ACADEMIC REGULATIONS

COURSE STRUCTURE AND

DETAILED SYLLABUS

COMPUTER SCIENCE AND ENGINEERING

M. TECH TWO YEAR UG COURSE

(Applicable for the batches admitted from 2022-2023)

REGULATION: R22

J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
(UGC AUTONOMOUS)
Bhaskar Nagar, Yenkapally (V), Moinabad (M), Hyderabad – 500075,
Telangana, India

INSTITUTE-VISION AND MISSION

VISION:

To be a Centre of Excellence in Engineering and Management Education, Research and Application of Knowledge to benefit Society with blend of Ethical Values and Global Perception.

MISSION:

M1: To provide world class engineering education, encourage research and development.

M2: To evolve innovative applications of technology and develop entrepreneurship.

M3: To mould the students into socially responsible and capable leaders.

DEPARTMENT-VISION AND MISSION

VISION:

To meet the emerging trends in Computer Science and Engineering, strive for self-reliance enabled through high end research by adapting a futuristic approach.

MISSION:

M1: To impart qualitative education, prepare students refurbish their latent talents and aspire for a pragmatic career in Computer Science and Engineering.

M2: To provide an ambiance to develop strategic areas of advance study with perception to foster industry centric education in computer science and Engineering.

M3: To Inculcate self-learning among students to make them self-reliant and socially responsible.

Program Educational Objectives (PEOs)

PEO1

To emphasize analytical, computational and programming based tools and methods of computer science and engineering to solve real-world problems.

PEO2

To mould the student's career by steering their confidence levels for better understanding, strengthening the technical outlook for innovation and better communication at the job place where they are employed.

PEO3

To hone the technical skills for creating and productivity in computer science and engineering beyond classroom learning.

PEO4

To promote multi-disciplinary awareness through exposure to areas of project development and industrial training for sustainable competition in Research and Development.

JBIET Academic Regulations - R22

Applicable to

Master of Technology
(M. Tech)
Regular Two-Year Degree Programme

(For the Batches admitted from the Academic Year 2022- 2023)

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JBIET Academic Regulations - R22

Applicable to

M. Tech Regular Two-Year Degree Programme

(For the Batches admitted from the Academic Year 2022- 2023)

Offered under **Choice Based Credit System (CBCS)**

1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T)

J. B. Institute of Engineering and Technology (JBIET) offers Two Years (Four Semesters) full-time Master of Technology (M. Tech.) Degree programmes, under Choice Based Credit System (CBCS) in the following branches of Engineering and Technology with different specializations as mentioned below:

Computer Science & Engineering	Computer Science & Engineering
Electronics & Communication Engineering	VLSI System Design
Electrical & Electronics Engineering	Electrical Power Systems
Mechanical Engineering	CAD / CAM
Civil Engineering	Structural Engineering

2.0 Eligibility for Admissions

2.1 Admission to the PGPs shall be made subject to eligibility, qualification and specializations prescribed by the University from time to time, for each specialization under each M.Tech programme.

2.2 Admission to the post graduate programme shall be made on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by Telangana State Government (PGCET) for M.Tech. programmes.

2.3 The medium of instructions for all PG Programmes will be ENGLISH only.

3.0 M.Tech. Programme (PGP in E & T) Structure

3.1 The M.Tech Programmes in E & T of JBIET are of Semester pattern, with Four Semesters consisting of Two academic years, each academic year having Two Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional

days per Semester.

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

3.3.1 Semester Scheme

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or 'Lab Course', or 'Seminar', or 'Comprehensive Viva', or 'Project' as the case may be.

3.3.2 Credit Courses

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

- One credit for one hour/week/semester for theory/lecture (L) courses
- One credit for two hours/ week/semester for laboratory/ practical (P) courses or tutorials
- Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and identified mandatory courses, if any, will not carry credits.

3.3.3 Mandatory Courses: A student shall register for all mandatory courses mentioned in the curriculum and get minimum pass marks (i.e., 40% of total marks through internal evaluation only) to get the degree. Grade points obtained in these courses will not be considered for awarding class.

3.3.4 Subject Course Classification

All subjects / courses offered for the Post-Graduate Programme in E & T (M.Tech Degree Programme) are broadly classified as follows. The institute has followed in general the guidelines issued by AICTE/UGC.

S. No	Broad Course Classification	Course Group/Category	Course Description
1	Core Courses (CoC)	PC – Professional Core	Includes subjects related to the parent discipline / department/ Branch of Engineering
		Project Work	M. Tech Project or PG Project or Major Project
		Seminar, Technical paper writing	Seminar/Colloquium based on core contents related to parent discipline/department/ Branch of Engineering
		Comprehensive Viva-Voce	Viva-voce covering all the PG subjects studied during the course work and related aspects
2	Elective Courses (EIE)	PE – Program Electives	Includes elective subjects related to the parent discipline/ department/ Branch of Engineering
		OE - Open Electives	Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/department/ Branch of Engineering
Total number of Credits = 68			

4.0. Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each specialization, who will advise on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 The Department invites 'Registration Forms' from students. Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

4.3 A Student can apply for Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the Department

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries during Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices also will not be considered. However, if the Subject/ Course that has already been listed for Registration by the Department in a Semester could not be offered due to unforeseen or unexpected reasons, then the Student will be allowed to have alternate choice either for a new Subject, if it is offered, or for another existing Subject (subject to availability of seats). Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

4.6 Program electives: The students have to choose 5 Program electives (PE-I to V) from the list of program electives given. (2 PEs in I Semester, 2 PEs in II Semester and 1 in III Semester).

4.7 Open electives: The students have to choose one open elective (OE-I) from the list of open electives given in II year I semester.

5.0 Attendance Requirements

The programmes are offered on the basis of a unit system with each subject being considered a unit.

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5.1 A student is eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses) for that semester..

5.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned on medical grounds.

5.3 Shortage of attendance below 65% in aggregate shall in no case be condoned.

5.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester.

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

5.6 A prescribed fee per subject shall be payable for condoning shortage of attendance.

6.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 5. The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks per subject / course (theory / practical), on the basis of Internal Evaluation and Semester End Examination.

6.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if he secures not less than 40% of marks (24 out of 60 marks) in the End Semester Examination, and a minimum of 50% of marks (50 out of 100 marks) in the sum total of CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

6.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/ course, if he secures not less than 50% of the total marks. The student is deemed to have failed, if he (i) does not attend the comprehensive viva-voce as per the schedule given, or (ii) does not present the seminar as required, or (iii) does not present the Technical Paper Writing as required. In such a case, he may reappear for comprehensive viva-voce in supplementary examinations and for seminar/ technical paper writing, in the subsequent semesters, as and when scheduled.

6.3 A student shall register for all subjects for total of 68 credits as specified and listed in the course structure for the chosen specialization, put in required the attendance and fulfill the academic requirements for securing 68 credits obtaining

a minimum of 'B' Grade or above in each subject, and all 68 credits securing Semester Grade Point Average (SGPA) 6.0 (in each semester) and final Cumulative Grade Point Average (CGPA) (i.e., CGPA at the end of PGP) 6.0, to complete the PGP successfully.

6.4 Marks and Letter Grades obtained in all those subjects covering the above specified 68 credits alone shall be considered for the calculation of final CGPA, which will be indicated in the Grade Card /Marks Memo of second year second semester.

6.5 If a student registers for extra subject(s) (in the parent department or other departments/ branches of Engineering) other than those listed subjects totalling to 68 credits as specified in the course structure, the performance in extra subject(s) (although evaluated and graded using the same procedure as that of the required 68 credits) will not be taken into account while calculating the SGPA and CGPA. For such extra subject(s) registered, a certificate will be issued with a letter grade indicated as a performance measure, subject to completion of the attendance and academic requirements as stated in items 5 and 6.1 - 6.3.

6.6 A student eligible to appear for the Semester End Examination in any subject, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that subject at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that subject will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that subject.

6.7 A Student who fails to earn 68 credits as per the specified course structure, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his seat in M.Tech. programme and his admission shall stand cancelled.

7.0 Evaluation - Distribution and Weightage of Marks

7.1 The performance of a student in every subject/course (including practicals) will be evaluated for 100 marks each, with 40 marks allotted for Continuous Internal Evaluation (CIE) and 60 marks for Semester End Examination (SEE).

7.2 For theory courses, during the semester there is **2 mid-term** examinations (internal exams of **30 marks** each) and **2 assignments** carrying **10 marks** each.

7.3 Each mid-term examination will be of 1 hour 20 minutes consisting of Part-A (short

answer questions) for **10 marks** and Part-B (long answer) for **20 marks**. Part-A consists of Five two marks questions and Part- B consists of five questions carrying 5 marks each and student should answer 4 questions.

7.4 First mid-term examination is conducted from first 2 Modules of syllabus and second mid-term examination is conducted for remaining 3 Modules of syllabus during the last week of instruction.

7.5 The Continuous Internal Evaluation for theory course shall be made as average of marks obtained in CIE – I and CIE –II as detailed in the table below.

CIE – I	Marks	CIE - II	Marks
MID – I	30	MID - II	30
Assignment – I	10	Assignment - II	10
Total	40	Total	40

7.6 If a student is absent for any test/assignment, he is awarded zero marks for that test/assignment. However, a candidate may be permitted on genuine grounds provided he/she has taken permission before the mid-term examination from the Head of the Department. Moreover, he/she has to apply for makeup examinations within a week after completion of mid-term examinations. A subcommittee will be constituted with the following composition to look into such cases.

Subcommittee-composition:

S. No.	Faculty Member	Designation
1	Concern Head of the Department	Chairman
2	Senior faculty nominated by Principal	Member
3	One Senior faculty member of the concern department	Member
4	One faculty member of the other department	Member
5	Additional Controller of Examinations	Member

7.7 The details of the Question Paper pattern for Semester End Examination (Theory) are given below:

The Semester End Examination will be conducted for **60 marks**. It consists of two parts. i).Part A for **10 marks**, ii). Part B for **50 marks**.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions carrying **10 marks** each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

7.8 For practical subjects, **60 marks** shall be awarded for performance in the Semester End Examinations and **40 marks** shall be awarded as Internal Marks. Out of the **40 marks** for internal evaluation, day-to-day work in the laboratory is evaluated for **30 marks** and internal practical examination is evaluated for **10 marks** conducted by the laboratory teacher concerned.

The semester end examination is conducted with an external examiner and the laboratory teacher. The external examiner is selected and appointed by the Principal from the list submitted by Head of the Department

7.9 The semester end examination is conducted with an external examiner and the laboratory teacher. The external examiner is selected and appointed by the Principal from the list submitted by Head of the Department.

7.10 There shall be a Seminar presentation during II Year I semester. For Seminar student under the supervision of a faculty member shall collect literature on a topic and critically review the literature and submit a report to the Department. Upon acceptance of the report by the Department committee candidate shall make an oral presentation before the Department Commitee. The Department Committee comprising of Head of The Department, supervisor, and two other senior faculty members of the Department shall evaluate for 50 marks. There is no external Evaluation for the Seminar.

