
# MVJCE CURRICULUM

FOR

# Bachelor of Engineering
# in
# Artificial Intelligence and Machine Learning
# (Scheme 2020)

## III - IV Semester Syllabus


## INSTITUTION VISION

To become an Institution of Academic excellence with International standards.

## INSTITUTION MISSION

The vision will be realized by the Institution Mission.

- Impart quality education along with Industrial exposure.
- Provide world class facilities to undertake research activities relevant to Industrial and professional needs.
- Promote entrepreneurship and value added education that is socially relevant with economic benefits.

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

### Vision:

To build an ecosystem that will contribute meaningfully to society by producing global leaders in Artificial Intelligence and Machine Learning via excellence in education and research.

### Mission:

- To work with industry to enhance cutting-edge research and development in Artificial Intelligence, Machine Learning, and related subjects in order to meet society's demands.
- To establish centre of excellence in leading areas of computing and artificial intelligence.
- To inculcate values of professional ethics, leadership qualities and lifelong learning.

Program Outcomes (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Program Specific Outcomes (PSOs)

1. Ability to apply acquired skills to build optimized solutions by incorporating Computational Intelligence.
2. Employ ethical strategies in project and product development.

## Program Educational Objectives (PEOs)

The Artificial Intelligence and Machine Learning program will prepare graduate Students such that:

1. **Professional Employment**: Graduates will be able to contribute to the growth of any core industry (Automobile, Aerospace& Manufacturing), Government Organizations and R&D establishments.
2. **Engineering Citizenship**: Graduates will be prepared to communicate, work effectively in team-based engineering projects and practice professional ethics consistent with a sense of social responsibility.
3. **Lifelong Learning**: Graduates will have continuous learning skills to become experts in the chosen domains and contribute to professional knowledge.

MVJ COLLEGE OF ENGINEERING, BENGALURU

(An Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi, Approved by AICTE, Recognised by UGC under 2(f) and 12(B), Accredited by NBA & NAAC)

# RULES AND REGULATIONS GOVERNING THE DEGREE OF BACHELOR OF ENGINEERING (B.E.)

(Registration, Attendance, Examinations, Evaluation and Award of Grades)

**Effective from the academic year 2019 – 20**

MVJ COLLEGE OF ENGINEERING, BENGALURU

(An Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi, Approved by AICTE, Recognized by UGC under 2(f) and 12(B), Accredited by NBA & NAAC)

# Index of Scheme and Syllabus for

## Bachelor of Engineering in Artificial Intelligence and Machine Learning

(Scheme 2020)

III - IV Semester

| | | | |
|---|---|---|---|
| 1 | | | **Short title and Commencement**: These Rules and Regulations may be called as "**MVJCE Rules and Regulations" Governing B.E. Programmes** for Implementation of academic autonomy. It will be in effect from the date of notification from UGC and VTU. |
| 2 | | | **Definitions of Key Words**<br>The following are the definitions/descriptions that have been followed for the different terms used in the Regulations of B.E. Programmes:<br>a. **Affiliating University**: Visvesvaraya Technological University (VTU), Belagavi.<br>b. **Academic Autonomy**: means freedom granted by the Affiliating University to the college in all aspects conducting of its academic programmes for promoting academic excellence.<br>c. **Autonomous College**: means a college notified as an autonomous college by the affiliating University as per its statutes i.e. VTU statutes on Autonomous Colleges (Amended) 2015 and further amended from time to time as per UGC regulations and guidelines.<br>d. **Statutes**: means VTU statutes on Autonomous Colleges (Amended) 2015 and further amended from time to time.<br>e. **Commission**:means University Grants Commission (UGC).<br>f. **Council**:means All India Council for Technical Education (AICTE).<br>g. **Course Instructor**: Teaching staff of the college appointed based on the norms laid down by the Affiliating University/Council.<br>h. **Proctor**: Faculty member of the college appointed as per the norms.<br>i. **Programme**: refers to ain a particular stream/ branch of Engineering/branch of specialization leading to award of Degree. It comprises events/activities, comprising of lectures/ tutorials/ laboratory work/field work, outreach activities/ project work/ vocational training/viva/seminars/Internship/ assignments/presentations/self-study etc., or a combination of some of these.<br>j. **Branch**: Means Specialization or discipline of B.E. Degree Programme, such as Civil Engineering, Mechanical Engineering, etc.<br>k. **Academic Year**: Means two main consecutive semesters (odd followed by an even) and a Supplementary (Summer) semester constitute one academic year.<br>l. **Semester**: The B.E. Degree Programme is of four academic years comprising of eight Semesters in case of students admitted to I year/ I semester of the B.E. programme and three academic years comprising of six Semesters in case of students admitted to II year/ III semester of the B.E.programme (Admission through Lateral entry scheme), with the year being divided into two main |

Semesters, Odd and Even of 19 to 20 weeks (with working days greater than or equal to 90) and a Supplementary (Summer) semester of 8 weeks. The odd semester may be scheduled from August, whereas even semestermay be scheduled from January and Supplementary (Summer) semester starting from May/June of the year.

m. **Course**: Usually referred as 'paper' or 'subject' and is a component of a programme. All courses need not carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/project work/ vocational training/viva/seminars/term papers/assignments/ presentations/ self-study etc., or a combination of some of these.

n. **Credit**: Refers to a unit by which the course work is measured. It also determines the number of hours of instructions required per week.

o. **Audit Courses (Non-Credit Course)/Mandatory Courses**: Means Knowledge/ Skill enhancing courses without the benefit of a grade or credit for a course.

p. **Choice Based Credit System (CBCS)**: Refers to customizing the course work for a student, through the prescribed courses (i.e., Core, Elective and soft skill courses).

q. **Course Registration**: Refers to formal registration for the courses in each Semester (Credits) by every student under the supervision of a Proctor (also called as Faculty Advisor, Mentor, Counselor etc.,) at the Institution.

r. **Course Evaluation**: Continuous Internal Evaluation (CIE) and Semester End Examinations (SEE) to constitute the major evaluation components prescribed for each Course, with only those students satisfying a minimum standard in CIE are being permitted to appear in SEE of the Course. CIE and SEE to carry equal weightage of 50:50 respectively, to enable each Course to be evaluated for 100 marks, irrespective of its Credits.

s. **Continuous Internal Evaluation (CIE)**: Refers to evaluation of student's achievement in the learning process. CIE shall be conducted by the Course Instructor and include mid-term/weekly/fortnightly class tests, homework, problem solving, group discussion, quiz, mini-project, activities & seminar throughout the Semester, with weightage for the different components being fixed. CIE through tests called the 'Internal Assessment Tests'.

t. **Semester end examinations (SEE)**: Refers to examination conducted at the college level at par with University level examination covering the entire Course Syllabus.

u. **Credit Based System (CBS)**: Refers to quantification of course work, after a student completes teaching – learning process, followed by qualifying in both CIE and SEE. Under the CBS, the requirement for awarding a degree is prescribed in terms of total number of credits to be earned by the students.

v. **Credit Representation**: Refers to Credit Values for different academic activities considered, as per the Table.2. Credits for seminar, project phases, project viva–voce and internship shall be as specified in the Scheme of Teaching and Examination.

Table 2: Credit Values

| Theory/Lectures (L) (hours/week/Semester) | Tutorials (T) (hours/week/Semester) | Laboratory/Practical (P) (hours/week/Semester) | Credits Sharing (L: T: P) | Total Credits |
|---|---|---|---|---|
| 4 | 0 | 0 | 4:0:0 | 4 |
| 3 | 0 | 0 | 3:0:0 | 3 |
| 2 | 2 | 0 | 2:1:0 | 3 |
| 2 | 0 | 2 | 2:0:1 | 3 |
| 2 | 2 | 2 | 2:1:1 | 4 |
| 0 | 0 | 6 | 0:0:3 | 3 |
| NOTE: Activities like, practical training, study tour and participation in Guest lecture shall not to carry Credits. | | | | |

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

x. **Grading**: Is done using Letter Grades such as: S(Outstanding), A(Excellent), B(Very Good), C(Good), D(Above Average), E(Average) and F(Fail), as qualitative measure of achievement in each Course, based on the percentage of marks secured in (CIE plus SEE) of the Course and conversion to Grade effected usingAbsolute Grading.

| Letter Grade and corresponding Grade Points on a typical 10 – Point | | | | | | | |
|---|---|---|---|---|---|---|---|
| Letter | S | A | B | C | D | E | F |
| Grade Point | 10 | 09 | 08 | 07 | 06 | 04 | 00 |

y. **Grade Point (GP)**: Refers to a numerical weightage allotted to each letter grade on a 10-point scale as under

z. **Passing Standards**: Refers to passing a Course only when getting GP greater than or equal to 04

aa. **Credit Point**: Is the product of grade point (GP) and number of credits for a course i.e.,

$$\textbf{Credit points (CrP)} = \textbf{GP} \times \textbf{Credits for the course}.$$

bb. **Semester Grade Point Average(SGPA)**: Refers to a measure of academic

performance of student/s in a semester. It is the ratio of total credit points secured by a student in various courses of a semester and the total course credits taken during that semester.

cc. **Cumulative Grade Point Average(CGPA)**: Is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points earned by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters.

dd. **Transcript or Grade Card:** Refers to a certificate showing the grades earned by a student. A grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the programme details (Course code, title, number of credits, grades secured) along with SGPA of that semester and CGPA earned till that semester.

