis of some classic expert systems – WATSON, Deep expert systems, Co-operating expert systems and the blackboard model. Contemporary Issues.

Reference(s) **Total: 45 Hours**

1. "Smart Product Design", Send points Publications, 2017
2. Grega Jakus, Veljko Milutinovic, Sanida Omerovic, Saso Tomazic, "Concepts, Ontologies and Knowledge Representation", Springer, 2013
3. Ronald J. Brachman and Hector J.Levesque, "Knowledge representation and reasoning", 2nd edition, Elsevier publications, 2004.
4. Simon Kendal, Malcolm Creen, "An Introduction to Knowledge Engineering", Springer, ISBN-13: 978-1846284755, 2007.

21AM006 MALWARE ANALYSIS

3 0 0 3

Course Objectives

- Understand and analyse malware using static and dynamic analysis
- Understand malware behaviour and analyse Malware Networks
- Understand adversary groups through shared code analysis
- Learn to build machine learning detector to catch vulnerabilities, malware campaigns, trends, and relationships.

Course Outcomes (COs)

- Analyse malware behaviour and identify its adversary groups.
- Build your own machine learning detector system to catch vulnerabilities and to measure its accuracy.
- Visualize malware threat data to reveal attack campaigns and trend

UNIT I **9 Hours**

STATIC AND DYNAMIC MALWARE ANALYSIS

Basic Static Malware Analysis: Static Analysis Definition - Microsoft Windows PE format – Dissecting PE format using PE file – Examining Malware images – Strings – Factors that Limit Static Analysis Introduction to Dynamic Analysis: Why use Dynamic Analysis – Dynamic analysis for data science – Basic tools for dynamic analysis – Limitation of basic dynamic analysis

UNIT II **9 Hours**

IDENTIFYING ATTACKS AND SHARED CODE ANALYSIS

Identifying Attack Campaigns using Malware Networks: Bipartite Networks – Building and Visualizing Malware Networks – Building a shared image relationship network Shared Code Analysis: Samples comparisons by extracting features – Jaccard Index to quantify similarity – Evaluate Malware Shared Code estimation methods – Building a Similarity Graph – Persistent Malware Similarity Search System

UNIT III **9 Hours**

MALWARE DETECTORS AND EVALUATION

Machine Learning Based Malware Detectors: Steps for building detector – Understanding Feature Spaces and Decision Boundaries – Over fitting and Under fitting – Major Types of Machine Learning Algorithms: Logistic Regression – K-Nearest Neighbours – Decision Trees – Random Forest - Toy Decision Tree based Detector – Real World Learning Detectors with sklearn – Industrial Strength Detector.

UNIT IV **9 Hours**

VISUALIZING MALWARE

Visualizing Malware Trends: Understanding our Malware Dataset – Using matplotlib to visualize data – Using seaborn to visualize Data

UNIT V **9 Hours**

DEEP LEARNING MODELS TO DETECT MALWARE

Deep Learning Basics - Building a Neural Network Malware Detector with Keras - Contemporary issues.

Total: 45 Hours

Reference(s)

- "Malware Data Science Attack Detection and Attribution", Joshua Saxe and Hillary Sanders, No Starch Press, 2018
- "Machine Learning and Security: Protecting Systems with Data and Algorithms", Clarence Chio, David Freeman, 1st Edition, O'Reilly Media, Feb 2018.
- "Mastering Malware Analysis: The complete malware analyst's guide to combating malicious software, APT, cybercrime, and IoT attacks, Alexey Kleymenov, Amr Thabet", 1st Edition, Packt publishing, 2019.
- "Practical Malware Analysis", Michael Sikorski, Andrew Honig, No Starch Press, 2012

21AM007 NEURAL NETWORKS

3 0 0 3

Course Objectives

- Understand the concept of Neural Networks.
- Understand the models of artificial neural networks.
- Understand the application of artificial neural networks model.

- Understand the concepts of feedforward and backward neural networks

Course Outcomes (COs)

- Design basic neural networks.
- Implement the artificial neural network models.
- Implement neural network concept as solution to real-time problems.