7.11 There shall be a mini project preferably suggested by the industry of their specialization. The mini project shall be carried out during the summer vacation between I Year II Semester and II year I Semester is evaluated for 50 marks in the II Year I Semester by the Head, Supervisor/ mentor and a senior faculty of the department. A candidate has to secure a minimum of 50% of marks (25 out of 50) to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same during the supplementary examinations as and when conducted, subject to item 3.2.

7.12 There shall be a dissertation/major project work of one-year duration which contributes strong weightage in the curriculum in the II year. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultation with industry preferably in the region. The planning of laboratory work/modelling/computational work with execution schedule is suggested at the beginning of the programme to ensure expected outcome. This will lead to creation of patents from the result of the programme.

7.13 Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

7.14 A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Coordinator and one senior faculty member of the Departments offering the M. Tech. programme.

7.15 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement in all the subjects, both theory and practicals.

7.16 After satisfying 7.15, a candidate has to present in Project Work Review I, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to then Project Work Review Committee (PRC) for approval within four weeks from the commencement of Second Year First Semester. Only after obtaining the approval of the PRC can the student initiate the Project work.

7.17 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

7.18 A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of approval of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

7.19 The major project work shall be carried out in two stages: Project Stage – I during II Year I Semester, Project Stage – II during II Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in II Year I semester and second report includes project work carried out in II Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

7.20 For Project Stage – I, the Project Review Committee shall evaluate the project work for 50 marks and project supervisor shall evaluate for 50 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 50% marks in the sum total of the CIE and SEE taken together. A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.21 For Project Stage – II, the external examiner shall evaluate the project work for 50 marks and the project supervisor shall evaluate it for 50 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 50% marks in the sum total of the CIE and SEE taken together. For conducting viva-voce of project stage – II, Principal selects an external examiner from the panel of experts in the relevant branch submitted by the HOD.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.22 After approval from the PRC, the soft copy of the thesis should be submiitted to the Department for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 30%, then only thesis will be accepted for submission.

7.23 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College, after submission of a research paper related to the project work in a UGC approved journal. A copy of the submitted research paper shall be attached to thesis.

7.24 The Project Viva-Voce External examination marks must be submitted to the Exam Branch on the same day of the examination.

8.0 Re-Admission/Re-Registration

8.1 Re-Admission for Discontinued Student

A student, who has discontinued the M.Tech. degree programme due to any reason whatsoever, may be considered for 'readmission' into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned, subject to item 6.6.

9.0 Examinations and Assessment - The Grading System

9.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Technical Paper Writing or Project, etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 7 above, and a corresponding Letter Grade shall be given.

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

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B+ (Good)	7
50 and less than 60%	B (Above Average)	6
Below 50%	F (FAIL)	0
Absent	Ab	0

9.3 A student obtaining F Grade in any Subject is deemed to have 'failed' and is required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those subjects will remain as obtained earlier.

9.4 If a student has not appeared for the examinations, 'Ab' Grade will be allocated to him for any subject and shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted.

9.5 A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.

9.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.

9.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

9.8 The student passes the Subject/ Course only when he gets GP ≥ 6 (B Grade or above).

9.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

$$SGPA = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{i=1}^{N} Ci} \text{ for each Semester}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects 'registered' for the semester (as specifically required and listed under the course structure of the department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \left\{ \frac{\sum_{J=1}^{M} C_J G_J}{\sum_{J=1}^{N} C_J} \right\} \text{..... FOR ALL "S" SEMESTERS REGISTERED}$$

(I.E., UP TO AND INCLUSIVE OF S SEMESTER, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' for from the 1^{st} Semester onwards up to and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (taking into account all Subjects from 1 to S Semesters), C_i is the no. of Credits allotted to the j^{th} Subject, and C_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	4	O	10	4 x 10 = 40
Course 3	4	C	5	4 x 5 = 20
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	C	5	3 x 5 = 15
	21			152

$$SGPA = \frac{152}{21} = 7.24$$

Illustration of calculation of CGPA:

Semester	Credits	SGPA	Credits*SGPA
Semester-I	16	7	16 x 7 = 112
Semester-II	18	6	18 x 6 = 108
Semester-III	18	6.5	18x 6.5 = 117
Semester-IV	16	6	16 x 6 = 96
	68		433

$$CGPA = \frac{433}{68} = 6.37$$

10.0 Award of Degree and Class

10.1 If a student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of 68 Credits (with CGPA 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with the specialization that he was admitted into.

10.2 Award of Class

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

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	6.75≤ CGPA < 7.75
Second Class	6.00≤ CGPA < 6.75

A student with final CGPA (at the end of the **PGP) < 6.00** shall not be eligible for the Award of Degree.

11.0 Withholding of Results

If the student has not paid the dues, if any, to the Institution or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester.

12.0. Transitory Regulations

12.1 A student who has been detained in any semester of I Year of Previous Regulations due to lack of attendance, shall be permitted to join the same semester of I Year of R22 Regulations and he is required to complete the study of M.Tech programme within the stipulated period of four academic years from the date of first admission in I Year I semester. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

12.2 For student readmitted to R22 Regulations, the maximum credits that a student acquires for the award of the degree, shall be the sum of the total number of credits secured in previous regulations of his/her study including R22 Regulations.

12.3 If a student readmitted to R22 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 regulations will be substituted by another subject to be suggested by the Concerned Board Of Studies (BOS).

13 General

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

13.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Institution is final.

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

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.

3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.

6.	Refuses to obey the orders of the chief superintendent /assistant superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performancein that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.

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

J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOMOUS)

Bhaskar Nagar, Moinabad Mandal, R.R. District, Hyderabad -500075

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M. Tech - COMPUTER SCIENCE AND ENGINEERING (CSE): R-22

CHOICE BASED CREDIT SYSTEM (CBCS)

COURSE STRUCTURE (2022-2023)

I YEAR – I SEMESTER							
Sl. No	**Code**	**Core/ Elective**	**Course Title**	**L**	**T**	**P**	**C**
1.	LM71A	Core1	Machine Learning	3	0	0	3
2.	LM71B	Core2	Cloud Computing	3	0	0	3
3.	LM71C	PE 1	1. Advanced Data Structures	3	0	0	3
	LM71D		2. Internet of Things				
	LM71E		3. Cryptography &Network Security				
4.	LM71F	PE 2	1. Software Architectures	3	0	0	3
	LM71G		2. Data Science				
	LM71H		3. Distributed Systems				
5.	LM71I	Lab1	Machine Learning Lab	0	0	4	2
6.	LM71J	Lab2	Cloud Computing Lab	0	0	4	2
7.	LM91A	MC-I	Soft Skills	2	0	0	0
TOTAL CREDITS				**14**	**0**	**8**	**16**
I YEAR – II SEMESTER							
Sl. No	**Code**	**Core/ Elective**	**Course Title**	**L**	**T**	**P**	**C**
1.	LM72A	Core3	Android Application Development	3	0	0	3
2.	LM72B	Core4	Network Programming	3	0	0	3
3.	LM72C	PE 3	1. Adhoc and Sensor Network	3	0	0	3
	LM72D		2. Data Analytics				
	LM72E		3. Parallel Computing				
4.	LM72F	PE 4	1. Human Computer Interaction	3	0	0	3
	LM72G		2. Computer Vision				
	LM72A		3. Distributed Data Bases				
5.	LM72H	Core	Research Methodology and IPR	2	0	0	2
6.	LM72I	Lab1	Android Application Development Lab	0	0	4	2
7.	LM72J	Lab2	Network Programming Lab	0	0	4	2
8.	LM92B	MC-II	Personality Development and Professional Values	2	0	0	0
TOTAL CREDITS				16	0	8	18

II YEAR – I SEMESTER							
Sl. No.	**Code**	**Core/ Elective**	**Course Title**	**L**	**T**	**P**	**C**
1.	LM73A	PE 5	Block Chain Technology	3	0	0	3
	LM73B		High Performance Computing				
	LM73C		Design Thinking				
2.		OE	Open Elective-I	3	0	0	3
3.	JM73D		Mini Project	0	0	4	2
4.	JM73E		Technical Seminar	0	0	2	1
5.	JM73F	Major Project	Major Project Phase-I Dissertation	0	0	20	09
TOTAL CREDITS				6	0	26	**18**
II YEAR – II SEMESTER							
Sl. No.	**Code**	**Core/ Elective**	**Course Title**	**L**	**T**	**P**	**C**
1.	LM74A	Major Project	Major Project Phase-II Dissertation	0	0	32	16
TOTAL CREDITS				0	0	32	**16**
GRAND TOTAL CREDITS							**68**

PE: Program Elective
OE: Open Elective

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course	MACHINE LEARNING	L	T	P	D
Credits: 3		3	0	0	0

MACHINE LEARNING

Pre-Requisites:

1. A course on Linear Algebra and Advanced Calculus.
2. A course on "Probability and Statistics."
3. A course on "Data structures".

Course Objectives

The student will:

1. Use Models, methods and tools to solve regression, classification, feature selection, dimensionality reduction and density estimation problems.
2. Learn and adapt in supervised, unsupervised and semi-supervised modes of learning.
3. Gain knowledge of recognition, decision making and statistical learning problems.
4. Understand current research topics and issues in machine learning.
5. Conduct and present a literature review on a research topic.

Module 1:

INTRODUCTION - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision treelearning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Module 2:

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neuralnetwork learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks.

EvaluationHypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

Module 3:

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximumlikelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs

algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning
Instance-Based Learning- Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning,
Genetic Algorithms –Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Paralleling Genetic Algorithms

Module 4:
Learning Sets of Rules –Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution
Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

Module 5:
Combining Inductive and Analytical Learning –Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators,
Reinforcement Learning –Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming.
Text Books:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

Reference Books:

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

E - Resources:

1. https://www.slideshare.net/darshanharry/machine-learning-46440299
2. https://news.vidyaacademy.ac.in/wp-content/uploads/2018/10/NotesOnMachineLearningForBTech-1.pdf
3. https://nptel.ac.in/courses/106/106/106106202/

Course Outcomes

The Student will be able to:

1. Summaries on well posed problem, concept learning and various perspectives of machine learning
2. Apply machine learning algorithms such as Decision tree, Artificial Neural Networks to solve real world problems and formulate evaluation hypotheses.
3. Compare and contrast various machine learning methodologies such as Bayesian Learning, Computational learning theory, instance based learning and Genetic algorithms.
4. Implement rule based learning and analytical learning strategies to solve complex problems.
5. Combine inductive learning with analytical learning and deploy Reinforcement learning which supports dynamic programming.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	2	-	-	-	-	-	-	-	-	1	2
CO2	-	2	2	2	-	-	-	-	-	-	-	-	-	2
CO3	2	2	-	3	-	-	-	-	-	-	-	-	2	2
CO4	2	3	2	1	-	-	-	-	-	-	-	-	1	2
CO5	2	1	2	2	-	-	-	-	-	-	-	-	2	2
Average	2.0	2.0	2.0	2.0	-	-	-	-	-	-	-	-	1.5	2.0

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	CLOUD COMPUTING	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1. A course on “Computer Networks”.
2. A course on “Operating Systems”.
3. A course on “Data base management systems"

Course objectives:

The Student will:

1. Understand the fundamentals of the Cloud Computing and strategies in the New Economy.
2. Provide a fundamental understanding of different types of cloud computing applications.
3. Provide insights to implement virtualization techniques.
4. Understand the design of cloud and its architecture.
5. Outlines the categories and multimedia in Cloud Computing.