3 **Preamble**

MVJ College of Engineering (MVJCE), Bengaluru is an autonomous institute affiliated to Visvesvaraya Technological University, Belagavi and is one of the reputed institutes in the state of Karnatakaand rated as one among the top institutes in the state by various rating agencies. Academic autonomy has provided a great opportunity for the institute to design/frame the curriculum that meets the global requirements, adopting teaching-learning process that brings out innovation, creativity latent,enhances rational, logical and objective thinking ability of students.

The main advantage of academic autonomy is continuous learning and evaluation. Academic autonomy facilitates a shift over from examination centric to student learning centric. To bring this into reality is through understanding rules and regulations governing the academic programmes.

Academic autonomy aids to emerge as a leading technological institute in the country with gain in confidence, gratitude and respect of all its stake holders especially students, alumni, parents and the society at large.

4 **Program Duration and Total Credits**

The duration of various programmes and Number of Credits to be earned for award of degree is given in the Table 4.1.

Table 4.1: Programme Details

| Sl. No. | Programmes | Duration | Total No. of Credits for the award of Degree | Maximum duration for obtaining degree |
|---|---|---|---|---|
| 1. | B.E. | 4 Years (Eightsemesters) | 175 | 8 Years |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2. | B.E. (Lateral Entry) | 3 Years (six semesters) | 135 | 6 Years | | |

a) Students admitted to 1st year B.E. programme

i. Students admitted to 1st year B.E. shall complete the programme within a period of eight academic years from the date of first admission, failing which student has to discontinue the Course.

ii. Student who has not obtained eligibility to 3rd semester even after three academic years from the date of admission to 1st semester shall discontinue the programme or get readmitted to 1st year of the programme

iii. Student who gets admitted to 3rd semester in three or less than three years shall complete the programme with or without break within eight academic years from the date of admission to 1st year, failing to which shall discontinue the programme or seek fresh admission following the prevailing admission procedure at that time.

b) Students admitted II Year B.E. under lateral entry

i. Students admitted II Year B.E. under lateral entry scheme shall complete the Programme within a period of six academic years from the date of first admission, failing which student has to discontinue the programme.

ii. A student who has not obtained the eligibility to 5thsemester even after two academic years from the date of admission shall discontinue the Programme or get readmitted to 3rdsemester of the programme

iii. Student who gets admitted to 5th semester in two or less than two years shall complete the programme with or without break within six academic years from the date of admission to 1st year, failing to which shall discontinue the programme or seek fresh admission following the prevailing admission procedure at that time.

| | | | |
|---|---|---|---|
| 5 | | | Eligibility for Admission (As per the Government/University orders issued from time to time) |
| | 5.1 | | For Regular students |

i. Admission to I year/ I semester Bachelor Degree in Engineering/ shall be open to the students who have passed the II PUC/ XII Standard/ Equivalent Examination with English as one of the Languages and obtained a Minimum of 45% of Marks in aggregate in Physics and Mathematics along with Chemistry / Bio-Technology / Biology / Electronics / Computer Science.

ii. In case of SC/ST, Category -1 and OBC (2A, 2B, 3A and 3B) category students from Karnataka (Karnataka candidates only) the minimum marks for eligibility

| | | | |
|---|---|---|---|
| | | | shall be 40 %.<br>iii. With regard to the qualification earned from foreign countries, Equivalence certificate from the Association of Indian Universities and Eligibility Certificate from Affiliating University is Mandatory for admission to B.E. programme. In case of any dispute about the equivalence in qualification earned from foreign countries, the decision of the Affiliating University's Equivalence committee shall be the final in establishing the eligibility of the student. |
| | 5.2 | | For Lateral Entry students<br>i. Admission to II year/ III semester Bachelor Degree in Engineering/ Technology (Lateral Entry) shall be open to the Diploma holders and B.Sc. graduates.<br>ii. Must have passed Diploma or equivalent examination as recognized by University and secured not less than forty-five percentage (45%) marks in the final year examination (fifth and sixth semesters) in the appropriate branch of engineering. In case of SC/ST and OBC students from Karnataka the minimum marks for eligibility shall be forty percent (40%).<br>iii. Those candidates who have completed Diploma from other than Karnataka state shall provide the Equivalence/ Eligibility Certificate from the Director of Technical Education, Karnataka.<br>B.Sc. Graduates<br>i. Must have passed B.Sc. degree from a recognized University under the UGC or equivalent qualification as recognized by University and secured not less than forty-five percentage (45%) marks in aggregate (considering the marks of all six semesters). In case of SC/ST and OBC students from Karnataka (Karnataka candidates) the minimum marks for eligibility shall be forty percent (40%). Candidates must have studied Mathematics as subject of study at XII Standard.<br>ii. Those students, who have passed a qualifying examination other than the PUC II examination of the Pre-University Education Board of Karnataka, have to obtain eligibility certificate for seeking admission to B.E. Degree Programme from Visvesvaraya Technological University, Belagavi. |

| | | | |
|---|---|---|---|
| 6 | | | **Academic Administration**<br>Academic administration is monitored by the following academic committees / officers of the institute:<br>- Governing Council (GC)<br>- Academic Council (AC)<br>- Institute Academic Affairs Committee (IAAC)<br>- Departmental Academic Affairs Committee (DAAC)<br>- Joint Board of Studies (JBoS)<br>- Board of Studies (BoS)<br>- Board of Examiners (BoE)<br>- Programme Accreditation Committee (PAC)<br>- Malpractice Enquiry Committee (MEC)<br>- Grievance Redressal Cell (GRC)<br>- Internal Quality Assurance Cell (IQAC)<br>- Disciplinary Committee (DC)<br>- Student Counseling Cell (SCC)<br>- Departmental Project Evaluation Committee (DPEC)<br>- Departmental Seminar Evaluation Committee (DSEC)<br>- Interdisciplinary Project Evaluation Committee (IPEC)<br>- Controller of Examination (CoE)<br>- Dean of Academic Affairs (DAA)<br>- Dean Student Welfare (DSW) |
| | 6.1 | | **Governing Council (GC):** Responsible for overall general and academic administration of the Institute. |
| | 6.2 | | **Academic Council (AC):** Responsible for overall academic regulations, curricula, scheme of syllabi, evaluation and approval of results. |
| | 6.3 | | **Institute Academic Affairs Committee (IAAC):** Responsible for implementation of all academic decisions of AC and monitoring the registration of students, formulation of guidelines for conduct of examination and evaluation and all the issues connected to the academic activity. Responsible for award of 'I' Grade and approving the course to be studied by students having shortage of credits for all award of degree.<br><u>Structure of IAAC</u><br>Chairman : Principal<br>Members : Chairmen of all Boards of Studies<br>: Vice-Principal |

| | | | |
|---|---|---|---|
| | | | : Controller of Examination<br>: Registrar<br>: Two senior faculty members appointed by Principal<br>Member Secretary : Dean (Academic) |
| | 6.4 | | **Departmental Academic Affairs Committee (DAAC)**: Helps Dean of Academic Affairs and Heads of the Departments in the registration of all departmental courses and preparation of academic timetable. Responsible for constitution of Departmental Project Evaluation Committee (DPEC) for project evaluation and Departmental Seminar Evaluation Committee (DSEC) for the evaluation of student seminars and Industrial training/field training. Responsible for identification of courses to be offered during evening / summer semester, allotment of guides for mini and major projects and recommending a course to be studied by students having shortage of credits for award of degree. Approval of registration to different soft core course of failed students.<br><u>Structure of DAAC</u><br>Chairman : Head of the Department<br>Members : Three senior faculty members appointed by Head of the Department<br>Convener: Faculty member appointed by Head of the Department |
| | 6.5 | | **Joint Board of Studies (JBoS)**: Responsible for discussing common academic issues and recommend to academic issues and recommend to academic council for approval.<br><u>Structure of JBoS</u><br>Chairman : Principal<br>Members : Chairmen of all Boards of Studies<br>Invitees : Controller of Examination & Training & Placement Officer<br>Member Secretary : Dean (Academic) |
| | 6.6 | | **Board of Studies (BoS)**:<br><u>Structure of BoS</u><br>Chairman : Head of the Department<br>Members : All members of DAAC<br>Convener : Convener DAAC<br>• Two experts from outside the Institute<br>• One expert from outside the Institute nominated by the Vice-Chancellor from a panel of six recommended by Principal.<br>• One representative from industry/corporate sector/allied area relating to placement to be nominated by the AC. |