UNIT I **9 Hours**

INTRODUCTION

Fundamental concepts and Model: Models of artificial Neural Networks, Neural processing, Learning and Adaptation, Neural network Learning rules- Hebbianrule, Perceptron rule, Delta rule

UNIT II **9 Hours**

SINGLE LAYER PERCEPTRON MODEL

Single-layer perceptron classifiers: Classification model, Features and decision regions, Discriminant functions, Linear machine and Minimum distance classification, Non-parametric training concept, Training and Classification using the Discrete perceptron: algorithm and example, Single layer continuous Perceptron networks for linearly separable classifications.

UNIT III **9 Hours**

MULTI LAYER FEED FORWARD NETWORKS

Multilayer feed forward Networks: Linearly separable Pattern classification, Delta learning rule for Multiperceptron model, Generalized Delta learning rule, Feed forward recall and error back propagation training.

UNIT IV **9 Hours**

SINGLE LAYER FEEDBACK NETWORKS

Single-layer Feedback Networks: Basic concepts of dynamic systems, Mathematical foundations of Discrete-time Hopfield Networks, Mathematical foundations of Gradient type Hopfield networks, Associative memories: Basic concepts, Linear Associator.

UNIT V **9 Hours**

ASSOCIATIVE MEMORY

Bidirectional associative memory - associative memory for spatio-temporal patterns - Case study: Implementation of NN in anysimulator. Self-Learning: Bidirectional Associative memory.

Total: 45 Hours

Reference(s)

1. E. A.E and S. J.E, "Introduction to Evolutionary Computing | The on-line accompaniment to the book Introduction to Evolutionary Computing", Evolutionary computation.org, 2015.
2. F. Lobo, "Evolutionary Computation 2018/2019", Fernandolobo.info, 2018.
3. "EC lab Tools", Cs.gmu.edu, 2008.
4. "Kanpur Genetic Algorithms Laboratory", Iitk.ac.in, 2008.
5. "Course webpage Evolutionary Algorithms", Liacs.leidenuniv.nl, 2017.

21AM008 MOBILE APPLICATION DEVELOPMENT

3 0 0 3

Course Objectives

- Understand the concept of Mobile system.
- Understand the mobile application development.
- Understand the mobile OS.
- Understand the concepts Android and IOS

Course Outcomes (COs)

- Build interface for mobile applications and web applications.
- Design mobile application for Android platform using primitive UI features, SQLite and GPS.
- Design a mobile application for Android platform using advanced features like animations and graphics.
- Develop mobile application for IOS platform

UNIT I **9 Hours**

INTRODUCTION

Introduction to mobile applications – cost of development - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications. Third party Frameworks. - Mobile Content- Mobile Applications.

UNIT II **9 Hours**

BASIC DESIGN

Introduction to Web Services – Web service language Format –Creating a Web service using Microsoft stack – Using the Linux Apache MySQL PHP (LAMP) Stack Debugging Web Services. Mobile User Interface Design. -Mobile Web Apps Using HTML5.Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing 9environment – Design patterns for mobile applications.

UNIT III **9 Hours**

TECHNOLOGY II – ANDROID 1

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server-side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT IV **9 Hours**

TECHNOLOGY II – ANDROID 2

Animating views - Scenes and Transitions, Frame Animations, Tween Animation, scale, rotate, translate, alpha, Interpolation, Canvas/Drawing into a view, Surface View/Surface Holder, Adding animations - Crossfading two views. Graphics: Graphics & Multimedia – Introduction to Graphics, displaying bitmaps, displaying graphics with OpenGL ES, defining and drawing shapes.

UNIT V **9 Hours**

TECHNOLOGY III - IOS

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wi-Fi – CASE STUDY- iPhone marketplace and mobile application development.

Total: 45 Hours

Reference(s)

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, Wiley Publications, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Manning Publications Co., 2012

3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012
4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development:
5. Exploring the iOS SDK", Apress, 2013.