Module 1:

Principles of Parallel and Distributed Computing, Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies

Cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and Mapreduce.

Module 2:

Cloud Platforms in the Industry, Understanding Scientific Applications for Cloud Environments, cloud applications.

Healthcare and education, Scientific Applications, Business and Consumer Applications.

Module 3:

Virtualization, cloud virtualization technology, deep dive: cloud virtualization, migrating in to cloud computing.

Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems.

Module 4:

Enterprise cloud computing Paradigm, Federated cloud computing Architecture.

SLA Management in Cloud Computing, Developing the cloud: cloud application Design.

Module 5:

Cloud management, Organizational Readiness and change management in the cloud age, Cloud Security, Data security in the cloud.

Legal Issues in the Cloud , Achieving Production Readiness for the cloud Services.

Text Books:

1. Cloud Computing: Raj Kumar Buyya , James Broberg, andrzejGoscinski, 2013 Wiley.
2. Cloud computing: Dr Kumar Saurab Wiley India 2011.

Reference Books:

1. Cloud Computing: ArshdeepBahga, Vijay Madisetti, 2014, University Press.
2. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola,selvi-2013.

E - Resources:

3. https://nptel.ac.in/courses/106/105/106105167/
2. https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf
3. https://www.alljntuworld.in/download/cloud-computing-cc-materials-notes/
4. https://www.slideshare.net/jeetraj17/cloud-computing-it703-Module-1-5

Course outcomes:
The Student will be able to:

1. Identify different elements of cloud computing.
2. Examine the essential processes of a Cloud Computing system.
3. Analyze the impact of Cloud Computing on organizations and strategy.
4. Learns the various marketing strategies for an online business.
5. Explain the infrastructure and multimedia concepts.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	-	2	2	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	2	-	-	-	-	-	-	-	-	2
CO4	2	2	2	-	1	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	2
Average	2.0	2.0	2.0	2.0	1.7	-	-	-	-	-	-	-	2.0	2.0

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	ADVANCED DATASTRUCTURES (Professional Elective-1)	L	T	P	D
Credits: 3		3	0	0	0

Prerequisites

1. A course on " Data Structures"

Course objectives:

Students will :

1. Introduces the heap data structures such as leftist trees, binomial heaps, fibonacci and min-max heaps
2. Introduces hash tables, different hashing techniques and collision resolution techniques.
3. Understand variety of data structures, search structures and multiway search trees.
4. Gain the Knowledge of different digital search structures and Tries.
5. Understand the different pattern matching techniques for searching pattern in the text.

Module - 1

Heap Structures- Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

Module - 2

Hashing and Collisions

Introduction, Hash Tables, Hash Functions, different Hash Functions:- Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

Module – 3

Search Structures- OBST, AVL trees, Red-Black trees, Splay trees,

Multiway Search Trees - B-trees., 2-3 trees

Module - 4

Digital Search Structures - Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

Module - 5

Pattern matching : Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String , Harspool, Rabin Karp

Textbooks

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

References

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran, Universities Press.

Course outcomes:

Students will be able to:

1. Attain the Knowledge of heap data structures such as leftist trees, binomial heaps, Fibonacci and min-max heaps.
2. Apply the hashing and collision resolution techniques.
3. Implement and differentiate different search trees.
4. Differentiate different types of Tries.
5. Apply the different pattern matching techniques for searching pattern in the text.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	3	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	3	-	-	-	-	-	-	-	-	1	2
CO4	3	2	1	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	-	3
Average	3.0	2.0	1.8	2.2	-	-	-	-	-	-	-	-	1.5	2.4

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	INTERNET OF THINGS (Professional Elective-1)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Nil

Course Objectives

The Student will:

1. Understand the current vision of the Internet of Things and its impact on the world
2. Classify basic concepts of IoT and M2M & IoT system management
3. Describe concepts of python language and different python packages.
4. Explain how to design IoT Physical devices with built-ins of python Programs
5. Identify the advanced concepts of IoT physical servers, cloud offerings.

Module 1:

Introduction to Internet of Things –Introduction, Definition and Characteristics of IoT,

Physical Design of IoT – Things in IoT, IoT Protocols, Logical Design of IOT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs

IoT Enabling Technologies – Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems.

Domain Specific IoTs – Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

Module 2:

IoT and M2M – Introduction, M2M, Difference between IOT and M2M, SDN and NFV for IoT-Software Defined Networking, Network Function Virtualization,

IoT System Management with NETCONF-YANG- Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, NETOPEER.

Module 3:

IoT Systems-Logical Design Using Python-Introduction, Installing Python, Data types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Date/Time Operations, Classes.

Python Packages of Interest for IoT- JSON, XML, HTTPLib, URLLib, SMTPLib

Module 4:

IoT Physical Devices and Endpoints – What is an IoT Device,Exemplary Device: Raspberry Pi,About the Board,Linux on Raspberry Pi, Raspberry PI-Interfaces (Serial, SPI, I2C),Programming Raspberry Pi with Python-Controlling LED, Interfacing an LED and Switch and interfacing a light sensor with Raspberry Pi.

Module 5:

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage Models and communication APIs, WAMP-AutoBahn for IoT,Xively Cloud for IoT, Python web application

framework Designing a RESTful web API.

Text book:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Reference Books:

1. Internet of Things by Jeeva Bose 1st edition, Khanna publishing.

E - Resources:

1. https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
2. https://nptel.ac.in/courses/106/105/106105166/
3. https://www.slideshare.net/MohanKumarG/internetofthings-iot-aseminar-ppt-by-mohankumarg

Course Outcomes

The Student will be able to:

1. Analyze current vision of the Internet of Things and its impact on the world.
2. Demonstrate basic concepts of IoT and M2M & IoT system management
3. Practice the concepts of python language using different python packages
4. Design IoT Physical devices using python Programming.
5. Categorize advanced concepts of IoT physical servers, cloud offerings and Hadoop.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	1	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	1	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	2
Average	3.0	3.0	2.8	-	-	-	-	-	-	-	-	-	1.6	2.0

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	CRYPTOGRAPHY &NETWORK SECTURITY (Professional Elective-1)	L	T	P	D
Credits: 3		3	0	0	0

Prerequisites

1. A Course on "Computer Networks

Course objectives:

Students will :

1. To impart knowledge on network security issues, services, goals and mechanisms.
2. To analyze the security of communication systems, networks and protocols.
3. To apply algorithms used for secure transactions in real world application
4. To understand the email privacy and IP security.
5. Gain knowledge about web security protocols and intruders, threats, firewalls

Module - 1

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms.

A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module -2

Conventional Encryption: Principles, Conventional encryption algorithms (DES, AES, RC4, Blowfish), cipher block modes of operation, location of encryption devices.

Key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC.

Module -3

Number Theory: Modular Arithmetic, Euclid's Algorithm, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Public key cryptography principles.

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

Module - 4

Email privacy: Pretty Good Privacy (PGP) and S/MIME.

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module - 5

Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).
Intruders, Viruses and related threats, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.
Text Books:

1. "Cryptography and Network Security" by William Stallings 3rd Edition, Pearson Education.
2. "Applied Cryptography" by BruceSchneier 2nd Edition,Wiley Publisher.

References:

1. Cryptography and Network Security by Behrouz A.Forouzan, 2nd edition, Tata McGraw-Hill Education.

Course outcomes:

Students will be able to:

1.Demonstrate the knowledge of cryptography and network security concepts and applications.
2.Ability to apply security principles in system design.
3.Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.
4.Implement the privacy to message transmission by providing IP security.
5.Analyze about web security protocols and intruders, threats, firewalls

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
Average	3.0	3.0	2	-	-	-	-	-	-	-	-	-	2	2.5

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	SOFTWARE ARCHITECTURE (Professional Elective-2)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite:

1. A course On "Software Engineering"

Course Objectives:

Students will:

1. Understand the concept of software architecture
2. Understand the design, documentation of software Architecture and Reconstruct.
3. Understand importance of Architecture Evaluation and Methods.
4. Understand reusability of Architecture

Module 1:

Envisioning Architecture

The Architecture Business Cycle, What is Software Architecture, Architectural patterns,reference models, reference architectures, architectural structures and views.

A-7E – A case study in utilizing architectural structures

Module 2:

Creating an Architecture

Understanding Quality Attributes, Achieving qualities, Architectural styles and patterns

Air Traffic Control – a case study in designing for high availability

Module 3:

Designing the Architecture, Documenting software architectures, Reconstructing Software Architecture

Flight Simulation – a case study in Architecture for Integrability

Module 4:

Analyzing Architectures

Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

The Nightingale System - a case study in Applying the ATAM

The NASA ECS Project – a case study in Applying the CBAM

Module 5:

Moving from one system to manySoftware Product Lines, Building systems from off the shelf components, Software architecture in future.

Celsius Tech – a case study in product line development

Text Books:

1. Software Architecture in Practice, , Len Bass, Pau Clements & Rick Kazman, second edition Pearson Education,2003.

Reference Books:

1. Beyond Software architecture, Luke Hohmann, Addison wesley,2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR,2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

E- Resources:

Course Outcomes:

1. Design, document and Reconstruct Software Architecture
2. Gain knowledge on Software Architecture
3. Evaluate Architecture
4. Reuse the Architecture

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2												2
CO2	2		2											
CO3	2	2												
CO4	2	2	2											2
CO5	2	2	2											2

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	DATA SCIENCE (Professional Elective-2)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite:
1.Good mathematical background and programming skills.
Course Objectives:
The students will
1. To explain how math and information sciences can contribute to building better algorithms and software.
2. To develop fundamental knowledge of concepts underlying data science projects.
3. To develop applied experience with data science software, programming, applications and processes.
4. To develop practical data analysis skills, which can be applied to practical problems.
5. To develop practical skills needed in modern analytics.

Module 1:
Introduction to Data Science
What is Data Science? - Big Data VS Data Science, Datafication, Current landscape of perspectives and Skill sets needed.
Module 2:
Statistics in Data Science
Statistical Inference, Populations and samples, Statistical modeling, probability distributions, fitting a model.
Module 3:
Exploratory Data Analysis
Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process.
Module 4:
Liner Regression for Data Science
Simple Linear Regression, Multiple Linear Regression, other Considerations in the Regression Model,
Module 5:
Classification
An Overview of Classification, Why Not Linear Regression?, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods.

Text Books:
1. Practical Data Science with R". Nina Zumel, John Mount. Manning, 2014.

Reference Books:

1. Data Science for business", F. Provost, T Fawcett, 2013.

E-Resources:

1. https://www2.cs.duke.edu/courses/compsci190/fall18

Course Outcomes:

The students will able to

1. Know basic notions and definitions in data analysis.
2. Know standard methods of data analysis
3. Understand and Apply Statistical Methods for Data Analysis.
4. formulate the problem of knowledge extraction.
5. translate a real-world problem into mathematical terms.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	DISTRIBUTED SYSTEMS (Professional Elective-2)	L	T	P	D
Credits: 3		3	0	0	0

Prerequisites

1. A course on " Operating Systems"
2. A course on "Network Security and Cryptography"

Course objectives:

Students will :

1. Attain the knowledge onbasic distributed systems.
2. Get knowledge of distributed file systems.
3. Discuss Peer to Peer systems.
4. Demonstrate concurrency control techniques.
5. Attain the knowledge about security and its applications

Course outcomes:

Students will be able to:

1. Understand the concept of distributed system IPC and RPC.
2. Analyze distributed file systems and name services.
3. Understand Peer to Peer systems and distributed coordination .
4. Illustrate various transaction and concurrency control methods.
5. Analyze various security issues and its applications.