| | | | |
|---|---|---|---|
| | | | • One post graduate meritorious alumnus to be nominated by Principal as member<br>• Chairman co-opts the following members.<br>Co-opted: Experts from outside the Institute whenever special courses of studies are to be formulated.<br>• Other members of the faculty of the same Department.<br>**The term of nominated members shall be three years.**<br>The functions of BoS are to:<br>• Prepare the syllabi for various courses keeping in view the objectives of the institute, interest of the stakeholders and State / National/International and societal requirements for the consideration and approval of academic council.<br>• Suggest Head of Department for improving teaching and evaluation techniques<br>• Prepare panel of experts for appointment as examiners<br>• Guide the department with respect to teaching, extension and other academic activities in the departments<br>• Perform any other function assigned by the AC |
| | 6.7 | | **Board of Examiners (BoE)**<br><u>Structure of BoE</u><br>Chairman : Head of the Department<br>Members : Two or three faculty members covering different areas of specialization, recommended by HoDOne /Two experts from other institutions.<br>Convener: Faculty member appointed by Head of the Department<br>The functions of BoE are to:<br>• Scrutinize the question papers<br>• Forward the panel of examiners for each course to the Controller of Examination<br>• Prepare and approve the detailed scheme of evaluation pertaining to practical courses<br>• Analyze the semester end examination results of all the semesters. |
| | 6.8 | | **Programme Accreditation Committee (PAC):** Responsible for measuring the attainment of Cos (Course Outcomes), and Pos (Programme Outcomes) of each of the programme offered in the department and presenting the report to IAAC, PAC is constituted separately for each programme.<br><u>Structure of PAC</u><br>Chairman : Head of the Department |

| | | | |
|---|---|---|---|
| | | | Members : Two Associate Professors<br>Two or Three Assistant Professors<br>Convener : Faculty member appointed by Head of the Department |
| | 6.9 | | **Malpractice Enquiry Committee (MEC):** To conduct enquiry of the students involved in malpractice and decide the nature of punishment to be awarded depending upon the gravity of the offence.<br>Structure of MEC<br>Chairman : Principal<br>Members : Dean (Academic)<br>: Vice-Principal<br>: Registrar<br>: Respective Head of Department/s<br>: Legal advisor<br>Member Secretary : Controller of Examinations |
| | 6.10 | | **Grievance Redressal Cell (GRC):** Receives written complaints from thestakeholders regarding any kind of academic grievances. Examines the genuineness of the complaint and suggest remedies. Forward the recommendations to the chairperson of AC for implementation.<br>Structure of AGC<br>Chairman : Dean (Academic)<br>Members : Vice-Principal<br>: Registrar<br>: Two or Three Senior faculty members appointed by Principal<br>Member Secretary : Dean of Student Welfare |

| | | | |
|---|---|---|---|
| | 6.11 | | **Internal Quality Assurance Cell (IQAC):**<br>- Development and application of quality benchmarks.<br>- Parameters for various academic and administrative activities of the institution.<br>- Facilitating the creation of a learner-centric environment conducive to quality education and faculty maturation to adopt the required knowledge and technology for participatory teaching and learning process.<br>- Collection and analysis of feedback from all stakeholders on quality-related institutional processes.<br>- Dissemination of information on various quality parameters to all stakeholders.<br>- Organizing inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles.<br>- Documentation of the various programmes/activities leading to quality improvement.<br>- Acting as a nodal agency of the Institution for coordinating quality-related activities, including adoption and dissemination of best practices.<br>- Development and maintenance of institutional database through MIS for the purpose of maintaining / enhancing the institutional quality.<br>- Periodical conduct of Academic and Administrative Audit and its follow-up.<br>- Preparation and submission of the Annual Quality Assurance Report (AQAR) as per guidelines and parameters of NAAC/NBA.<br><u>Structure of IQAC</u><br>Chairman : Principal<br>Members : Dean (Academic)<br>: Three Senior faculty members appointed by Principal<br>: One member from Management<br>: Few Senior administrative officers<br>: One/ Two Nominees from local Society, Students and Alumni<br>: One/ Two Nominees from Employers /Industrialists/Stakeholders<br>: Registrar<br>Member Secretary :Vice-Principal |
| | 6.12 | | **Disciplinary Committee (DC):** Conduct enquiry pertaining to indiscipline and award suitable punishment.<br><u>Structure of DC</u><br>Chairman : Principal<br>Members : Head of Department/s<br>: Vice-Principal |

| | | | |
|---|---|---|---|
| | | | : Registrar<br>: Dean of Student Welfare<br>Invitees : Controller of Examinations<br>Member Secretary: Dean (Academic) |
| | 6.13 | | **Student Counselling Cell (SCC):** "Adolescence is a period when individual is over whelmed by a number of simultaneous developments, to meet this situation proper guidance is needed in this period. The teacher and institute encourage the development of effective maturity by providing the counselling and guidance". Whereas i feel dropping and withdrawal be advised by course co-ordinators. |
| | 6.14 | | **Departmental Project Evaluation Committee (DPEC):**<br>**Structure of DPEC**<br>Chairman : Head of the Department<br>Members : Two faculty members and guide<br>Convener: Faculty member nominated by Head of the Department<br>The functions of DPEC are to:<br>• Evaluate project<br>• Furnish the details of evaluation to concerned HoD |
| | 6.15 | | **Departmental Seminar Evaluation Committee (DSEC):**<br>**Structure of DPEC**<br>Chairman : Head of the Department<br>Members: Two faculty members and guide<br>Convener : Faculty member nominated by Head of the Department<br>The functions of DSEC are to:<br>• Evaluate Technical seminar<br>• Furnish the details of evaluation to concerned HoD |
| | 6.16 | | **Interdisciplinary Project Evaluation Committee (IPEC):**<br>**Structure of IPEC**<br>Chairman : Nominated by IAAC<br>Members : Two faculty members from each department<br>Minimum six faculty nominated by Chairman<br>Convener : Faculty member nominated by the Chairman<br>The functions of IPEC are to:<br>• Evaluate interdisciplinary projects<br>• Furnish the details of evaluation to concerned HoDs |
| | 6.17 | | **The following officials are also involved in academic administration.** |

**Controller of Examination (CoE)**: Responsible for preparation of examination manual, all matters pertaining to smooth conduct of examinations, evaluation and grading, publication of results and printing of grade cards, provisional degree certificates and transcripts. Responsible for maintaining all records pertaining to examinations.

**Dean of Academic Affairs (DAA)**: Responsible for receiving, processing and maintaining all records pertaining to undergraduate program and post graduate programs including curricula, courses offered, academic calendar, records of drop, withdraw, rejection of results and long leave of students. Preparation of first year, OE/HS timetable

**Dean of Student Welfare (DSW)**: Attend to all student related problems and disciplinary matters.

7 **Academic Year**

The breakup of academic year for regular semesters and supplementary (Summer) semester are given in the Tables 7.1 and 7.2. Details of vacation are given in Table 7.3.

Table 7.1: Break-up of academic year for regular semesters

| Sl. No. | Action Plan | Odd Semester | Vacation between Odd and Even semesters | Even Semester | Vacation between Odd and Even semesters |
|---|---|---|---|---|---|
| 1 | Registration of courses | 2 days (before the commencement of the semester) | | 2 days (before the commencement of the semester) | |
| 2 | Course Work | 16 weeks | | 16 weeks | |
| 3 | Examination preparation holidays | 1 week | | 1 week | |
| 4 | Semester End Examination | 2 to 3 weeks | | 2 to 3 weeks | |
| | **Total** | **19 to 20 weeks** | **1 to 2 weeks** | **19 to 20 weeks** | **10 weeks** |

Table 7.2: Break-up of summer semester

| Sl.No. | Action Plan | Summer Semester |
|---|---|---|
| 1 | Registration of courses | 1 day (The next working day after the announcement of even semester examination results) |
| 2 | Course Work | 7 weeks |
| 3 | Examination preparation holidays | 1 weeks |
| 4 | Semester End Examination | 1 weeks |
| 5 | Vacation | 1 weeks |
| | **Total** | **10 weeks** |

Table 7.3: Details of vacations

| | |
|---|---|
| Between odd and even semester | 2 weeks |
| Between even and odd semester (which includes one week vacation between summer & odd semester | 10 weeks |
| **Total** | **12 weeks** |

8

**General Structure of Credit Allocation**

Every course offered carries credits which are specified in the scheme of the study.

Credits allocation : 1 credit for 1 Lecture hour

1 credit for 2 Tutorial hours

1 credit for 2 Lab hours

For example : Engg. Maths-I carries 4.5 credits (4 lecture hrs. + 1 Tutorial hr.)

Engg. Physics carries 4 credits (4 lecture hrs.)

Physics Lab carries 1.5 credits (3 lab hrs.)

All courses carry a maximum of 100 marks.

A typical structure of the courses and credit allocation for Hard-core, Soft-core and Mandatory course (for undergraduate engineering programme) is given in Table 8.1.