21AM009 BLOCK CHAIN TECHNOLOGY

3 0 0 3

Course Objectives

- Introducing blockchain technology.
- Understand the blockchain technology properties.
- Understand the blockchain technology application.

Course Outcomes (COs)

- Build interface for mobile applications and web applications.
- Design mobile applications for Android platform using primitive UI features, SQLite and GPS.
- Design a mobile application for Android platform using advanced features like animations and graphics.
- Develop mobile application for IOS platform

UNIT I **9 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain- A history of Blockchain- Blockchain as Public Ledgers, Bitcoin and Blockchain, Technology behind bitcoin—Blockchain 2.0 and Smart Contracts, Block in a Blockchain securing data, Structure of a Block, Block Header.

UNIT II **9 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto primitives: Digital signature, reducing signature size, introduction to cryptocurrency using digital signature and hash chain, What is bitcoin, Creation of bitcoins, Payments and double spending, FORTH – How FORTH works, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network.

UNIT III **9 Hours**

BITCOIN CONSENSUS

Introduction to Consensus, Distributed consensus, Consensus in a Bitcoin network, Proof of Work (PoW)- Cryptographic Hash as PoW, Hashcash PoW, Bitcoin PoW, Tempering of PoW- Sybil attacks, DoS attacks, PoW power consumption, monopoly problem- Proof of Stake, Proof of Burn, Proof of Elapsed Time. Basics of PoET.

UNIT IV **9 Hours**

DISTRIBUTED CONSENSUS, HYPER LEDGER FABRIC & ETHERUM

Consensus algorithm- RAFT Consensus, PAXOS consensus, Byzantine general model, Byzantine general problem, Lamport-Shostak-Pease, Practical Byzantine Fault Tolerance. Introduction to Hyperledger fabric v1.1, Architecture of Hyperledger fabric v1.1, Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle-Design and issue Crypto currency, Mining, DApps, DAO.

UNIT V **9 Hours**

BLOCKCHAIN APPLICATIONS

Understanding business problems, understanding the participants, building communities in blockchain networks, Blockchain in Financial services, Supply chain management, revolutionizing global trade.

Reference(s) **Total: 45 Hours**

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.
2. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, by Bikram Aditya Singhal, Gautam Dhamija, Priya's Sekhar Panda, Apress.
3. Blockchain: A Step-by-step Guide for Beginners to Implementing Blockchain Technology and Leveraging Blockchain Programming, Tailor Jacobs, Copyrighted by Tailor Jacobs, 2017.
4. Basic Blockchain: What It Is and How It Will Transform the Way We Work and Live, David A Shrier, Robinson Publication.
5. Blockchain: The next Every Thing, Stephen P Williams, Copyrighted by Stephen P Williams, 2019

21AM010 DATA ANALYTICS AND DATA SCIENCE

3 0 0 3

Course Objectives

- Build computational abilities, inferential thinking, and practical skills for tackling core data scientific challenges
- Explores foundational concepts in data management, processing, statistical computing, and dynamic visualization using modern programming tools.
- Introduce modern data analytic techniques and develop skills for importing and exporting, cleaning and fusing, modelling and visualizing, analysing and synthesizing complex datasets.

Course Outcomes (COs)

- Identify exploratory and statistical analysis methods to prepare the big data Build interface for mobile applications and web applications.
- Choose basic tools to carry out exploratory data analysis and produce effective visualization of given data Design mobile application for Android platform using primitive UI features, SQLite and GPS.
- Perform parallel data processing and duplication with Hadoop and Map-Reduce. Design a mobile application for Android platform using advanced features like animations and graphics.

UNIT I **9 Hours**

DATA SCIENCE BASICS

Mathematics foundations for data science, Statistical inference – Statistical modelling, Probability distributions, Fitting a model, Exploratory Data Analysis(EDA) and data visualization - Basic tools (Plots, Graphs and Summary statistics) of EDA, Data science process, Data visualization – Basic principles, ideas and tools for visualization, Analytic processes and tools - Analysis Vs Reporting

UNIT II **9 Hours**

BIG DATA DATABASES

Big data platform – Challenges of conventional systems - Intelligent data analysis - Transition to big data databases-Map reduce – Hadoop, HBase,Hive, MapR – Sharding – NO-SQL databases – Hadoop distributed file systems - Anatomy of file write and read –PIG,HIVE,SPARK.