Module - 1

Characterization of Distributed Systems-Introduction, Examples of Distributed systems, Resource sharing and web,challenges,System models-Introduction, Architectural and Fundamental models, Networking and Internetworking.

InterProcess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects,RPC,Events and notifications, Case study-Java RMI.

Module - 2

Operating System Support- Introduction, OS layer,Protection,Processes and Threads, Communication and Invocation, Operating system architectur,DistributedFile Systems-Introduction, File Service architecture, case study- SUN network file systems.

Name Services-Introduction, Name Services and the Domain Name System,Case study of the Global Name Service, Case study of the X.500 Directory Service.

Module - 3

Peer to Peer Systems–Introduction,Napster and its legacy, Peer to Peer middleware, Routingoverlays, Overlay case studies-Pastry,Tapestry,Application case studies-Squirrel,OceanStore.

Time and Global States-Introduction,Clocks,events and Process states, Synchronizing physical clocks, logical time and logical clocks, globalstates, distributed debugging. Coordination and Agreement-Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

Module - 4

Transactions and Concurrency control-Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control.

Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery,Replication-Introduction,System model and group communication, Fault tolerant services, Transactions with replicated data.

Module - 5

Security-Introduction, Overview of Security techniques, Cryptographicalgorithms, Digitalsignatures, Case studies-Kerberos, TLS,802.11Wi-Fi.

Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munincasestudy, Other consistency models, CORBA case study-Introduction, CORBARMI,CORBA Services.

Text Books

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems,S.Ghosh,Chapman&Hall/CRC,Taylor&Francis Group,2010.

Reference Books

1. Distributed Computing,S.Mahajan and S.Shah,Oxford University Press.
2. Distributed Operating Systems Concepts and Design,PradeepK.Sinha,PHI.
3. Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, TMH.
4. Reliable Distributed Systems,K.P.Birman,Springer.
5. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
6. Distributed Operating Systems and Algorithm Analysis,R.Chow,T.Johnson,Pearson.
7. Distributed Operating Systems,A.S.Tanenbaum,Pearson education.
8. Distributed Computing,Principles,Algorithms and Systems,AjayD.Kshemakalyani and Mukesh Singhal,Cambridge,rp 2010.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
Average	3.0	3.0	2	-	-	-	-	-	-	-	-	-	2	2.5

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	MACHINE LEARNING LAB	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1.A course on Linear Algebra and Advanced Calculus.

2.A course on "Probability and Statistics."

3. A course on "Data structures".

Course Objectives

The student will:

1. Use Models, methods and tools to solve regression, classification, feature selection, dimensionality reduction and density estimation problems.
2. Learn and adapt in supervised, unsupervised and semi-supervised modes of learning.
3. Gain knowledge of recognition, decision making and statistical learning problems.
4. Understand current research topics and issues in machine learning.
5. Conduct and present a literature review on a research topic.

List of Programs

Experiment 1: Familiarizing with Ananconda and Jupyter, for importing modules and dependencies for ML

Experiment 2: Familiarization with numpy, Panda and Matplotlib by Loading Dataset in Python.

Experiment 3:Familiarization with Pytorchin Python.

Experiment 4: Find S algorithm in Python

Experiment 5: Candidate Elimination Algorithm in Python

Experiment 6: ID3 Algorithm for Decision Tree in Python

Experiment 7: C4.3 Algorithm for Decision Tree in Python.

Experiment 8: Demonstration of Logistic Regression using Python.

Experiment 9: Demonstration of Classification using Python.

Experiment 10: Demonstration of Clustering using Python.

Experiment 11: Implementation of Bayesian Network in Python.

Experiment 12: Implementation of SVM using Python.

Experiment 13: Implementation of XOR function using NN and Python.

Experiment 14: Implementation of Backpropagation using Python.

Experiment 15: Implementation of Autoencoder in python.

Experiment 16: Sentiment Analysis using "Bag of Words" in Python

Experiment 17: Recommender System in Python.

Text Books:
1.Machine Learning – Tom M. Mitchell, - MGH
2.Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)
Reference Books:
1.Machine Learning Methods in the Environmental Sciences, Neural Networks, William whsieh, Cambridge Univ. Press.
2.Richard O. Duda, Peter E. Hart and David G. Stork, Pattern classification, John Wiley & Sons Inc., 2001.
3.Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Presss, 1995.

Course Outcomes

The Student will be able to:
1. Summaries on well posed problem, concept learning and various perspectives of machine learning

2. Apply machine learning algorithms such as Decision tree, Artificial Neural Networks to solve real world problems and formulate evaluation hypotheses.

3. Compare and contrast various machine learning methodologies such as Bayesian Learning, Computational learning theory, instance based learning and Genetic algorithms.

4. Implement rule based learning and analytical learning strategies to solve complex problems.

5. Combine inductive learning with analytical learning and deploy Reinforcement learning which supports dynamic programming.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	-	-	-	-	-	-	-

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – I Sem			
Course Code:	CLOUD COMPUTING LAB	L	T	P	D
Credits: 3		3	0	0	0

Course Objective:
To develop web applications in cloud

1. To learn the design and development process involved in creating a cloud based application

Course Outcome:

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

- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.
- To learn to implement and use parallel programming using Hadoop

List of Experiments:

1.Install VirtualBox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Implement data Migration between virtual machines installed within a single computer.
5. Use GAE launcher to launch the web applications.
6. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
7. Find a procedure to transfer the files from one virtual machine to another virtual machine.
8. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
9. Install Hadoop single node cluster.
10. Run simple applications of wordcount in Hadoop Single node cluster.
11. Implement File level Security in the Cloud.
12. Implement “Access level Security” in the Cloud.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	-	-	-	-	-	-	-

onwards	(UGC Autonomous)	I Year – I Sem			
Course Code:	SOFT SKILLS (Mandatory Course – I)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
Course Objectives The student will: This course will enable students to: 1. Study the Positivity, Motivation and developing positive thinking and attitude. 2. Summarize the listening skills and essential formal writing skills. 3. Explain the Time Management and Personality Development. 4. Describe the Decision-Making and Problem-Solving Skills. 5. Study the Psychometric Analysis and Mock Interview Sessions.
Module 1: Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.
Module 2: Interpersonal Communication: Interpersonal relations; communication models, process, and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. Non-Verbal Communication: Importance and Elements; Body Language. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.
Module 3: Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. Etiquette and Manners – Social and Business. Time Management – Concept, Essentials, Tips. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.
Module 4: Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution. Stress

Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and 8 Impact of Stress; Measurement and Management of Stress, Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertivness Skills. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

Module 5:

Employability Skills: Resume buildings – Facing the Personal Interview (HR and Technical)- Psychometric Analysis- Mock Interview Sessions.

Text Books:

REFERENCE BOOKS:

1. Managing Soft Skills for Personality Development –edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

E - Resources:

Course Outcomes

The Student will be able to:

On completion of the course, the students will be able to:

1. Describe the Positivity, Motivation and developing positive thinking and attitude.
2. Explain the listening skills and essential formal writing skills.
3. Discuss the Time Management and Personality Development.
4. Illustrate the Decision-Making and Problem-Solving Skills.
5. Describe the Psychometric Analysis and Mock Interview Sessions.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	ANDROID APPLICATION DEVELOPMENT	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1. Software Engineering
2. Java Programming

Course objectives:

The student will:

1. Describe Android SDK features and understand Android Architecture.
2. Configure Android project and SDK setting for Android Application.
3. Understand the life cycle of activity and service.
4. Understand the structure of an Intent, custom app permissions and Application Resources
5. Build screens, layouts and draw shapes and text.

Module -1

INTRODUCTION TO ANDROID, TOOLS, AND BASICS

The Android Platform:

Introduction - History of mobile application development - The Open Handset Alliance (OHA) - The Android Platform - Android Versions -Native Android Applications -Android SDK Features - Android Architecture -Factors that affect Mobile Application development

Android Studio for Android Software Development: Installing Android Studio-System Requirements for Android Studio -Downloading Android Studio 2.4 -Downloading JDK 2.5- Installing JDK 2.6- Installing Android- Features of Android Studio -App Workflow -Android Virtual Devices (AVD) -Using Hardware Device to test Application -Android Studio IDE Components

Module -2

ANDROID APPLICATION DEVELOPMENT BASICS

Android Project Structure and Basics: Creating a new Android Project- Defining the Project and SDK Settings -Creating Activity -Running a HelloWorld Application -Android Project Structure - Android Project Files -Android Application Modules -Types of Modules -Project structure settings -Anatomy of an Android Application -Important Android Terminology -Basic Android API Packages -Android Advanced API Packages

Android Manifest File and Its common settings: Components of Manifest file -Package name and application ID -App components -Permissions -Device compatibility-File conventions -Manifest element

Module -3

ANDROIDAPPLICATIONDESIGNESSENTIALS - 1

Activities: Introduction -What is activity? -Configuring the AndroidManifest.xml file -Life Cycle of an Activity -Understanding Life Cycle of an Activity -Context -Activity Transition
Services: Introduction -Use of services -Creating a service -Start and Stop Service – Service Life Cycle-Creatingyourownservice

Module –4

ANDROIDAPPLICATIONDESIGNESSENTIALS - 2

Intent: Introduction -Intent Structure -Other Operations on Intent -Types of Intent -Intent Resolution -Example of Intent -Explanation of Example -Standard Activity Actions – Standard Broadcast Actions
Permissions: Introduction -Permission approval -Request prompts for dangerous permissions -Permission for optional hardware features -Custom App Permission -Permission Protection Level -How to view App's Permission?
Application Resources: What are resources? -Resource Directory Hierarchy -Resource Value Types-Storing Different Resource Value Types -Accessing Resource Programmatically – Referencing System Resources

Module –5

ANDROID USER INTERFACE DESIGN

Basic User Interface Screen Elements: Introduction to Views, Controls and Layout -TextView -EditText -AutoCompleteTextView -Spinner -Buttons -Check Box
Designing User Interfaces with Layouts: Introduction -Creating Layouts Using XML Resources -Creating Layouts Programmatically -Built-In Layouts -Frame Layout -Linear Layout -Relative
Drawing and Working with Animation: Introduction -Canvas and Paints -Bitmaps -Shapes -Frame by Frame animation -Tweened Animation

Text Books:

1. PGDMAD-103: Android Mobile Application Development, ISBN-978-81-940577-2-7 June 2019 by Dr. Babasaheb Ambedkar Open University.
2. PGDMAD-105: Software Lab for Android Mobile Application Development, ISBN-978-81-940577-4-7 June 2019 by Dr. Babasaheb Ambedkar Open University.
3. PGDMAD-201: Advanced Android Mobile Application, ISBN-978-81-940577-5-8 by Dr. Babasaheb Ambedkar Open University.
4. PGDMAD-203: Software Lab for Advanced Android Mobile Application, ISBN-978-81-940577-7-2 by Dr. Babasaheb Ambedkar Open University.