Table 8.1: Categories of courses

| Sl. No. | Course/Course Area | Type of Course | Credit Allocation |
|---|---|---|---|
| 1. | Basic Sciences | Hardcore[1] | 24 |
| 2. | Engineering Sciences | Hardcore[1] | 20 |
| 3. | Professional Core courses | Hardcore[1] | 75 |
| 4. | Professional Elective courses | Soft core[2] | 18 |
| 5. | Open Electives | Soft core[2] | 9 |
| 6. | Humanities & Social Sciences | Soft core[2] | 8 |
| 7. | Project work, Seminar and others | Soft core[2] | 21 |
| 8. | Soft Skills, Environmental Engineering on any other course offered by the respective departments for zero credits | Mandatory[3/4] | -- |

[1] If a student gets 'F' grade in a hard-core course, he/she should repeat that course in its entirety. *Further, if a student gets 'F' grade in credit course consecutively five times, he/she has to leave the Engineering program. However, this student can take re-admission to the 1st semester afresh.*

[2] If a student fails in a soft-core course he/she can re-register for same course or different course in the same soft-core group with the permission of DAAC and approved by IAAC

[3] **Students have to pass the mandatory courses for the award of the degree.**

[4] Any additional course/s taken by the student over and above the stipulated will not earn any credit.

| | | | |
|---|---|---|---|
| 9 | | | **Registration**<br>Students should register, for the courses as per the scheme of study, in each of the semester/s (odd / even) with the respective proctors. The dates for registration are specified in academic calendar of the Institute published before the commencement of academic year. Registration by the students should be completed within the dates specified in the academic calendar. **Registration after the last date is not permitted. Students should be present in person to obtain the approval (Form-1) from the proctor for registered courses.** |
| | 9.1 | | **Registration procedure**<br>i. On the day of registration, the students have to approach the concerned proctor.<br>ii. Proctor will counsel the students and will advise the students regarding the courses to be registered during the current semester taking into account the performance of the student during the previous semester/s.<br>iii. Students have to register through online mode using their credentials.<br>iv. A print copy of the filled registration form **(Form-1)** shall be submitted to the Proctor along with fee paid receipt.<br>v. The proctor will enroll the students for the courses as indicated in the registration form. |
| | 9.2 | | **Eligibility requirements for Registration to an academic year**<br>i. He/she should not have obtained 'F' grades in credit courses five times consecutively.<br>ii. For the registration to odd semester, *the total number of courses Withdrawn (W), Dropped (DP), Not Eligible (NE), Failed (F), Incomplete grade (I) and X grade should not exceed 4.*<br>iii. CGPA should be $\geq 5$ at end of academic year.<br>iv. Dues of the previous semester to the Institution, Hostel and Library are to be paid.<br>v. Should not have any disciplinary proceeding pending against the candidate.<br>**Illustrations:**<br>a) A candidate seeking eligibility to $3^{rd}$ semester should not have W, DP, NE, F, I or X grade in more than four courses of first, second and supplementary semesters taken together excluding mandatory courses.<br>b) A candidate seeking eligibility to $5^{th}$ semester should not have W, DP, NE, F, I or X grade in more than four courses of $1^{st}$ to $4^{th}$ semesters and supplementary semester put together excluding mandatory courses. |

| | | | |
|---|---|---|---|
| | | | c) A candidate seeking eligibility to 7th semester should have passed in all the courses of 1st and 2nd semesters and should not have W, DP, NE, F, I or X grade in more than four courses of 3rd to 6th semesters and supplementary semester put together excluding mandatory courses.<br>i. Dues of the previous semesters to the Institution, Hostel and Library are paid.<br>ii. Should not have any disciplinary proceeding pending against the candidate. |
| | 9.3 | | Registration for odd semester<br>i. For registration to III, V and VII semesters, students should satisfy eligibility criteria as per the clause 9.2.<br>ii. A student has to register for all the courses offered in the semester.<br>iii. A student has to register for a minimum of 16 and a maximum of 28 credits including re-registered courses, if any. |
| | 9.4 | | Registration for even semester<br>i. All students are eligible to move from odd semester to even semester during the same academic year.<br>ii. A student has to register for all the courses offered in a semester.<br>iii. A student has to register for a minimum of 16 and a maximum of 28 credits including re-registered courses, if any. |
| | 9.5 | | Registration of courses for 'DP','W', 'NE' and 'F' grades<br>i. Students who have dropped, withdrawn, secured NE / F grade in courses of any semester should repeat those courses in their entirety to secure E or higher grades by re-registering in supplementary (Summer) semester or as and when offered in the regular semesters.<br>ii. If a student has dropped, withdrawn, secured NE / F grade in a Professional Electives / OE / HS course, then student may re-register for the same or different course.<br>iii. If a student gets F grade in project / seminar, he/she has to take up new project / seminar topic. |

| | | | |
|---|---|---|---|
| | 9.6 | | Registration for supplementary (Summer) semester<br>i. Supplementary semester is of eight weeks' duration and is offered at the end of even semester.<br>ii. Supplementary semester is for students who have failed with F grade during regular semesters, dropped, withdrawn, secured NE grade in the courses.<br>iii. The list of courses offered during the supplementary semester will be announced at the end of even semester.<br>iv. Registration by the students should be completed on or before the registration dates specified in the academic calendar.<br>v. Registration after the last date is not permitted.<br>vi. A student is allowed to register for a maximum of four theory courses during the supplementary semester excluding one mandatory course provided that there is no overlap of timings even for one hour.<br>vii. Dropping and withdrawal of courses are not allowed in supplementary semester.<br>a) Compensatory Test will not be conducted in supplementary semester.<br>b) X and I grades are not awarded in supplementary semester. |
| | 9.7 | | Course prerequisites<br>Certain courses need the knowledge of courses offered in the previous semesters, called prerequisites. Each department notifies the courses, which need prerequisites and the candidate shall register for such courses(s) only after he/she completes the prerequisites by securing at least E grade. Students are not permitted to register for the courses having prerequisites in the higher semester, if they had dropped or withdrawn the prerequisite courses in the previous semesters. |
| | 9.8 | | Registration for Elective courses (Professional and Open Electives)<br>i. List of elective courses offered will be published by the respective department<br>ii. Student shall exercise his/her option in respect of elective course/s and register for the same offered by the department at the beginning of respective semester<br>iii. Elective/s can be offered if the minimum number of students registered shall not be less than ten<br>iv. However, the condition as stated in clause 9.8 (ii) shall not be applicable to the programme having class strength is less than 10. In such cases only one elective shall be offered<br>v. The maximum number of registration to an elective may be restricted by the concerned department<br>vi. Student may be permitted to opt for change of elective course/s within fifteen |

| | | | |
|---|---|---|---|
| | | | days from the date of commencement of the semester. |
| | 9.9 | | **Range of minimum and maximum credits to be earned in an academic year (inclusive of supplementary semester)** |
| | | | i. I year ≥ 28 to ≤ 40<br>ii. II and III year ≥ 32 to ≤ 56 |
| | 9.10 | | **Range of minimum and maximum credits to be registered per semester** |
| | | | In each semester students have to register for a minimum of 16 and a maximum of 28 credits including re-registered courses, if any. |
| | 9.11 | | **Lateral entry**<br>i. Diploma Holders: Students admitted to Bachelor of Engineering at the III semester level have to register for mandatory non-credit courses "Additional Mathematics-1" in III semester and "Additional Mathematics-2" in IV semester respectively for award of degree. These students are exempted from studying a professional Core Course which they have already studied in their Diploma level. Also they have to study Communicative English as Non-credit Mandatory Course.<br>ii. B.Sc. Degree holders: Students admitted to Bachelor of Engineering at the III semester level have to register for mandatory non-credit courses "Engineering Graphics and Elements of Civil Engineering and Mechanics for award of degree. |
| 10 | | | **Attendance Requirement**<br>i. A candidate has to obtain a minimum attendance of 85% in each course to appear for the Semester End Examination (SEE). However, such of the students who have attendance between 75% and less than 85% may get condonation of attendance by Academic Council only on valid grounds such as hospitalization, participation in university and intercollegiate sports, cultural activities and participation in seminar, workshop and paper presentation with prior permission. Students must submit the request for condonation of attendance in the prescribed format with supporting documents and duly recommended by the Head of the Department at least one week before the commencement of examination, failing which condonation of attendance will not be considered.<br>ii. Students having less than 75% are not eligible for condonation of attendance on any ground.<br>iii. If a candidate fails to satisfy the minimum attendance requirements in any |