UNIT III **9 Hours**

MINING DATA STREAMS

Stream data model and architecture – Stream computing, sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in window – Decaying window – Real-time analytics platform (RTAP) applications.

UNIT IV **9 Hours**

DESCRIPTIVE ANALYTICS

Mining frequent item sets – Apriori algorithm – Handling large data sets in main memory – Limited pass algorithm – Segmentation techniques – Hierarchical – KMeans – Clustering high dimensional data – CLIQUE and PROCLUS – Clustering in nonEuclidean space – Clustering for streams and parallelism, online algorithms

UNIT V **9 Hours**

CASE STUDIES - PRESCRIPTIVE ANALYTICS

Optimization and Simulation with Multiple Objectives, Text Analytics- Text Analytics methods-metrics-Applications, Predictive Analytics – Models – Evaluation – Applications.

Total: 45 Hours

Reference(s)

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly. 2014.
2. Jure Leskovek, AnandRajaraman and Je_rey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press. 2014.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, Wiley, 2015
5. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.

21AM011 INTERNET OF THINGS AND ITS APPLICATIONS

3 0 0 3

Course Objectives

- Understand how connected devices work together to update other applications
- Acquire knowledge to interface sensors and actuator with microcontroller-based Arduino platform.
- Understand the Communication between microcontroller and PC using serial communication
- Understand IoT based applications and understand how data flows between things
- Understand how electronic devices control electrical appliances working at 220v AC
- Understand the security aspect of IoT devices

Course Outcomes (COs)

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.

- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT I

INTRODUCTION TO IoT **9 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 IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT II **9 Hours**

SMART OBJECTS

The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT III **9 Hours**

NETWORK LAYER

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.

UNIT IV **9 Hours**

DATA AND ANALYTICS FOR IoT

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, The Phased Application of Security in an Operational Environment

UNIT V **9 Hours**

CASE STUDIES – APPLICATION OF IoT

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Reference(s) **Total: 45 Hours**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
4. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

21AM012 COGNITIVE SYSTEMS

3 0 0 3

Course Objectives

- Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
- Understand and discuss the cognitive development stages and review existing frameworks for modelling memory and language
- Understand how cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.
- Understand the primary techniques and tools associated with cognitive computing

Course Outcomes (COs)

- Develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
- Demonstrate and apply the principal aspects of cognitive science, methods and paradigms.
- Demonstrate new cognitive model for application development.

UNIT I

INTRODUCTION TO COGNITIVE SYSTEMS

The Nature of Cognition, Overview, Four Aspects of modelling cognitive systems. Levels ofabstraction in modelling cognitive systems - Marr‘s hierarchy of abstraction, Kelso‘s hierarchy of abstraction. Paradigms of Cognitive Science- cognitivist paradigm, emergent paradigm

UNIT II **9 Hours**

COGNITIVE ARCHITECTURE

The cognitivist perspective, The emergent perspective- Desirable characteristics: Realism, Behavioural characteristics, Cognitive characteristics, Functional capabilities, Development, Dynamics - Anatomy – Types of Anatomy - Embodiment and Its Implications, Cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks, DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge

UNIT III **9 Hours**

MODELING PARADIGMS

Declarative/ logic-based computational cognitive modelling, connectionist models of cognition,
Bayesian models of cognition, a dynamical systems approach to cognition. Classical models of rationality, symbolic reasoning and decision making; Formal models of inductive generalization, causality, categorization and similarity; the role of analogy in problem solving.

UNIT IV **9 Hours**

COGNITIVE DEVELOPMENT

Memory – Types of memory, Computational models: episodic and semantic memory, modelling psycholinguistics (with emphasis on lexical semantics), modelling the interaction of language,
memory and learning Piaget- Vygotsky theory of cognitive development - Child concept acquisition, child language learning, acquisition of arithmetic skills.