Reference Book:

1. Https://developer.android.com.
2. Wireless Communications & Networks, Second Edition, William Stallings by Pearson.
3. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH.
4. Android Application Development Black Book, Pradeep Kothari, dreamtech press.
5. Wireless and mobile networks, Dr.Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri by WILEY.
6. Wireless networks, P. Nicopolitidis, M. S. Obaidat, G.I. Papadimitriou, A.S. Pomportsis by WILEY.
7. Mobile Computing, Raj Kamal by Oxford.
8. Mobile Computing Theory and Practice-Kumkum Garg- Pearson.

Course outcomes:

The student will be able to:

1. Devise App Workflow and use hardware device to test an application.
2. Create an android application and run the application.
3. Illustrate Activity transition and create a service.
4. Perform operations on intent and provide permission with different protection levels.
5. Implement style controls and apply themes to entire screens.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	2
CO2	2	2	3	2	2	-	-	-	-	-	-	-	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	3
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	3
Average	2.8	2.0	2.3	2.0	2.0	-	-	-	-	-	-	1.0	2.0	2.8

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	NETWORK PROGRAMMING	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Knowledge of Linux Operating system.
2.A good knowledge of the C programming language.
3. Knowledge of Operating Systems concepts.

Course Objectives
The student will:

- To understand socket programming in its entirety
- To understand usage of TCP/UDP / Raw sockets
- To understand how to build network applications

Module 1:
Introduction to Network Programming: OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

Sockets: Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.

Module 2:
TCP client server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.

Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. I/O Multiplexing: I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server,.

Module 3:
Socket options: getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.

Advanced I/O Functions-Introduction, Socket Timeouts, recv and send Functions,readv and writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued?, Sockets and Standard I/O, T/TCP: TCP for Transactions.

Module 4:
Elementary name and Address conversions: DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information. Daemon Processes and inetd Superserver – Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd Function

Broadcasting- Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions Multicasting- Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast_join and Related Functions, dg_cli Function Using Multicasting, Receiving MBone Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol, SNTP

Module 5:
Raw Sockets-Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon, Datalink Access- Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux:

SOCK_PACKET, libpcap: Packet Capture Library, Examining the UDP Checksum Field. Remote Login: Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.

Text Books:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, - W. Richard Stevens. PHI.

REFERENCE BOOKS:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

E - Resources:

Course Outcomes
The Student will be able to:

- Comprehend the differences between typical scripting languages and typical system and application programming languages.
- Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.
- Acquire programming skills in scripting language

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3		2	2									3
CO2	2		3									2		
CO3	3	2		2										3
CO4	2	1	2		2							2		2
CO5	3	2	3	3	2									3

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	ADHOC AND SENSOR NETWORK (Professional Elective-3)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Computer Networks
2.Distributed Systems
3.Mobile Computing

Course Objectives
The student will:
1.Understand the concepts of sensor networks
2.Understand the MAC and transport protocols for adhoc networks
3.Understand the security of sensor networks
4.Understand the applications of adhoc and sensor networks

Module 1:
Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.
Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology-based routing algorithms-Proactive: DSDV, WRP; Reactive: DSR, AODV, TORA;

Hybrid: ZRP; Position- based routing algorithms-Location Services-DREAM, Quorum-based, GLS; Forwarding Strategies: Greedy Packet, Restricted Directional Flooding-DREAM, LAR; Other routing algorithms-QoS Routing, CEDAR.

Module 2:
Data Transmission - Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP.

Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR and Geocasting: Data- transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR

Module 3:
TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc Basics of Wireless.

Sensors and Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

Module 4:
Data Retrieval in Sensor Networks
Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

Module 5:
Security - Security in Ad Hoc networks, Key management.,implmentations and issues,power restriction in security manahgement

Secure routing, Cooperation in MANETs, Intrusion Detection systems.

Text Books:

1.Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications, March 2006, ISBN – 981-256-681-3

2.Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

REFERENCE BOOKS:
E - Resources:

1.www.cs.princeton.edu
2.http://sureshq.blogspot.in/2016/12/wireless-sensors-networks-wsn-notes-and.html
3. www.cs.ucl.ac.uk
2.www.comp.nus.edu.sg
3.www.iitk.ac.in
4.www.iitd.ernet.in
5.www.iitr.ac.in
6.www.iitg.ernet.in
7.www.bits-pilani.ac.in
10. www.iisc.ernet.in
Course Outcomes
The Student will be able to:
1.Elaborate the state of the art research in emerging subject of Ad hoc and Wireless Sensor Networks (ASN).
2.Solve the issues in real-time application development based on ASN.
3.Conduct further research in the ASN domain.
4.Analyze concepts of Routing and Data Retrieval in Sensor Networks.
5.Construct secured ad-hoc and sensor networks

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak													
Program Outcomes (POs)												Program Specific Outcomes*	
PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
2	2	2										2	1
2	3	3	2									2	2
2	2	2	2									2	2
2	3	2	2									2	2
2	2	3	1									3	2

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	DATA ANALTYTICS (Professional Elective-3)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1. Data Warehousing and data mining
2. Database Management Systems

Course Objectives

The student will:

1.Explore the fundamental concepts of data analytics.

2.Learn the principles and methods of statistical analysis

3.Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

4.Understand the various search methods and visualization techniques.

Module 1:

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc.

Data Management, Data Quality(noise, outliers, missing values, duplicate data) and Data Processing & Processing.

Module 2:

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables.

Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

Module 3:

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

Module 4:

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision

Trees etc.
Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

Module 5:
Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques.
Hierarchical Visualization Techniques, Visualizing Complex Data andRelations.

Text Books:
1.Student's Handbook for Associate Analytics – II,III.
2.Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.
REFERENCE BOOKS:
1.Introduction to Data Mining, Tan, Steinbach and Kumar, AddisionWisley, 2006.
2.Data Mining Analysis and Concepts, M. ZakiandW.Meira
3.Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.
4.Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005
5.Windows Forensics by Chad Steel, Wiley India Edition.

E - Resources:

Course Outcomes
The Student will be able to:
1.Understand the impact of data analytics for business decisions and strategy
2.Carry out data analysis/statistical analysis
3.Carry out standarddata visualizationand formal inference procedures
4.Design Data Architecture
5.Understand various Data Sources

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														
CO5														

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	PARALLEL COMPUTING (Professional Elective-3)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Computer Organization & Architecture
2.Operating Systems
3.Programming for problem solving
Course Objectives
The student will:
1.Introduce the foundations of parallel Computing.
2.Learn various parallel computing architectures and programming models.
3.Gain knowledge of writing efficient parallel programs.

Module 1:
Parallel Computing: Introduction, Motivation and scope - Parallel Programming Platforms – Basic Communication Operations

Module 2:
Principles of Parallel Algorithm Design - Analytical Modeling of Parallel Programs

Module 3:
Programming using Message Passing Paradigm(MPI) – Programming Shared Address Space Platforms(PThreads)

Module 4:
Dense Matric Algorithms (Matrix-Vector Multiplication , Matrix-Matrix Multiplication) – Sorting Algorithms (Issues, Bubble Sort, Quick Sort, Bucket Sort, Enumeration Sort, Radix Sort)

Module 5:
Graph Algorithms (Minimum Spanning Tree: Prim's Algorithm - Single- Source Shortest Paths: Dijkstra's Algorithm) Search Algorithms (DFS, BFS)

Text Books:
1. Introduction to Parallel Computing, Second Edition, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003, ISBN: 0201648652

REFERENCE BOOKS:
1.Parallel Computing – Theory and Practice, Second Edition, Michaek J. Quinn, Tata McGraw-Hill

Edition.
2.ParallelComputers–Architecturesand Programming,
V. Rajaraman, C. Siva RamMurthy, PHI.

E - Resources:

Course Outcomes
The Student will be able to:
1.Understand the concepts of parallel architectures
2.Select the data structures that efficiently model the information in a problem.
3.Develop an efficient parallel algorithm to solve it.
4.Implement an efficient and correct code to solve it, analyze its performance

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														
CO5														

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	HUMAN COMPUTER INTERACTION (Professional Elective-4)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1.Basic computer knowledge.

Course Objectives

The student will:

1.Understand of user interface design in general, and alternatives to traditional, keyboard and mouse" computing.

2.Elaborate to apply models from cognitive psychology to predicting user performance

3.Be familiar with a variety of both conventional and non-traditional user interface paradigms.

4.Understand the social implications of technology and their ethical responsibilities as engineers in the design of technological systems.

5.Plan for small groups on a product design from start to finish will provide you with invaluable team-work experience.

Module 1:

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design

The graphical use rinterface: Popularity of graphics, direct manipulation, graphical system, Characteristics, Web user –interface popularity, characteristics- Principles of user interface.

Module 2:

Design process: Human interaction with computers, important of human characteristics in design, human considerations in design, Human interaction speeds, understanding business junctions.

Module 3:

Screen Designing: Interface design goals, Screen meaning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis, presenting information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

Module 4:

Windows: Window characteristics, components of a window, presentation styles, types, management, organizing window functions, operations

Selection of device based and screen based controls.

Module 5:

Write clear text and messages, create meaningful Graphics, Icons, Images, Choose proper colors

Interaction Devices: Keyboard and function keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

Text Books:

1.Wilbent. O. Galitz ,"The Essential Guide To User InterfaceDesign", Second Edition, Wiley

IndiaEdition
2.Ben Sheiderman, “Designing The User Interface”, ThirdEdition, Addison-Wesley

REFERENCE BOOKS:
1.Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEALG, PEARSON.
2.Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech.
3.User Interface Design, Soren Lauesen , Pearson Education.

E - Resources:
1.https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_introduction.htm
2.https://lecturenotes.in/subject/445/human-computer-interaction-hci
3.https://www.studocu.com/in/document/anna-university/human-computer-interaction/lecture-notes/hci-notes-all-units-1/3707695/view
4.https://www.alljntuworld.in/download/human-computer-interaction-materials-notes/
Course Outcomes
The Student will be able to:
1.Analyze the user interface design in general, and alternatives to traditional, keyboard and mouse” computing
2.Apply models from cognitive psychology to predicting user performance
3.Analyze the variety of both conventional and non-traditional user interface paradigms.
4.Analyze the social implications of technology and their ethical responsibilities as engineers in the design of technological systems.
5.Create for small groups on a product design from start to finish will provide you with invaluable team-work experience.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2					2							1	
CO2	2					2				2			1	
CO3	2									2				
CO4	2					2				2			1	
CO5	2									2			1	

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	COMPUTER VISION (Professional Elective-4)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: NIL

Course Objectives
The student will:
1.Review image processing techniques for computer vision
2.Understand shape and region analysis
3.Understand Hough Transform and its applications to detect lines, circles, ellipses
4.Understand three-dimensional image analysis techniques
5.Understand motion analysis

Module 1:
IMAGE PROCESSING FOUNDATIONS
Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

Module 2:
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

Module 3:
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 – spatial matched filtering – GHT for ellipse detection – object location– GHT for feature collation

Module 4:
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

Module 5:
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

Text Books:
1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
REFERENCE BOOKS:
1.R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer2011.
2.Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.
3.Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
4.D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
5.Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 2012.