| | | | |
|---|---|---|---|
| | | | course, NE grade is awarded to that course.<br>iv. The basis for the calculation of attendance shall be the period prescribed by the institute in its calendar of events. For I semester B.E. & lateral entry students, the attendance is reckoned from their date of admission. For all other semesters, attendance will be counted from the date of commencement of class as announced in the institute academic calendar.<br>v. It is mandatory on the part of the students to regularly check the status of their attendance with the respective faculty. |
| 11 | | | Projects<br>Projects consist of mini project spread over V & VI semesters and Major project spread over VII & VIII semesters. |
| | 11.1 | | A. Mini Project<br>The aim is to bring out creativity and innovation in the students preferably in the form of a working model. This project can be taken up by a group of students (normally four members) from the same or different departments. If the project demands, more man power, then the number of students in the group can be relaxed by the Heads of the concerned departments.<br>i. The project is spread over two semesters (V & VI) and evaluated at the end of each semester.<br>ii. No credit is allocated during V semester.<br>iii. Mini project is evaluated during the VI semester for 100 marks (50% CIE and 50% SEE)<br>iv. DAAC assigns guides for mini projects.<br>v. Interdisciplinary projects have a guide from each of the participating departments. |
| | 11.2 | | B. Major Project<br>i. It is spread over VII and VIII semesters and evaluated at the end of each semester for the assignment credits.<br>ii. The project may be based on;<br>• Design aspects<br>• Theoretical/Analytical Modelling<br>• Computer Simulation<br>• Developing Working Model<br>iii. The project could be part of the research activity carried out in the department.<br>iv. The literature survey should be one of the components of the project. |

| | | | |
|---|---|---|---|
| | | | v. The project can be carried outside the institute in a recognized industry/research lab.<br>vi. Head of the Department and DAAC assign guides for the major project.<br>• The project can be taken up by a group of students (normally four members) from the same or different departments.<br>• Interdisciplinary projects have a guide from each of the participating departments.<br>• The students should maintain a project diary consisting of day-to-day work carried out by them with monitoring by the guide on weekly basis.<br>vii. Project Report completed in all respects and approved by the guide and HoD must be submitted at least one week before the commencement of theory examination of VIII semester. Reports submitted after the last date will not be evaluated in the even semester and I grade will be awarded to major project. The students have to register during supplementary semester or subsequent semester.<br>viii. Plagiarism check has been made mandatory. The project report shall be summarily rejected, if the plagiarized content (similarity index excluding self-written research papers, common definitions) is >25%. In such cases students have to resubmit the project report with prescribed fee within fortnight from the date of rejection.<br>ix. Two chances shall be given for the resubmission. After two chances if the plagiarism level found unacceptable then, students have to repeat the project work entirely by reregistering during subsequent academic year. |
| 12 | | | Seminars<br>Students of VII semester have to present a technical seminar on emerging area in the respective discipline. |
| 13 | | | Field training/Industrial Internship<br>Students have to undergo this training for a period of 6 weeks (minimum) during the vacation between even and odd semesters of II and III year or III and IV year. Those students who are unable to complete during these periods will have to undergo the industrial training after the VIII semester and the VIII semester Grade Card will be issued only after the successful completion of industrial training by that student. |
| 14 | | | Research Initiative at UG level<br>Students who have CGPA of 8.5 and above up to 4$^{th}$semester and would like to pursue research work during 5$^{th}$& 6$^{th}$semesters are required to identify the area of |

| | | | |
|---|---|---|---|
| | | | research and the guide. The students have to submit the application to the concerned Head of the Department in the prescribed format (Form-6) available in the department. Students are exempted from studying one Open Elective and one Professional Elective course in 5th and 6th semesters. |
| 15 | | | **Examination and Evaluation**<br>Evaluation of a student in each course is a continuous process, which is based on:<br>- Continuous Internal Evaluation (CIE): 50% of the marks allotted for the course.<br>- Semester End Examination (SEE): 50% of the marks allotted for the course. |
| | 15.1 | | **Pattern of question papers for theory courses** |
| | | 15.1.1 | **Internal Assessment (IA)**<br>i. There will be three mandatory tests.<br>ii. Question paper for the IA consists two parts i.e. Part A and part B. Part A will be a compulsory question consists of objective type or short answer type questions of 1 or 2 marks each for a total of 6 marks covering the syllabus during the periods specified.<br>iii. Part B also covers the syllabus during the periods specified consists of two questions of 12 marks each having choices and may contain sub-divisions. Students have to answer two full questions.<br>iv. Duration of each test is 90 minutes |
| | | 15.1.2 | **Semester End examination**<br>i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit.<br>iv. The duration of examination is 3 hours. |
| | 15.2 | | **Examination and evaluation in theory courses** |
| | | 15.2.1 | **Continuous Internal Evaluation (CIE)**<br>CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be:<br>- Quizzes/mini tests (4 marks)<br>- Mini Project / Case Studies (8 Marks)<br>- Activities/Experimentations related to courses (8 Marks) |

- Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

a) First test is conducted at the end of sixth week from the beginning of the semester. The syllabus for this test is the syllabus covered in the first six weeks. The duration will be of 90 minutes.

b) Second test is conducted at the end of tenth week. The syllabus for this examination is the syllabus covered between first test and second test. The duration will be of 90 minutes.

c) Third test is conducted at the end of fifteenth week. The syllabus for this examination is the syllabus covered between second test and third test. The duration will be of 90 minutes.

d) A quiz is a mini test of about 20 minutes' duration. One quiz during the period up to first test, second quiz between first test and second test.

Details of marks distribution for evaluation of hard-core & soft core courses is shown in Table 15.2.1(a)

Table 15.2.1 (a)Marks distribution

| Details | | Marks |
|---|---|---|
| Average of three Internal Assessment (IA) Tests of 30 marks each i.e. ∑ (Marks obtained in each test)÷ 3 | CIE (50) | 30 |
| Quizzes | | 2x 2 = 4 |
| Activities/Experimentations related to courses | | 8 |
| Mini Project / Case Studies | | 8 |
| Semester End Examination | SEE (50) | 50 |
| | Total | 100 |

e) It is mandatory for a student to appear for all three tests. If any student who is unable to attend any one or both tests **on account of hospitalization only he/she is permitted to attend the compensatory test. He/she should have maintained a minimum of 85% attendance in that particular subject till the date of compensatory test.** A request letter in the prescribed proforma **(Form-2)** has to be submitted by the student to the Head of the Department within one week from the end of respective test which will be forwarded to Dean (Academic). The syllabus for compensatory test includes the syllabus covered from the beginning of the semester up to compensatory test time. The duration of test will be of 90 minutes. The marks secured in the compensatory examination are considered for computation of CIE in place of any one of the

three tests in which student was absent. If a student was absent for all three tests, the marks secured in compensatory examination is considered for the I-test and he/she is considered as absent for remaining tests.

i. Students who have missed quizzes, tests on account of, participation in co-curricular activities, sports and cultural fests are permitted to take alternative quiz and test. The original copy of the letter shall be approved by the Principal recommended by Physical Education Director/Cultural Committee Chairman has to be submitted to Dean, Academic Affairs. The faulty in-charge will conduct the quiz/test.

ii. Compensatory tests will be conducted during 16$^{th}$ week from 3.30 to 5.00 PM on normal working days or weekends.

iii. Compensatory test is not for improvement of marks. Compensatory test will not be given to students involved in malpractice either during tests and / or quizzes.

f) Minimum of two assignments are to be submitted, first between I and II test, second between II test and last working day of that semester.

g) For mandatory courses two tests are conducted and the sum of the two is taken as Continuous Internal Evaluation (CIE) marks. There will be only one compensatory test for 25 marks. Allotment of marks for Mandatory course is shown in Table 15.2.1 (b)

Table 15.2.1 (b) CIE & SEE marks allotment for mandatory courses

| Details | | Marks |
|---|---|---|
| First Test | CIE (50) | 25 |
| Second Test | | 25 |
| Semester End Examination | SEE (50) | 50 |
| | Total | 100 |

h) To maintain transparency, the students are provided access to the valued Test answer scripts, quiz papers and assignments. It is mandatory for the students to check the quiz/test answer papers after evaluation and affix their signature.

i) Head of the Department announces the CIE marks in the department notice board prior to the commencement of semester end examination. Any discrepancy in CIE marks shall be brought to the notice of concerned faculty immediately by the students for redressal before the commencement of SEE.

j) *If a student fails to obtain 40% (i.e., 20/50) of total marks allotted for CIE (Hardcore / Soft core courses) then, such a student is awarded NE grade*

| | | | |
|---|---|---|---|
| | | | *and will not be permitted to take SEE. Such students have to repeat the course in its entirety by re-registering that course when it is offered.*<br>k) **Quizzes and Assignment: Questions for quizzes may be objective type, short answer type and numerical problems. Assignments shall be given on complex engineering problems and students have to use problem** solving skills. |
| | | 15.2.2 | **Semester End Examination (SEE)**<br>i. Semester End Examination is conducted as per the academic calendar of the Institution. The examination is conducted for 100 marks and is reduced to 50 marks for computation of grades.<br>ii. A student has to obtain a minimum of 40% (i.e., 20/50 marks) of the marks allotted to SEE, failing which F or X grade will be awarded for that course. WhereasX grade is awarded to a student who has minimum attendance of 85% and minimum of 90% in CIE.<br>iii. SEE answer scripts are evaluated by the internal examiners normally the Course Instructor appointed by the Controller of Examination and normally 20% of the scripts moderated by the external examiners appointed by the Controller of Examination in consultation with respective BoEs.<br>iv. If the difference between the marks awarded by two evaluators is less than 10%, then the average of the marks awarded by the two evaluators is taken for further processing.<br>v. If the difference between the marks awarded by two evaluators is more than 10%, then a third evaluator assesses the answer script. The average marks of the nearest two evaluations are taken for further processing. If one of the three evaluation marks falls exactly midway between the other two, then higher two evaluation marks are taken for averaging. |
| | 15.3 | | **Evaluation of Practical courses** |

15.3.1 Continuous Internal Evaluation (CIE)

i. CIE marks for the practical course is computed by adding the average of the marks secured by the student for conducting each of the experiment plus the marks secured in the test conducted and also the marks secured for the open ended experiments (experiments embedded with theory concepts of the course/s) at the end of the course.

ii. Head of the Department announces the CIE marks in the department notice board and submits a copy to Controller of Examination duly signed by the faculty in-charge at the end of the semester.

iii. If a student fails to obtain 50% (i.e., 25/50) of total marks allotted for CIE in Practical/Mini Project/Project/Internship then, such a student is awarded NE grade and will not be permitted to take SEE in the said course. Such students have to repeat the course in its entirety by re-registering that course when it is offered.