UNIT V **9 Hours**

SOCIAL COGNITION

Social interaction. Reading intentions and theory of mind, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems. Case study.

Reference(s) **Total: 45 Hours**

1. Vishal Jain, Akash Tayal, Jaspreet Singh, Arun Solanki, Cognitive computing systems ,1st edition, Apple Academic Press (2021)
2. Vernon, David, Artificial Cognitive Systems: A Primer, (The MIT Press) 1st Edition, 2015
3. The Cambridge Handbook of Computational Psychology, Ron Sun (ed.), Cambridge University Press (2008)
4. Peter Finger, Cognitive Computing: A Brief Guide for Game Changers, Meghan Kiffler Press, 1st Edition, 2015, ISBN: 973-0-92965251-1
5. Kai Hwang, Cloud Computing for Machine Learning and Cognitive Applications, MIT Press Publishers, June 2017 | ISBN: 9780262341110

21AM013 CYBER THREAT INTELLIGENCE

3 0 0 3

Course Objectives

1. Understand how to leverage intelligence to understand adversary behaviour and make use of indicators of compromise to detect and stop malware.
2. Understand the security problems and defend the cyberspace
3. Understand and protect against attacks, threats and intrusion

Course Outcomes (COs)

- Develop incident response skills to combat network and system
- Evaluate the security of network and system
- Review and analyse threat intelligence logs and reports.
- Discover and Respond to the threats

UNIT I

CYBER ATTACKS, INTRUSIONS, THREATS

Introduction to cyber-attacks, attack model, Adversary Types, Vulnerability Types, Threat Types, Attacks vs. Intrusion, DDoS, Types, Malware, malware Types, Introduction to Dark net, Cybercrimes.

UNIT II **9 Hours**

CYBER THREATS AND INTRUSION KILL CHAIN

Introduction to Advanced Persistent Threats, Intrusion Kill Chain, Zero days, Attack surface, Attack vectors, Evasion techniques – Host and Network level evasions, Covert Communication: Infiltration and Exfiltration, Advanced Evasion techniques

UNIT III

9 Hours

THREAT INTELLIGENCE

Cyber Threat Intelligence (CTI), Overview of Threat Intelligence Lifecycle and Frameworks, CTI types, generic threat actor, Indicators of Compromise (IoCs).

UNIT IV **9 Hours**

THREAT INTELLIGENCE MODEL

Campaign analysis, Diamond model, Threat intel methodologies, Intrusion reconstruction, OSINT, Challenges with detection intrusions.

UNIT V **9 Hours**

SECURITY OPERATION CENTRE (SOC)

Introduction to SIEM, Threat Intelligence Data Collection, Threat Intelligence Collection Management, Threat Intelligence data Feeds and Sources, Data Processing and analysis, Buildingyour own SOC, Visualizing the threat intelligence data. Threat Intelligence Reports: Baseline and Diff, Blacklists and Whitelists, Tracking, Integration.

Total: 45 Hours

Reference(s)

1. Wilson Bautista, Practical Cyber Intelligence: How Action-based Intelligence Can be an Effective Response to Incidents, 2018, Packt publisher.
2. Arun E Thomas, Security Operations Center - SIEM Use Cases and Cyber Threat Intelligence, 2018.
3. Michael Hale Ligh , Andrew Case , Jamie Levy , Aaron Walters ,The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux and Mac Memory, Wiley Publisher.
4. Eoghan Casey, Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet, Elsevier.
5. John Sammons, The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, Syngress publisher.

21AM014 BIOINFORMATICS

3 0 0 3

Course Objectives

1. Understand the fundamental concepts of structural biology (chemical building blocks, structure, superstructure, folding, etc.)

2. Understand the sequence and structure alignment, protein structure prediction, protein folding, and protein-protein interaction

3. Understand and use bioinformatics databases and understand protein design

4. Understand the current approaches in bioinformatics application.

5. Understand the methodology of protein structure prediction and assessment.

6.Understand the role of bioinformatics in drug discovery.