E - Resources:

Course Outcomes
The Student will be able to:
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

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	DISTRIBUTED DATA BASES (Professional Elective-4)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Database Management Systems

Course Objectives
The student will:
1.Study the usage and applications of Object Oriented databases.
2.Learn the modeling and design of databases
3.Acquire knowledge on parallel and distributed databases and its applications.
4.Equip students with principles and knowledge of parallel and object oriented databases.
5.Know topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

Module 1:
Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

Module 2:
Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.
Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

Module 3:
The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions
Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

Module 4:
Reliability, Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of

Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection

Module 5:
Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects
Database Integration, Scheme Translation, Scheme Integration, Query Processing Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues Transaction Management Transaction and Computation Model, Multidatabase Concurrency Control, Multidatabase Recovery, Object Orientation and Interoperability, Object Management Architecture CORBA and Database interoperability, Distributed Component Object Model, COM/OLE and Database Interoperability, PUSH-Based Technologies

Text Books:
1.Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti,TMH.
2.Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez , Pearson Education, 2nd Edition.

REFERENCE BOOKS:
1.Distributed Database Systems,ChandaRay,Pearson.
2.Distributed Database Management Systems, S.K.Rahimi and Frank.S.Haug, Wiley.
E - Resources:
1. https://www.tutorialspoint.com/distributed_dbms/
2. https://www.geeksforgeeks.org/distributed-database-system/
3. https://docs.oracle.com/cd/B19306_01/server.102/b14231/ ds_concepts.htm
4. https://searchoracle.techtarget.com/definition/distributed-database
5. https://wps.prenhall.com/bp_hoffer_mdm_

Course Outcomes
The Student will be able to:
1.Demonstrate theoretical and practical aspects of distributed database systems.
2.Analyze the issues related to the development of distributed database system.
3.Apply the design aspects of object oriented database system and related development.
4.Solve the problem by using global queries for distributed databases.
5.Design applications / tools in order to utilize DDBMS applications.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2			2								2	
CO2	3	3	3	2	2								2	
CO3	3	3	3		3									2
CO4	3	3	3		2								2	2
CO5	2	3	3	2	3								1	2

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	RESEARCH METHODOLOGY& IPR	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Nil

Course Objectives

The student will:

1.To understand the basic concept of research problem formulation.

2.To be exposed to effective research report writing and research design.

3.To investigate the various methods of data collection and analysis.

4.To understand the various fields of Industrial Property and PCT.

5.To be exposed to administration of IP and new developments in IPR.

Module 1:

Introduction

Meaning and Objectives of Research, Types of Research, Research Approaches, Research Methods Vs Methodology, Research Process, Criteria of Good Research.

Research Problem

Meaning of Research Problem, Steps involved in Selecting a Research Problem, Scope and Objectives of Research Problem, Sources of Research Problem, Characteristics of a Good Research Problem, Steps involved in Defining a Research Problem.

Module 2:

Effective technical writing

Importance of Literature Review, Steps involved in conducting a Literature Review, Research Report, Characteristics of a Good Report, Layout of a Research Report, writing a Journal Paper, Writing a Research Proposal, Format of Research Proposal, Plagiarism and Research Ethics.

Research Design

Need for Research Design, features of a Good Design, Important Concept Relating to Research Design, Categories of Research Design, Design Thinking Approach

Module 3:

Data Collection

Methods of Primary Data Collection – Observation Method, Interview Method, Collection of Data through Questionnaire and Schedule, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Data Processing and Analysis

Processing Operations, Problems in Processing, Types of Analysis, Multivariate Analysis, Correlation Analysis, Regression Analysis.

Module 4:

Test Procedures:

Fields of Intellectual Protection

Patents - Conditions of Patentability, Drafting and Filing a Patent Application, Examination of a

Patent Application; Copyright - Copyright Protection, Subject Matter of Copyright Protection, Ownership of Copyright, Limitations on Copyright Protection; Trademarks - Definitions, Criteria of Protect ability, Protection of Trademark Rights; Industrial Designs; Geographical Indications.
International cooperation on intellectual property
World Intellectual Property Organization (WIPO) - Patenting under PCT; Patent information and databases; Licensing and transfer of technology.

Module 5:
Administration of Industrial Property
Administrative Structure in the Industrial Property Office, Patent Office, Trademark Office, Industrial Designs Office, Patent and Trademark Attorney.
New Developments in IPR
Technological and Legal Developments in IntellectualProperty, Traditional Knowledge, Case Studies.

Text Books:
1.Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & Engineering Students'', Juta& Co. Ltd Publishers, Revised Second Edition, 2006.
2.Halbert, "Resisting Intellectual Property", Routledge, Taylor & Francis Ltd, First Edition, 2007.
3.C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publications, Revised Second Edition, 2004.
REFERENCE BOOKS:
1.Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", British Library Publishers, Fourth Edition, 2014.
2.Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Wolters Kluwer Law & Business Publishers, 2016.
3.T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand Publications, First Edition, 2008.
E - Resources:
1.https://www.coursera.org/learn/research-methods
2.https://onlinecourses.nptel.ac.in/noc19_ge21/preview
3.https://www.edx.org/course/research-methods-an-engineering-approach
4.https://en.wikipedia.org/wiki/Intellectual_property
5.https://nptel.ac.in/courses/109/106/109106137/
Course Outcomes
The Student will be able to:
1.Understand the basic concept of research problem formulation.
2.Develop an effective research proposal and research report.
3.Identify appropriate method for data collection and analysis for effective research.
4.Apply for Patent Filing and other fields of IP.
5.Make use of new developments in IPR.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	ANDROID APPPLICATION LAB	L	T	P	D
Credits: 2		2	0	0	0

Pre-Requisites:

1.Software Engineering
2.Java Programming

Course objectives:

The student will:

1.Describe Android SDK features and understand Android Architecture.
2.Configure Android project and SDK setting for Android Application.
3.Understand the life cycle of activity and service.
4.Understand the structure of an Intent,custom app permissions and Application Resources
5.Build screens, layouts and draw shapes and text.

List of Experiments:

1. Create an application with default layout to demonstrate Android Activity Life Cycle.
2. Write a mobile application to create simple calculator and implement following functionalities:
a) When user press ADDITION Button add two numbers and show result
b)When user press SUBTRACT Button subtract two numbers and show result
c)When user press MULTIPLY Button multiply two numbers and show result
d)When user press DIVIDE Button divide number 1 by numbers 2 and show result.
3. Write a mobile application to create login interface and implement following functionalities:
a) if username is “abc@jbiet.edu.in” and password is “jbiet@123” then enable login button and when login button is pressed open another activity and display welcome<user-name> message
b) If username or password is not correct then login button should remain disabled
4. Create mobile interface with following functionalities.
a) When user press the submit button app should display highest qualification and hobbies selected by the user in the Toast.
5. Create mobile interface with following functionalities.
a) When user press the SELECT DATE button app should display date dialog and when user select date and press OK button it should display selected date in Toast
b) When user press the SELECT TIME button app should display time dialog and when user select time and press OK button it should display selected time in Toast.
c) If the user clicks CANCEL button, the dialog should be closed and return to home screen.
6. Create mobile interface with following functionalities
a) The spinner should display list of standard colors defined as string array in string.xml file
b) whenever user selects color from spinner, it should change the background color as per user choice.

7. Create mobile interface with following functionalities
a) The app should display list of person names defined as string array
b) Whenever user selects person name from list, it should display his/her name in Toast.
8. Create an application to call specific entered number by user in the Edit Text
9. Create an application that designs a layout with spinner and an image view. The spinner should contain various shapes like circle, rectangle, and rounded rectangle. When a shape is selected from the spinner that shape should be drawn in the image view. (Hint: Use shape Drawable or xml files for shapes on image view)
10. Create an application that load shape defined as an XML resource and display it in an image view.
11. Create an application that will have spinner with list of animation names as shown below. On selecting animation name, that animation should affect on the images.
12. Case Study:
Create an application that designs a layout having radio buttons and 2 text boxes for currency converter which allows user to select a particular conversion from following options.
a) Rupees to dollars
b) Dollars to Rupees
c) Rupees to pound
d) Pound to Rupees
The data for conversion should be entered by the user in textbox. When user clicking on the option, appropriate operation should be performed, and correct result should be displayed. You can assume suitable rates for conversion between rupees and dollars and rupees and pounds and vice versa.

E-Resources:
1.https://www.udacity.com/course/new-android-fundamentals--ud851
2.https://www.udacity.com/course/ud853
3.http://developer.android.com/training/basics/firstapp/index.html
4.http://developer.android.com/tools/sdk/eclipse-adt.html
5.http://www.tutorialspoint.com/android/
6.http://www.tutorialspoint.com/android/android_overview.htm
7.http://www.codelearn.org/android-tutorial
8.http://pl.cs.jhu.edu/oose/resources/android/Android-Tutorial.pdf
9.http://mobisys.in/blog/2012/01/introduction-to-android-sqlite-database/
10.www.appmakr.com/Android
11.www.telerik.com/android-development
12.www.developer.android.com/training/basics/firstapp

Course outcomes:

The student will be able to:

1.Devise App Workflow and use hardware device to test an application.
2.Create an android application and run the application.
3.Illustrate Activity transition and create a service.
4.Perform operations on intent and provide permission with different protection levels.
5.Implement style controls and apply themes to entire screens.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	2
CO2	2	2	3	2	2	-	-	-	-	-	-	-	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	3
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	3
Average	2.8	2.0	2.3	2.0	2.0	-	-	-	-	-	-	1.0	2.0	2.8

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	NETWORK PROGRAMMING LAB	L	T	P	D
Credits: 3		2	0	0	0

Pre-Requisites:
1.Basic Knowledge about Computer and Linux Operating system.
2.Good understanding of C Programming language.
Course Objectives
The student will:
1.Familiarize with the Linux environment.
2.Describe the fundamentals of shell scripting/programming.
3.Apply the various linux system calls for writing c programs to implement inter-process communication.
4.Analyze use of UNIX utilities like pipes, FIFOs.
5.Analyze TCP and UDP programs.
List of Programs

Note: Use Bash for Shell scripts.
EXPERIMENT 1. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.
EXPERIMENT 2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
EXPERIMENT 3. Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute
permissions.
EXPERIMENT 4. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
EXPERIMENT 5. Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
EXPERIMENT 6. Write a shell script to list all of the directory files in a directory.
EXPERIMENT 7. Write a shell script to find factorial of a given integer.
EXPERIMENT 8. Write an awk script to count the number of lines in a file that do not contain vowels.
EXPERIMENT 9. Write an awk script to find the number of characters, words and lines in a file.
EXPERIMENT 10. Write a c program that makes a copy of a file using standard I/O and system calls.
EXPERIMENT 11. Implement in C the following Unix commands using System calls
A. cat B. Ls C. mv
EXPERIMENT 12. Write a program that takes one or more file/directory names as command line

input and reports the following information on the file.
A. File type. B. Number of links.
C. Time of last access. D. Read, Write and Execute permissions.
EXPERIMENT 13. Write a C program to emulate the Unix ls –l command.
EXPERIMENT 14. Write a C program to list for every file in a directory, its inode number and file name.
EXPERIMENT 15. Write a C program that demonstrates redirection of standard output to a file. Ex: ls > f1.
EXPERIMENT 16. Write a C program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.
EXPERIMENT 17. Write a C program to create a Zombie process.
EXPERIMENT 18. Write a C program that illustrates how an orphan is created.
EXPERIMENT 19. Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex:- ls –l | sort
EXPERIMENT 20. Write C programs that illustrate communication between two unrelated processes using named pipe.
EXPERIMENT 21. Write a C program to create a message queue with read and write permissions to write 3 messages to it with different priority numbers.
EXPERIMENT 22. Write a C program that receives the messages (from the above message queue as specified in (21)) and displays them.
EXPERIMENT 23. Write a C program to allow cooperating processes to lock a resource for exclusive use, using a)Semaphores b)flock or lock fsystem calls.
EXPERIMENT 24. Write a C program that illustrates suspending and resuming processes using signals.
EXPERIMENT 25. Write a C program that implements a producer- consumer system with two processes. (using Semaphores).
EXPERIMENT 26. Write client and server programs(using c) for interaction between server and client processes using Unix Domain sockets.
EXPERIMENT 27. Write client and server programs(using c) for interaction between server and client processes using Internet Domain sockets.
EXPERIMENT 28. Write a C program that illustrates two processes communicating using shared memory.