The breakup of CIE marks is given in the Table 15.3.1 9a) and (b)

Table 15.3.1 (a) Breakup of CIE marks for lab courses without Open Ended Experiments

| | |
|---|---|
| Regular Lab Work and writing lab records | (20 + 15) 35 marks |
| Lab test and Viva-voce at the end of the semester | (10 + 5) 15 marks |
| **Total** | **50 marks** |

Table 15.3.1 (b) Break up of CIE marks for lab courses with Open Ended Experiments

| | |
|---|---|
| Regular Lab Work and writing lab records | (15 + 10) 25 marks |
| Lab test and Viva-voce at the end of the semester | (10 + 5) 15 marks |
| Evaluation of open ended experiment | 10 marks |
| **Total** | **50 marks** |

15.3.2 **Semester End Examination (SEE)**

Semester end practical examination is conducted jointly by one internal examiner and one external examiner. Break up of SEE marks is given in the Table 15.3.2

Table 15.3.2 Breakup of SEE marks for lab courses

| | |
|---|---|
| Writing the procedure | 10 marks |
| Conducting lab experiment(s) | 20 marks |
| Analysis of experimental result & presentation | 10 marks |
| Viva-voce related to the experiments | 10 marks |
| **Total** | **50 marks** |

**For pass in practical course students has to secure minimum 40% of allotted marks (i.e. 20/50).**

15.4 **Evaluation of Projects, Seminars, Industrial / Field training & Co-curricular activities**

15.4.1 *CIE for Mini Project*

The CIE for mini project is spread over V and VI semesters. At the end of V semester student have to submit a report containing details of the work done. The breakup of marks of CIE for mini project is given in table 15.4.1

Table 15.4.1 Breakup of CIE marks for Mini Project

| | |
|---|---|
| Evaluation at the end of V semester (DPEC) | 15 marks |
| Evaluation at the end of VI semester (DPEC) | 15 marks |
| Evaluation by Guide | 20 marks |
| **Total** | **50 marks** |

15.4.2 **SEE for Mini Project**

Mini project work will be jointly evaluated by one internal and one external examiner appointed by the Chairman BoE. The breakup of marks is shown in Table 15.4.2For pass in mini students has to secure minimum 40% of allotted marks (i.e. 20/50).

Table 15.4.2 Breakup of SEE marks for Mini Project

| | |
|---|---|
| Project Report, Presentation, Demonstration and Quality of work | 30 marks |
| Viva-Voce | 20 marks |
| Total | 50 marks |

If a student fails to satisfy the prescribed CIE and SEE, has to be repeated in its entirety by reregistering for the same.

15.4.3 **CIE for Major Project**

At the end of VII semester, for major project, student has to give the seminar covering the literature survey and preliminary requirements/specifications/flow chart/design steps pertaining to the chosen project. Also, the students in the project batch have to submit a report to the respective guide.

The breakup of marks for CIE for major project at the end of VII semester is given in Table 15.4.3

Table 15.4.3 CIE marks break up for major project (during VII semester)

| | |
|---|---|
| Relevance of the topic | 10 marks |
| Report | 20 marks |
| Evaluation by Guide | 25 marks |
| Presentation | 30 marks |
| Viva-voce | 15 marks |
| **Total** | **100 marks** |

CIE for report shall be awarded only on submission of report covering the literature survey and problem definition. Two credits are assigned for the work done during VII semester. However, there is no SEE for major project during VII semester.

15.4.4 **CIE for major project during VIII semester**

Major project is evaluated for 100 marks (50% CIE & 50% for SEE) during VIII semester. The breakup of CIE marks is given in table 15.4.5

15.4.5 **Co-curricular Activities (Max of five marks)**

Weightage of 5 marks is given for co-curricular activities, with an objective of inculcating in students, the culture of preparing and presenting papers, encouraging them to apply the technical knowledge for solving real life problems and motivating them towards self-study.

- 2 marks for presenting paper in National / International conference by maximum of two authors.
- Additional 2 marks for every additional paper presentation but not in the same conference and the paper should not be same.
- 2 marks for participation in hobby project exhibition.
- Additional 2 marks for participation in hobby project exhibition held at different technical institutions or different project.
- 3 marks for obtaining any prize other than first prize.
- 4 marks for obtaining first prize.
- 5 marks for publication in journals.

- 3 marks for every certification obtained from reputed companies like IBM, Microsoft and other organizations approved by the department.
- Additional 3 marks for every additional certification.
- For paper presentation, a maximum of two authors (first two) is considered and if the paper is from the project work, all the students are considered.
- **Technical Quiz / Business Quiz / Auto Quiz**
  2 marks for qualifying in Written Test
  3 marks for obtaining any prize other than first prize
  4 marks for obtaining first prize
- **Hardware Debugging / Programming Contest**
  2 marks for qualifying in Written Test
  3 marks for obtaining any prize other than first prize
  4 marks for obtaining first prize
- **Robotics/Catia Design Contest/Cyber Eptymology/ Instantiania**
  2 marks for participation
  3 marks for obtaining any prize other than first prize
  4 marks for obtaining first prize
- This weightage is considered for computing CIE for the Project Work at VIII semester. The paper presentation and participation in hobby project exhibition & other activities mentioned above may be in any semester (I to VIII sem).

In View of the proposed weightage for co-curricular activities, following is the modification in the breakup of CIE for major Project.

Table 15.4.5 CIE marks break up for major project (during VIII semester)

| | |
|---|---|
| Seminar on project and demonstration | 20 marks |
| Report | 10 marks |
| Evaluation by Guide | 15 marks |
| Co-curricular Activities | 05 marks |
| **Total** | **50 marks** |

15.4.6 **SEE for the major project**

SEE is conducted by one external examiner and one internal examiner. The breakup of marks is given in Table 15.4.6. For pass in project work students has to secure minimum 40% of allotted marks (i.e. 20/50).

Table 15.4.6 Breakup of SEE marks for major project

| | |
|---|---|
| Project Report, Presentation, Demonstration and Quality of work | 30 marks |
| Viva-Voce | 20 marks |
| **Total** | **50 marks** |

If a student fails to satisfy the prescribed CIE and SEE, has to be repeated in its entirety by reregistering for the same.

**15.5 Evaluation of Seminars**

Students of VII semester have to present a technical seminar on emerging area in the respective discipline.Seminar is evaluated for 100 marks.The breakup of marks for the evaluation of seminar is given in Table 15.5. For pass students has to secure minimum 50% of allotted marks.

Table 15.5 Breakup of Seminar

| | |
|---|---|
| Relevance of the topic | 10 marks |
| Report | 20 marks |
| Presentation | 50 marks |
| Viva-voce | 20 marks |
| **Total** | **100 marks** |

*Note: There is no CIE and SEE for seminar.*

**15.6 Evaluation of Field training/Industrial Internship**

Evaluation of the Field training/Industrial Internship shall be conducted during VIII semester by internal and external examiners for 100 marks. The external examiner shall be from the Industry where the student carried out the Field training/Industrial Internship. In case of non-availability of external examiner, the concerned head of the department shall appoint an external examiner from the nearby college or a senior faculty member from outside the department in consultation with respective BOE and approved by Principal. The Field training/Industrial Internship carries two credits. A student has to get a minimum of 40% marks for a pass. If a student fails to complete the same, then the Field training/Industrial Internship has to be repeated in its entirety.For pass in internship students has to secure minimum 40% of allotted marks (i.e. 20/50).