Course Outcomes (COs)

- Develop the ability to design, predict, analyse and compare the protein structures as well as predict the function of target proteins.
- Ability to reach the frontier of bioinformatics and use bioinformatics tools to solve the research problems.
- Understand the current approaches in bioinformatics application and discover the methodology of protein structure prediction and assessment.

UNIT I

BASICS OF BIOINFORMATICS

Introduction: What is bioinformatics, Principles of protein structure, Tertiary structure, Quaternary structure, Similarity of ternary and quaternary structure; Bioinformatics databases: Introduction, Nucleotide sequence databases, Protein sequence databases, Sequence motif databases, Protein structure database.

UNIT II **9 Hours**

SEQUENCE ALIGNMENT

Similarity and Homology, Types of divergence, Conserved regions, Methodological principles, Substitution scores, Insertion/deletion scores, Statistical significance, Database search, Multiple alignment, Structure alignment, matching algorithms, Searching 3D Databases.

UNIT III **9 Hours**

PROTEIN STRUCTURE AND MODELLING

Protein secondary structure: Introduction, Hydrogen bond, defining a secondary structure element, Methods for predicting secondary structure; Experimental methods for protein structure determination: X-ray crystallography, Nuclear magnetic resonance (NMR); Protein folding and dynamic simulation.

UNIT IV **9 Hours**

CURRENT TECHNIQUES AND DRUG DISCOVERY

Bayesian Networks, Nearest neighbourhood approach, Neural Networks, Genetic algorithms,
Ensemble learning. Computer Aided Drug Designing (CADD): SBDD, LBDD, Drug discovery, Drug Target Identification, Drug Target Validation.

UNIT V **9 Hours**

STRUCTURAL DOMAINS IN PROTEIN AND APPLIED BIOINFORMATICS TOOLS

basics, First and second-generation algorithms for domain assignments, domain assignment based on graph theoretical methods, prediction of binding sites and characterization. Designing protein interfaces: Designing for affinity, Designing for specificity. Entrez, ExPASy, BLAST: Online and Local BLAST, Motif Search: SMART Search, MEME Search, HMM Search, Scoring Matrix, Dotlet.

Reference(s) **Total: 45 Hours**

1. Bioinformatics and Functional Genomics (2nd edition) by Jonathan Pevsner, Wiley-Liss.
2. Keedwell, Edward, and Ajit Narayanan. Intelligent bioinformatics: The application of artificial intelligence techniques to bioinformatics problems. John Wiley & Sons, 2005.
3. Lesk, A.M. 2005, 2nd edition, Introduction to Bioinformatics. Oxford University Press.
4. Structural Bioinformatics (2nd Edition), Jenny Gu, Philip E. Bourne
5. D.W. Mount Bioinformatics: Genome and Sequence Analysis: (2001) Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
6. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
7. Bioinformatics Databases: Design, Implementation, and Usage by SorinDraghici
8. Basics of Bioinformatics: Lecture notes of the Graduate Summer School, Rui Jiang, Zhang, Springer.

21AM015 DATA VISUALIZATION

3 0 0 3

Course Objectives

1. Understand the various types of data, apply and evaluate the principles of data visualization.
2. Acquire skills to apply visualization techniques to a problem and its associated dataset.
3. Understand structured approach to create effective visualizations thereby building visualization

dashboard to support decision making.

Course Outcomes (COs)

- Identify the different data types, visualization types to bring out the insight. Relate the visualization towards the problem based on the dataset.
- Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data.
- Ability to visualize categorical, quantitative and text data. Illustrate the integration of visualization tools with hadoop.
- Ability to visualize categorical, quantitative and text data.
- Design visualization dashboard to support the decision-making on large scale data.
- Match the knowledge gained with the industry's latest technologies.

UNIT I

INTRODUCTION TO DATA VISUALIZATION **9 Hours**

Overview of data visualization - Data Abstraction -Analysis: Four Levels for Validation- Task Abstraction - Analysis: Four Levels for Validation.