Text Books:

1.Unix System Programming using C++, T.Chan, PHI.(UnitsII,III,IV)
2.Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.(Unit I)
3.An Introduction to Network Programming with Java, Jan Graba, Springer, rp2010. (Unit V)
4.Unix Network Programming, W.R. Stevens, PHI. (UnitsII, III,IV)
5.Java Network Programming, 3rd edition,E.R.Harold,SPD, O'Reilly. (Unit V)

REFERENCE BOOKS:

1.Linux System Programming, Robert Love, O'Reilly,SPD.
2.Advanced Programming in the UNIX environment, 2ndEdition, W.R.Stevens, PearsonEducation.
3.UNIX for programmers and users, 3rd Edition, Graham Glass, King Ables, PearsonEducation.
4.Beginning Linux Programming, 4thEdition, N.Matthew, R.Stones, Wrox, Wiley IndiaEdition.

5.Unix Network Programming The Sockets Networking API, Vol.- I,W.R.Stevens, Bill Fenner, A.M.Rudoff, PearsonEducation.
6.Unix Internals, U.Vahalia, PearsonEducation.
7.Unix shell Programming, S.G.Kochan and P.Wood, 3rd edition, PearsonEducation.
8.C Programming Language, Kernighan and Ritchie,PHI

E - Resources:
1.https://www.tutorialspoint.com/unix/index.htm
2.https://www.tutorialspoint.com/operating_system/os_linux.htm
3.https://www.tutorialspoint.com/unix/unix-signals-traps.htm
4.https://www.tutorialspoint.com/network_socket_programming_in_c_practical_way/index.asp
5.https://www.edureka.co/blog/java-networking/

Course Outcomes
The Student will be able to:
1.Implement various shell commands
2.Write various shell scripts.
3.Use various API's to perform file opearions.
4.Implement inter-process communication between processes.
5.Establish simple tcp/ip network services on a linux system.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2		2	2									2
CO2	2		2									2		
CO3	3	2		2										2
CO4	2	1	2		2							2		2
CO5	3	2	2	3	2									3

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE I Year – II Sem			
Course Code:	PERSONALITY DEVELOPMENT AND PROFESSIONAL VALUES	L	T	P	D
Credits: 3		2	0	0	0

Pre-Requisites: Nil

Course Objectives
The student will:
1.Study the sensitization towards gender equality, physically challenged, intellectually challenged.
2.Summarize the Leadership and qualities of a successful leader.
3.Explain the Modern Challenges of Adolescent Emotions and behaviour.
4.Describe the Personality Development Body language.
5.Study the Workplace Rights & Responsibilities.

Module 1:
Concept of Human Values, Value Education Towards Personal Development
Aim of education and value education; Evolution of value-oriented education; Concept of Human values; types of values; Components of value education.
Personal Development: Self-analysis and introspection; sensitization towards gender equality, equitability, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.
Character Formation Towards Positive Personality: Truthfulness, Constructively, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.
Module 2:
Aspects of Personality Development -Body language- Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work s - Positive attitude – Advantages –Negative attitude- Disadvantages– Time management - Work ethics –Good manners and etiquette.
Module 3:
Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.
Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

Module 4:
Workplace Rights & Responsibilities, Ethics in changing domains of Research, Engineers and

Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Module 5:

Impact of Global Development on Ethics and Values

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges, and compromise. Defining the difference between aggressive, submissive, and assertive behaviours.

Modern Challenges of Adolescent Emotions and behaviour; Sex and spirituality: Comparison and competition; positive and negative thoughts. Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

Text Books:

1.Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2.Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

REFERENCE BOOKS:

1.Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi, Tata McGraw-Hill 1988.
2.Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3.Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
1.Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001

E - Resources:

Course Outcomes

The Student will be able to:

1.Describe the sensitization towards gender equality, physically challenged, intellectually challenged.
2.Explain the Leadership and qualities of a successful leader.
3.Discuss the Modern Challenges of Adolescent Emotions and behaviour.
4.Illustrate the Personality Development Body language.
5.Identify the Workplace Rights & Responsibilities.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														
CO5														

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	BLOCK CHAIN TECHNOLOGY (Professional Elective-5)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:Nil

Course Objectives

The student will:

1.Learn the fundamentals of BlockChain Technology

2.Understand the History of Money and working with Bitcoin

3.Understand usage of cryptography in Block Chain Technology

4.Create smart account and decentralized Systems.

Module 1:

Introduction: History, what is blockchain, the structure of block chains, types of block chain, block chain applications, block chain lifecycle. Limitations and challenges of blockchain.

Module 2:

Crypto currencies: Cryptography, the science behind crypto currencies, Symmetric key cryptography, cryptography hash functions, MAC and HMAC, asymmetric key cryptography Diffie-Hellman key exchange, symmetric versus asymmetric key cryptography, game theory Nash equilibrium, prisoners dilemma, byzantine Generals' problem, zero-sum games.

Module 3:

Bitcoin: History of Money, working with Bitcoins, the Bitcoin Blockchain, Bitcoin network, bitcoin scripts, Full nodes vs SPVs, Bitcoin wallets.

Module 4:

Ethereum: Ethereum as Next-Gen Blockchain, Design Philosophy of Ethereum, Ethereum Blockchain, Ethereum Accounts, Trie Usage, RLP Encoding, Ethereum Transaction Message structure, Ethereum smart contracts, Ethereum Virtual Machine, Ethereum Eco System.

Module 5:

Block chain application development, Interacting with bitcoin blockchain, interacting programmatically with ethereum for sending transactions, creating smart account, executing smart contract functions, decentralised application structure. Building an ethereumDapp

Text Books:

1.Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Bikramaditya Singhal, Gautam Dhameja ,Priyansu Sekhar Panda.

2.Blockchain Technology Explained: The Ultimate Beginner’s Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple,Dash

REFERENCE BOOKS:

1.Blockchain Technology: Introduction to Blockchain Technology and its impact on Business Ecosystem
2.Blockchain: Bitcoin, Ethereum & Blockchain: Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency
3.Blockchain: Discover the Technology behind Smart Contracts, Wallets, Mining and Cryptocurrency.

E - Resources:

Course Outcomes
The Student will be able to:
1.Understated the block chain Technology andlimitations
2.Analyse the history of money and working with Bitcoin and Bitcoin wallets
3.Use cryptography in bitcoin transactions
4.Understand the Design philosophy of Block Chain Technology and Virtual Machine
5.Develop Decentralized applications and BuildingethereumDapp

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														
CO5														

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	HIGH PERFORMANCE COMPUTING (Professional Elective-5)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Computer Organization &Architecture
2.Operating System Programming

Course Objectives
The student will:
1.Improve the system performance
2.Learn various distributed and parallel computing architecture
3.Learn different computing technologies

Module 1:
Grid Computing: Data & Computational Grids, Grid Architectures And Its Relations To Various Distributed Technologies. Autonomic Computing, Examples Of The Grid Computing Efforts (Ibm).
Module 2:
Cluster Setup & Its Advantages, Performance Models & Simulations; Networking Protocols & I/O, Messaging Systems. Process Scheduling, Load Sharing And Balancing; Distributed Shared Memory, Parallel I/O.
Module 3:
Example Cluster System – Beowlf; Cluster Operating Systems: CompasAnd Nanos
Pervasive Computing Concepts & Scenarios; Hardware & Software; Human – Machine Interface.
Module 4:
Device Connectivity; Java For Pervasive Devices; Application Examples.
Module 5:
Classical Vs Quantum Logic Gates; One, Two & Three Qubit Quantum Gates; Fredkin&Toffoli Gates; Quantum Circuits; Quantum Algorithms.

Text Books:
1.Selected Topics In Advanced Computing" Edited By Dr. P. Padmanabham And Dr. M.B. Srinivas, 2005 Pearson Education.

REFERENCE BOOKS:
1.J. Joseph & C. Fellenstien: 'Grid Computing ', Pearson Education
2.J. Burkhardt et.al: 'pervasive computing' Pearson Education
3.Marivesar:' Approaching quantum computing', pearson Education.
4.Raj kumarBuyya:'High performance cluster computing', pearson Education.
5.Neilsen &ChungL:'Quantum computing and Quantum Information', Cambridge University Press.
6.A networking approach to Grid Computing ,Minoli ,Wiley

E - Resources:

Course Outcomes
The Student will be able to:
1.Understanding the concepts in grid computing
2.Set up cluster and run parallel applications
3.Understand the cluster projects and cluster OS
4.Understand the concepts of pervasive computing & quantum computing.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														
CO5														

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	DESIGN THINKING (Professional Elective-5)	L	T	P	D
Credits: 3		3	0	0	0

Prerequisites
Nil
Course Objectives
• Expose students to the design process as a tool for innovation.
• Develop students' professional skills in client management and communication.
• Demonstrate the value of developing a local network and assist students in making lasting connections with the business community.
• Students develop a portfolio of work to set them apart in the job market.
• Provide an authentic opportunity for students to develop teamwork and leadership skills.

Module –I

Introduction to Design Thinking and Design Process

Intro to Design Thinking and Product Design, Creativity and Creative Confidence, Creative Techniques for Design Thinking, Design Thinking and Systems Thinking, Iterative properties of Design Thinking.
Stanford model ,HECModel,Dardan Model of Design Thinking

Design Process, Tools of persona, Journey Map and Empathy Map and Other Design Mapping tools, Design Thinking process planning, Divergent and Convergent Phases. Introduction to Synthesis phase of Design.

Module -II

Empathy: Identification of Real Requirement
Identifying insights and opportunities) of Product, How might we help and its iterations, Challenge findings, Identifying Target audience and its real needs.
Role of Leadership in Design Thinking, Feedback, visualizing ideas, Storytelling: Techniques and importance. Seen, perceived, thought, acted equilibrium.