The breakup of marks for the evaluation of training is as in Table 15.6

Table 15.6 Marks break up for field training evaluation

| | |
|---|---|
| Evaluation by the supervisor under whom the training was carried out | 25 marks |
| Evaluation by DSEC | |
| i. Relevance of the Field training/Industrial Internship | 10 marks |
| ii. Report | 25 marks |
| iii. Evaluation | 40 marks |
| **Total** | **100 marks** |

**15.7 Review of Answer Scripts**

Evaluated Answer Scripts are made available to the students for review in presence of parents by registering for the same within the dates prescribed in the academic calendar.

| | | | |
|---|---|---|---|
| | 15.8 | | Extended (Revaluation)Evaluation<br>The students, who have not satisfied with the evaluation in SEE, can apply for Extended Evaluation on payment of prescribed fee within the stipulated time as notified by the institute.<br>Extended Evaluation is carried out by external examiners independently (who have not evaluated the answer script earlier). The highest marks among earlier awarded marks and theawarded by the external examiners is considered as the final marks in SEE for award of grade. |
| | 15.9 | | Rejection of Results<br>i. A student may reject his/her results of all the courses registered in a semester of an academic year *if he/she is not satisfied with the result of any semester,* subject to the condition that the maximum duration for the completion of the course as mentioned in Table 4.1 is not exceeded. The rejection is permitted only once during the entire program of study<br>ii. Student who desire to reject the SEE results of a semester shall reject the total performance in all courses of semester (including CIE marks) either rejecting or retaining the CIE marks.<br>iii. Student who desire to reject the total SEE performance of an odd/even semester including CIE marks, have to repeat that semester of prevailing scheme by taking readmission during the subsequent academic year/s. However, student is governed by clause 4<br>iv. If the student rejects the SEE permanence of odd semester excluding CIE marks shall be permitted to register the courses of next immediate even semester.<br>v. If the student rejects the SEE permanence of even semester excluding CIE marks shall not be permitted to register the courses of next immediate odd semester as per clause 19. In such cases student shall take admission to the next odd semester of prevailing scheme during the subsequent academic year/s after obtaining eligibility. However, student is governed by clause 4<br>vi. Application for Rejection of results shall be submitted in the prescribed format **(Form-5)** to respective Head of the department within a week from the date of announce of results. Same shall be approved by the Principal.<br>vii. Rejection of the performance of VII semester project work is not permitted<br>viii. **Students who opt for rejection of results shall not be eligible for award of ranks and Honours Degree.** |
| 16 | | | Grade card<br>- Grade card is issued normally within months' time from the date of |

announcement of the results.

- The total number of activity points earned will be indicated in the Grade Card
- CGPA is computed by considering the latest grade obtained by the student in the courses repeated.
- After graduation, a student can apply for a consolidated grade report by paying prescribed fee for to the Institute.
- There is a provision for the issue of actual marks card after the graduation on payment of prescribed fee to the institute.

For obtaining a duplicate grade report, the student has to lodge a complaint in the jurisdictional police station and obtain the FIR. An affidavit on a stamp paper duly signed by a Notary and FIR should be submitted to the principal.

16.1

Percentage equivalence of the Grade Points

Sometimes, it would be necessary to provide equivalence of the CGPA with the percentages and/or class awarded as in the conventional system of declaring the result of university examinations. Conversion formula for the Conversion of CGPA into Percentage on a 10-points Scale is Given as Percentage of Marks Secured, $P = [\text{CGPA Earned} - 0.75] \times 10$

Illustration for A CGPA of 8.25:

$$P = [\text{CGPA Earned } 8.25 - 0.75] \times 10 = 75\ \%$$

Table 16.1(a) Percentage equivalence of grade points 10-points Scale

| Grade point | Percentage of marks |
|---|---|
| 5.75 | 50 |
| 6.25 | 55 |
| 6.75 | 60 |
| 7.25 | 65 |
| 7.75 | 70 |
| 8.25 | 75 |

Table 16.1(b) Class Designation

| Grade point range | Class |
|---|---|
| ≥ 5 &< 6.75 | Second |
| ≥ 6.75 < 7.75 | First |
| ≥ 7.75 | Distinction |

16.2

Letter Grades

Awarding Letter Grades

i. A letter grade is basically a qualitative measure indicating the performance of a student in that course, such as Outstanding (S), Excellent (A), Very Good (B), Good (C), Average (D), Poor (E) and unsatisfactory / Fail (F).

ii. Letter grades are awarded for each course based on the total marks obtained in CIE and SEE.

iii. Pass grades are awarded only when CIE≥ 40% and SEE ≥ 40%.

iv. The range of marks corresponding to letter grades is indicated in the Table 16.2. The grade point indicates the numerical value associated with each letter grade.

Table 16.2 Letter grades, grade points and corresponding marks range

| Level | Out-standing | Excellent | Very Good | Good | Average | Poor | Fail |
|---|---|---|---|---|---|---|---|
| Letter grades | S | A | B | C | D | E | F |
| Grade points | 10 | 9 | 8 | 7 | 6 | 4 | 0 |
| Absolute Marks Range (%) | ≥ 90 | 80 to 89 | 70 to 79 | 60 to 69 | 50 to 59 | 40 to 49 | < 40 |

v. There are two other letter grades, Pass (PP) / Fail (NP) applicable for mandatory course. Grade PP is awarded only when SEE ≥ 40% (for 50 marks) and CIE + SEE ≥ 40% (for 100 marks), otherwise the grade NP is awarded.

**16.3 Transitional Letter Grades**

Transitional letter grades (I, X) are awarded in the following cases as per clause 16.3.1 and 16.3.2. I or X should be converted into one of the letter grades between S to E within that academic year.

**16.3.1 Incomplete Grade (I)**

A student who has missed SEE, due to valid reasons like his/her hospitalization/disaster in his/her family should immediately apply for the award of I grade in that course. Clash in SEE time table (permission from CoE has to be taken for clash in SEE time table). The IAAC subcommittee (Principal as Chairman, Deans and CoE, as members) will decide about awarding 'I' grade taking into consideration all the documentary evidences produced by the student. The student is permitted to appear for the SEE in that course, which is conducted in either even semester or in summer semester of that academic year. His/her CIE marks secured in the course earlier will be considered for the award of grade along with SEE marks.

If permission for 'I' grade is not accorded by IAAC subcommittee, then F grade is awarded for the course and the student has to re-register for the course in its entirety when it is offered.

'I' grade is not awarded for re-registered courses during Supplementary

| | | | |
|---|---|---|---|
| | | | Semester Examination. |
| | | 16.3.2 | **X-Grade**<br>If a student has a minimum attendance of 85% and a minimum 90% in CIE and has obtained < 40% marks in SEE, in regular even or odd semester, then, he/she will be awarded X grade.<br>- Such a student is permitted to appear for SEE conducted during that academic year.<br>- If such a student fails to obtain E grade or above in regular or summer semester, he/she will be awarded F grade. The student should re-register for the same course in its entirety whenever the course is offered.<br>- If such a student fails to appear for SEE either in even semester or in summer semester of that academic year, X grade will be automatically converted into 'F'-grade.<br>- However, a student who has been awarded X-grade also has the option of:<br>i. Reregistering of such courses either during summer semester or whenever the courses are offered.<br>ii. Audit the courses during summer semester of that academic year by paying prescribed fees.<br>iii. **X-grade is not awarded during supplementary semester SEE.** |
| | 16.4 | | **Dropping of the courses (DP)***<br>- Student, who wants to drop a theory course, has to apply in a prescribed format (Form-3) through concerned teacher, Proctor and Head of the Department to the Dean (Academic) for permission.<br>- Students are not permitted to drop theory course that are integrated with |

| | | | |
|---|---|---|---|
| | | | laboratory course in that semester/any other semester.<br>- Mandatory courses cannot be dropped.<br>- The dropping of course is allowed within the date specified in the academic calendar of that semester, usually eight weeks from the commencement of the semester. A student is allowed to drop a maximum of two courses. If the student drops the course within specified date, the fee for the course dropped will not be adjusted for subsequent registration of the same course. The course dropped will not be indicated in the grade card.<br>- Dropping of laboratory course(s) is not allowed.<br>- Any re-registered course cannot be dropped.<br>*** A student can drop and or withdraw maximum of two courses.** |
| | 16.5 | | **Withdrawal Grade (W)***<br>A student, who wants to withdraw a theory course, has to apply in the prescribed proforma**(Form-4)** through the faculty who teaches the course, Proctor and Head of the Department to the Dean (Academic) for the permission to withdraw.<br>**A student is not allowed to withdrawn/drop same course more than once.**<br>Withdrawal of practical course(s) is not allowed.<br>- Students are not permitted to withdraw theory courses that are integrated with laboratory course wither in that semester or in any other semester.<br>- Withdrawal of a course is allowed within the specified date in the academic calendar. A student is not permitted to withdraw any course after the specified date in the academic calendar.<br>- If a student withdraws the course after eight weeks from the commencement of the semester and up to fourteenth week, the registration fee will be forfeited.<br>- Students have to reregister the withdrawn course after paying the prescribed fees in the summer semester or in the subsequent semesters during which the course is offered.<br>- Transitional grades like withdrawal, incomplete and X grade are not awarded during summer semester. |
| | 16.6 | | **Not Eligible Grade (NE)**<br>Grade NE is awarded to the students who fail to secure attendance at least 85% and CIE of 40%. |
| | 16.7 | | **Make-up Examination:**<br>The students who has been awarded with 'X' or 'I' gradesare eligible to attend make-up examinations as per the dates notified in Academic Calendar of the institution. |