UNIT II **9 Hours**

VISUALIZATION TECHNIQUES AND VISUAL ANALYTICS

Scalar and point techniques Colour maps Contouring Height Plots, Vector Visualization techniques Vector properties Vector Glyphs Vector Colour Coding Stream Objects.

UNIT III

9 Hours

VISUAL ANALYTICS

Visual Variables- Networks and Trees - Map Colour and Other Channels- Manipulate View. Arrange Tables Geo Spatial data Reduce Items and Attributes

UNIT IV **9 Hours**

VISUALIZATION TOOLS AND TECHNIQUES AND DIVERSE TYPES OF VISUAL ANALYSIS

Introduction to data visualization tools- Tableau - Visualization using R. Time- Series data visualization Text data visualization Multivariate data visualization and case studies.

UNIT V **9 Hours**

VISUALIZATION DASHBOARD CREATIONS

Dashboard creation using visualization tools for the use cases: Finance-marketing-insurance healthcare. Recent Trends.

Reference(s) **Total: 45 Hours**

1. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014 AlexandruTelea, Data Visualization Principles and Practice CRC Press 2014.
2. Paul J. Deitel, Harvey Deitel, Java SE8 for Programmers (Deitel Developer Series) 3rd Edition, 2014.
3. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015.
4. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011.
5. Cay Horstmann BIG JAVA, 4th edition,John Wiley Sons,2009
6. Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.

7. Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar.

List of Challenging Experiments (Indicative)

1. Acquiring and plotting data
2. statistical Analysis such as Multivariate Analysis, PCA, LDA, Correlation, regression and analysis of variance.
3. Time-series analysis stock market.
4. Visualization on Streaming dataset.
5. Dashboard Creation.
6. Text visualization.

21AM016 SOCIAL AND INFORMATION NETWORKS

3 0 0 3

Course Objectives

1. Understand the components of social networks.
2. Model and visualize social networks.
3. Understand the role of semantic web in social networks.
4. Familiarize with the security concepts of social networks.
5. Find out various applications of social networks.

Course Outcomes (COs)

- Illustrate the basic components of social networks.
- Analyse the different measurements and metrics of social networks.
- Apply different techniques to detect and evaluate communities in social networks.
- Apply various types of social network models.
- Apply semantic web format to represent social networks.
- Develop social network applications using visualization tools.
- Usage of the security features in social and information networks for various practical applications.

UNIT I

INTRODUCTION **9 Hours**

Introduction to social network analysis Fundamental concepts in network analysis social network data notations for social network data Graphs and Matrices. Measures and Metrics: Strategic network formation - network centrality measures: degree, betweenness, closeness, eigenvector - network centralization density reciprocity transitivity ego network measures for ego network - dyadic network triadic network - cliques - groups-clustering search.

UNIT II **9 Hours**

COMMUNITY NETWORKS

Community structure - modularity, overlapping communities - detecting communities in social networks – Discovering communities: methodology, applications - community measurement - evaluating communities – applications.

UNIT III **9 Hours**

MODELS

Small world network – Watts Strogatz networks - Statistical Models for Social Networks Network evolution models: dynamical models, growing models - Nodal attribute model: exponential random graph models Preferential attachment - Power Law - random network model: Erdos -Renyi and Barabasi-AlbertEpidemics - Hybrid models of Network Formation.

UNIT IV **9 Hours**

SEMANTIC WEB

Modelling and aggregating social network data developing social semantic application evaluation of web-based social network extraction Data Mining Text Mining in social network tools-case study.

UNIT V **9 Hours**

VISUALIZATION AND SECURITY APPLICATIONS

Visualization of social networks novel visualizations and interactions for social networks applications of social network analysis tools - sna: R Tools for Social Network Analysis - Social
Networks Visualiser (SocNetV) - Pajek.