Module –III
Ideation
Divergent phase of Ideation, Brain Storming, Various Brain storming Techniques, Tools for idea generation, TRIZ, SCAMPER, Case Study on Ideation.
Convergent phase of selection of few ideas for Prototype. Analysis for selection, Business Model Canvas for project.
Design Thinking for personal change

Module –IV

Prototype
Low Fidelity Prototype, Low fidelity techniques, Feedback collection process and iterative

improvement, advantages, and disadvantages of low fidelity prototyping. Low Fidelity prototype in UI/UX design, Wireframe modelling.
High Fidelity Prototype, Cost vs benefit analysis for High Fidelity Prototype, Why High Fidelity protype is not preferred, Use areas of high-Fidelity prototype, Product Launch process.

Module -V
Test and Implementation

Final Test Process, Test tools, Prelaunch, Limited Launch and Actual Launch Process. Feedback generation at Pre-launch and Limited Launch. Post implementation iterations.

Design Thinking in Social sector

Textbooks
1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross, Berg Publication 2011
2. Creative Confidence: Unleashing the Creative Potential Within Us, By David Kelly and Tom Kelly, William Collins, 2013

Reference Books
1. Thinking Design by S. Balram, Sage Publication, 2011
2. Solving Problems with Design Thinking: Ten Stories of What Works by Jeanne Liedtka, Columbia Business School Publishing, 2013

Course Outcomes
1. Students develop a strong understanding of the Design Process using Journey Map, Empathy Map, and Persona and how it can be applied in a variety of business settings.
2. Students learn to research and understand the unique needs of a company around specific challenges.
3. Students learn to build empathy for target audiences from different “cultures”.
4. Students learn to develop and test innovative ideas through a rapid iteration cycle.
5. Students learn how to create physical prototypes / a visual representation of an idea and test it.

	CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium & 1-Weak													
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	2	-	2		-	-	-	-	-	-	3	3
CO2	3	3	2	3	2		-	-	-	-	-	-	3	3
CO3	3	-	2	-	2		-	-	-	-	-	-	-	-
CO4	3	-	2	-	2		-	-	-	-	-	-	3	3
CO5	3	-	2	-	2		-	-	-	-	-	-	3	3
Average	3.0	0.6	2.0	0.6	2.0		-	-	-	-	-	-	2.4	2.4

OPEN ELECTIVE-1

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	PYTHON PROGRAMMING (Open Elective -1)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:
1.Need basic knowledge about computer.
2.Need Basic understanding of Programming language

Course Objectives
The student will:
1.Learn how to design and program Python applications.
2.Learn how to use lists, tuples, and dictionaries in Python programs.
3.Learn how to identify Python object types, Components decision statements, pass arguments in Python.
4.Learn how to build and package Python modules for reusability, design object oriented programs with Python classes, use class inheritance in Python for reusability.
5.Learn how to use exception handling in Python applications for error handling

Module 1:
Programming paradigms; Structured programming vs object oriented programming, OOPs fundamentals- class, object, abstraction, encapsulation, polymorphism, and inheritance; Introduction toPythonGettingstartedtoPython-aninterpretedhighlevellanguage,interactivemode and script mode. Variables, Expressions and Statements Values and types, Variables and keywords, statements, evaluating expressions, operators and operands, order of operations, composition. Functions function calls, type conversion, type coercion, pre-defined functions, composition, user define functions, flow of execution, passing parameters, function parameters and scope. Conditionals and recursion modulus operator, Boolean expression, logical operators, conditional execution, alternative execution, chained and nested conditionals, return statement; Recursion, infinite recursion.

Module 2:
Python data structures Strings Creating, initializing and accessing the elements; String operators, comparing strings using relational operators; String functions and methods.
Lists: Concept of mutable lists, creating, initializing and accessing the elements, traversing, appending, updating and deleting elements; List operations; List functions and Methods, list parameters, nested lists, Matrices.
Dictionaries: Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, dictionary operations traversing, appending, updating and deleting elements, Dictionary functions and methods.
Tuples:Mutability and tuples, Immutable concept, creating, initializing and accessing the elements in a tuple, Tuple functions.

Module 3:
Object oriented programming using Python: creating python classes, classes and objects: user defined compound types, attributes, instances as arguments, instances as return values, objects are mutable, copying; classes and functions: pure function, modifiers;
Exceptions: raising exceptions, handling exceptions, exception hierarchy.
Module 4:
Classes and methods: object oriented features, optional arguments, initialization method, operator overloading and polymorphism. Inheritance: Basic Inheritance: extending built-ins, overriding and super;
Multiple inheritance: the diamond problem, different sets of arguments

Module 5:
Files handling and Exceptions: Text files, writing variables, Directories, Pickling;
Database Programming in Python: Connection module, connect MySQL Data base, perform DDL, DML and DQL operations.

Text Books:
1.Python 3 Object Oriented Programming, Dusty Phillips, Packet Publishing,2010.
2.Programming in Python 3 - A complete Introduction to the Python Language- Second Edition, Mark Summerfiels, Addison- Wesley2010.

REFERENCE BOOKS:
1.Programming Python- 4th Edition, Mark Lutz, O'Reilly,2011.
2.Object-Oriented Programmingin Python, Michael H, Goldwasser, David Letscher,Pearson Prentice Hall,2008.

E - Resources:
•Python data structures: https://www.tutorialspoint.com/python3/python_strings.htm
•Classes and methods: https://www.youtube.com/watch?v=yCH9CUiXrP0
•Files handling and Exceptions: https://www.youtube.com/watch?v=RSl87lqOXDE
•Database Programming in Python: https://www.youtube.com/watch?v=bSZtsYYwFS0

Course Outcomes
The Student will be able to:
1.Apply Basic input /output operations for working with different data types in python.
2.Design functions for achieving code reusability and string manipulations.
3.Create a python program for implementing list, tuple dictionary.
4.Demonstrate Class and objects.
5.Implement File handling operation.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2									2
CO2	2	2		2									2	2
CO3	2	2	2	2									1	2
CO4	2	2	1	2										2
CO5	2	2	2	2										2

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	QUANTUM COMPUTING (Open Elective -1)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1. Knowledge on “Machine Learning”.
2. Knowledge on “Probability and Statistics”.

Course objectives:
The Student will:

1. Interpret the fundamentals of quantum computing.
2. Know the how quantum Mechanics is applied in quantum computing.
3. Illustrate the Quantum information with architecture and algorithms.
4. Develop the quantum programming languages.
5. Explain the current status of quantum computing.

Module 1:
Introduction to Basic quantum Mathematics
Complex numbers and its geometrical representations, Complex vector spaces, inner products and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces.

Module 2:
Basic Quantum Mechanics
Deterministic Systems, Probabilistic descriptions and Quantum systems, Basics of Quantum theory, Schrodinger’s time dependent equation, Wave nature of Particles, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states, entanglement.

Module 3:
Quantum Information
Bits and Qubits, Classical gates versus quantum gates, Deutsch’s Algorithm, Deutsch-Jozsa Algorithm, Simon’s periodicity algorithm, Grover’s search algorithm, Shor’s Factoring algorithm

Module 4:
Quantum Programming
Quantum programming languages, Probabilistic and Quantum computations, introduction to quantum cryptography and quantum information theory.

Module 5:
Current Status of Quantum Computing
Multi Qubit Systems, why are qubits superior, Quantum computing and Security, Sycamore

processors, IBM Quantum Computer, Quantum Simulations.

Text Books:

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008.

Reference Books:

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008.
2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010.
3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995.

E - Resources:

1. http://patrickjmt.com/
2. https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
3. https://homes.cs.washington.edu/~oskin/quantum-notes.pdf
4. https://nptel.ac.in/courses/104/104/104104082/

Course outcomes:

The Student will be able to:

1. Understand the Basics of complex vector spaces.
2. Analyze Quantum mechanics as applied in Quantum computing.
3. Analyze the quantum information with Architecture and algorithms.
4. Apply the quantum programming languages.
5. Understand the current status of quantum computing.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	3	3	-	-	-	-	-	-	-	-	3
CO4	-	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	3	3	-	-	-	-	-	-	-	-	-	3
Average	3.0	3.0	3.0	3.0	3.0	-	-	-	-	-	-	-	3.0	3.0

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech CSE II Year – I Sem			
Course Code:	COMPUTER FORENSICS (Open Elective -1)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Nil

Course objectives:
The Student will:

1. Learn the fundamentals of computer forensics
2. Differentiate the rules of evidence and methods of collecting
3. Know what forensic data to collect and analyse
4. Understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.
5. Learn e-mail investigations and mobile device forensics.

Module 1:
Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional Forensics Methodology, Steps taken by computer Forensics Specialists. Types of Computer Forensics Technology: Types of Military Computer Forensics Technology, Types of Law Enforcement – Computer Forensic Technology – Types of Business Computer Forensics Technology. Computer Forensics Evidence and Capture: Data Recovery Defined- Data Back-up and Recovery the Role of Back-up in Data Recovery- The Data Recovery Solution.

Module 2:
Evidence Collection and Data Seizure: Why Collection Evidence? Collection Options – Obstacles – Types of Evidence – The Rules of Evidence- Volatile Evidence- General Procedure – Collection and Archiving – Methods of Collection – Artifacts – Collection Steps – Controlling Contamination: The chain of Custody. Duplication and preservation of Digital Evidence: Preserving the Digital Crime Scene – Computer Evidence Processing Steps – Legal Aspects of Collecting Preserving Computer Forensics Evidence. Computer Image Verification and Authentication: Special Needs of Evidential Authentication – Practical Consideration – Practical Implementation..

Module 3:
Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data – hiding techniques, performing remote acquisitions. Network Forensics: Network Forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project

Module 4:

Processing crime and incident scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case. Current computer forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software.

Module 5:
E-Mail investigations: Exploring the role of E-mail in investigation, exploring the role of the client and server in E-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools. Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices. Working with windows and DOS Systems: Understanding file systems, exploring Microsoft File Structures, Examining NTFS Disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS Startup tasks, virtual machines.

Text Books:

1. Computer forensics, computer crime investigation by John R.Vacca, Firewall Media, New Delhi.
2. Computer forensics and investigations by Nelson, Phillips EnfingerSteuart, CENGAGE Learning

References Books:

1. Real Digital Forensics by Keith J.Jones, RechardBejtlich, Curtis W.Rose, Addison-Wesley Pearson Education.
2. Forensic compiling, A Tractitioneris Guide By Tony Sammes and Brain Jenkinson, Springer International Edition.
3. Computer Evidence Collection & Presentation by Christopher L.T.Brown, Firewall Media.

E – Resources:

1. https://www.smartzworld.com/downloads/download/cf-complete-pdf-notes/
2. https://www.cs.nmt.edu/~df/lectures.html
3. https://www.youtube.com/watch?v=2ESqwX3qb94

Course outcomes:
The Student will be able to:

1. Identify the fundamentals of computer forensics
2. Classify the rules of evidence and methods of collecting
3. Describe what forensic data to collect and analyse
4. Appraise the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations
5. Summarize e-mail investigations and mobile device forensics.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (Cos)	Program Outcomes (Pos)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	2	-	1	-	-	-	-	-	-	-	-
CO2	2	-	3	2	-	-	-	-	-	-	-	-	3	1
CO3	-	2	-	2	-	-	-	-	-	-	-	-	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	-	2	-	-	-	-	-	-	-	-
Average	2.0	2.3	3.0	2.0	-	1.5	-	-	-	-	-	-	3.0	1.5