Total: 45 Hours

Reference(s)

1. Stanley Wasserman, Katherine Faust, Social network analysis: Methods and applications, Cambridge university press, 2009.
2. John Scott, Social network analysis, 3rd edition, SAGE, 2013.
3. Borko Furht, Handbook of Social Network Technologies and applications, Springer, 2010.
4. Jalal Kawash, Online Social Media Analysis and Visualization, 2015.
5. Charu Aggarwal, Social Network data analysis, Springer, 2011.
6. Easley and Kleinberg, Networks, Crowds, and Markets: Reasoning about a highly connected world. Cambridge University Press, 2010.

21AM017 VIDEO ANALYTICS

3 0 0 3

Course Objectives

1. Understand the need for video Analytics.
2. Understand the basic configuration of video analytics.
3. Understand the functional blocks of a video analytic system.
4. Get exposed to the various applications of video analytics.

Course Outcomes (COs)

- Design video analytic algorithms for security applications.
- Design video analytic algorithms for business intelligence.
- Design custom made video analytics system for the given target application.

UNIT I

VIDEO ANALYTIC COMPONENTS **9 Hours**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction- classifier - Pre-processing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features.

UNIT II

FOREGROUND EXTRACTION **9 Hours**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment.

UNIT III

CLASSIFIERS **9 Hours**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier.

UNIT IV **9 Hours**

LEAD MANAGEMENT & DIGITAL MARKETING

Web to lead forms- Web to case forms- Lead generation techniques- Leads are everywhere- social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker- CPC reduction (in case of paid ads) Group posting on Social Media platforms.

UNIT V **9 Hours**

VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE

Customer behaviour analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning.

Total: 45 Hours

Reference(s)

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing, Kluwer academic publisher, 2001.
2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video
3. Processing in Surveillance and Monitoring Systems (IGI global) 2016.
4. 3. Zhihao Chen (Author), Ye Yang (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
5. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012.

21AM018 INFORMATION STORAGE MANAGEMENT

3 0 0 3

Course Objectives

1. Understand the challenges in information storage and management
2. Describe the core elements in a data centre.
3. Understand RAID and its various levels for data backup

Course Outcomes (COs)

1. 1.Explain physical and logical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems.
2. 2.Describe storage networking technologies such as FC-SAN, IP-SAN, FCoE, NAS and object-based, and unified storage.
3. 3.Illustrate and articulate business continuity solutions, backup and replications, along with archives for managing fixed content.
4. 4.Explain key characteristics, services, deployment models, and infrastructure components for cloud computing.
5. Implement the concept of security storage infrastructure management.

UNIT I **9 Hours**

STORAGE SYSTEM

Introduction to information storage, Virtualization and cloud computing, Key data centre elements, Compute, application, and storage virtualization, Disk dive & flash drive components and performance, RAID, Intelligent storage system and storage provisioning (including virtual provisioning)

UNIT II **9 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Fibre Channel SAN components, FC protocol and operations, Block level storage virtualization, iSCL and FCIP as an IP-SAN solutions, Converged networking option FcoE, Network Attached Storage (NAS) components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.

UNIT III **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Business continuity terminologies, planning and solutions, Clustering and multipathing to avoid single points of failure, Backup and recovery methods, targets and topologies, data deduplication and backup in virtualized environment, fixed content and data archive.

UNIT IV

CLOUD COMPUTING CHARACTERISTICS AND BENEFITS **9 Hours**

Cloud Enabling Technologies - Characteristics of Cloud Computing- Benefits of Cloud Computing-Cloud Service Models Cloud deployment models- Cloud Computing Infrastructure-Cloud Challenges, Cloud migration considerations.

UNIT V **9 Hours**

SECURING AND MANAGING STORAGE INFRASTRUCTURE

Security threats, and countermeasures in various domains, Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle Management (ILM) and storage tiering.

Total: 45 Hours

Reference(s)

1. EMC Infrastructure Management Tools-Parallel SCSI-SAN Design Exercises-Network Technologies for Remote Replication-Information Availability.
2. Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments, 2nd Edition, EMC Educations Services, Wiley, May 2012.
3. Information Storage and Management: Storing, Managing, and Protecting Digital Information, EMC Education Services, Wiley, January 2010.
4. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,"Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009.