| | | | |
|---|---|---|---|
| 17 | | | **Temporary Withdrawal**<br>Student shall be permitted to withdraw temporarily on the grounds like, prolonged illness, grave calamity in the family or any other serious happening. The withdrawal hall be for periods which are integral multiples of a semester, provided that,<br>i. Student applies to the college within at least 6 weeks of the commencement of semester or from the date student last attended the classes, whichever is later, stating the fully the reasons for such a withdrawal along with supporting documents endorsed by the parents/guardians<br>ii. Such withdrawal shall be permitted only under the provisions of clause 4<br>iii. Student availing temporary withdrawal shall be required to pay tuition and other fee.<br>iv. Student will be entitled to avail temporary withdrawal facility only once during the programme. Any concession for the student shall be approved the Academic Council of the College<br>v. Student seeking temporary withdrawal facility shall not have any dues or demands at College/University including tuition and other fee. Once paid shall not be refunded |
| 18 | | | **Academic Performance Evaluation** |
| | | | The academic performance of a student is indicated by two different indices, Semester Grade Point (SGPA) and Cumulative Grade Point Average (CGPA).<br>- SGPA is an indication of the performance of the student in the current semester. SGPA is calculated as below.<br>$SGPA = \frac{\sum [(\text{Course credits}) \times (\text{grade points})] \text{ for all course that semester excluding transitional grades}}{\sum [(\text{Course credits}) \text{ for all course registered in that semester including F grades and excluding W and DP courses.}}$<br>- CGPA is an indication of the cumulative performance of the student from the first semester up to the current semester.<br>$CGPA = \frac{\sum [(\text{Course credits}) \times (\text{grade points})] \text{ for all course with letter grades are E and above from the I semester till the current semester}}{\sum [(\text{Course credits}) \text{ whose letter grades are E and above from the I semester till the current semester.}}$<br>**Illustrative Example Calculations of SGPA and CGPA for an academic year** |

| Semester (Odd/Even/ Supplementary) | Course Code | Credits | Grade Obtained | Grade Points | Credit Points | SGPA, CGPA |
|---|---|---|---|---|---|---|
| I | MJXXX001 | 5:0:0 | B | 8 | 5 x 8 = 40 | SGPA = 117/20 =5.85 |
| I | MJXXX002 | 3:2:0 | W | - | - | |
| I | MJXXX003 | 3:0:0 | A | 9 | 3 x 9 = 27 | |
| I | MJXXX004 | 0:1:1 | F | 0 | 00 | |
| I | MJXXX005 | 4:1:0 | D | 6 | 5 x 6 = 30 | |
| I | MJXXX006 | 5:0:0 | E | 4 | 5 x 4 = 20 | |
| | Total | 20 (18*) | | Total | 117 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| II | MJXXX007 | 3:1:1 | C | 7 | 7 x 5 = 35 | SGPA =157/25 = 6.28 |
| II | MJXXX008 | 4:0:0 | B | 8 | 8 x 4 = 35 | |
| II | MJXXX009 | 3:0:0 | D | 6 | 3 x 6 = 18 | |
| II | MJXXX010 | 4:1:0 | E | 4 | 5 x 4 = 20 | |
| II | MJXXX011 | 2:1:1 | A | 9 | 4 x 9 = 36 | CGPA =274/41 = 6.68 |
| II | MJXXX012 | 2:0:0 | F | 0 | 00 | |
| II | MJXXX013 | 0:2:0 | B | 8 | 2 x 8 = 16 | |
| | Total | 25 (23*) | | Total | 157 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Supplementary | MJXXX002 | 3:2:0 | D | 6 | 5 x 6 = 30 | SGPA = 56/9 = 6.22 |
| Supplementary | MJXXX004 | 0:1:1 | C | 7 | 2 x 7 = 14 | |
| Supplementary | MJXXX012 | 2:0:0 | D | 6 | 2 x 6 = 12 | CGPA =330/50 = 6.60 |
| | Total | 9 | | Total | 56 | |

**Note: Minimum CGPA to be earned at the end of each academic year is 5.0.** SGPA and CGPA are normally calculated to the second decimal position, so that the CGPA, in particular, can be made use of in preparing the rank list of the student's performance at the college. If two students get the same CGPA, the tie would be resolved by considering the number of times a student has obtained higher SGPA and if it is still not resolved, the number of times a student has obtained higher grades like S, A, B etc., would be considered.

| | | | |
|---|---|---|---|
| 19 | | | Vertical Progression |

| | | | |
|---|---|---|---|
| | 19.1 | | For Regular students<br>i. The CGPA has to be ≥ 5.00 at the end of each the academic year. However, failure to secure a minimum CGPA of 5.00 at the end of any academic year for the first time shall attract warning before approval to continue in the semester to follow.<br>ii. Faculty Advisor (Mentor) / Head of the Department shall advice the students to maintain a CGPA of ≥ 5.00.<br>iii. Should not have 'F' Grade in more than FOUR courses (Excluding Non-Credit Mandatory Courses).<br>iv. For admission to 3rd Semester student should not have 'F' Grade in more than FOUR courses in 1st,2ndand supplementary semesters put together<br>v. For admission to 5th Semester students can carry any FOUR courses of 1st and 2nd year i.e. 1st to 4th and supplementary semesters put together.<br>vi. For admission to 7th B.E. the students should have completed all the courses of first year and can carry any FOUR courses of 2nd and 3rd year i.e. 3rd to 6thand supplementary semesters put together. |
| | 19.2 | | For Diploma Holders (Lateral Entry)<br>i. The CGPA has to be ≥ 5.00 at the end of the academic year. However, failure to secure a minimum CGPA of 5.00 at the end of any academic year for the first time shall attract warning before approval to continue in the semester to follow.<br>ii. Faculty Advisor (Mentor) / Head of the Department shall advice the students to maintain a CGPA of ≥ 5.00 at the end of each semester.<br>iii. Should not have 'F' Grade in more than FOUR courses (Excluding Non-Credit Mandatory Courses).<br>iv. For admission to 5$^{th}$ Semester students can carry any FOUR courses of 2nd year i.e. 3rd, 4thand supplementary semesters put together.<br>v. For admission to 7$^{th}$ semester B.E. the students should have completed all the courses of first year and can carry any FOUR courses of 2nd and 3rd year i.e. 3rd to 6thand supplementary semesters put together.<br>vi. Students admitted to Bachelor of Engineering at the III semester level will have to study mandatory non-credit courses "Additional Mathematics-1" in III semester and "Additional Mathematics-2" in V semester respectively. However, a pass or fail in this is not considered in vertical progression provided the attendance and CIE requirements are satisfied.<br>vii. If student fails to satisfies attendance and CIE requirements has to reregister for |

| | | | |
|---|---|---|---|
| | | | the course to make him/herself to appear for SEE<br>viii. Completion of "Additional Mathematics-1 and Additional Mathematics-2" is mandatory for award of degree. |
| | 19.3 | | **For B.Sc. students (Lateral Entry)**<br>i. The CGPA has to be ≥ 5.00 at the end of the academic year. However, failure to secure a minimum CGPA of 5.00 at the end of any academic year for the first time shall attract warning before approval to continue in the semester to follow.<br>ii. Faculty Advisor (Mentor) / Head of the Department shall advice the students to maintain a CGPA of ≥ 5.00 at the end of each semester.<br>iii. Should not have 'F' Grade in more than FOUR courses (Excluding Non-Credit Mandatory Courses).<br>iv. For admission to 5th Semester students can carry any FOUR courses of 2nd year i.e. 3rd, 4th and supplementary semesters put together.<br>v. For admission to 7th B.E. the students should have completed all the courses of first year and can carry any FOUR courses of 2nd and 3rd year i.e. 3rd to 6th and supplementary semesters put together.<br>vi. Students admitted to Bachelor of Engineering at the III semester level will have to study additional courses. Like 'Engineering Graphics and Elements of Civil Engineering and Mechanics' in addition to the regular courses from III to VIII semester. However, a pass or fail in these is not considered in vertical progression provided the attendance and CIE requirements are satisfied.<br>vii. If student fails to satisfies attendance and CIE requirements has to reregister for the course to make him/herself to appear for SEE<br>viii. Completion of mandatory non-credit courses "Engineering Graphics and Elements of Civil Engineering and Mechanics are mandatory for award of degree. |
| 20 | | | **Award of Degree** |

| | | | |
|---|---|---|---|
| | 20.1 | | Degree is awarded to students satisfying the following requirements:<br>i. Students have registered for courses totalling to credits given in Table 4.1.<br>ii. Should not have any transitional grades (I, W, X, NE, DP) in any of the courses.<br>iii. Should have CGPA ≥ 5.00 at the end of last semester. In case, if the students not fulfil this requirement are permitted to appear again for SEE in full or Part of the previous year theory course/s by rejecting the performance of them (other than internship, technical seminar, project and laboratories) for any number of times subject to the provision of maximum duration of the programme, to make up the CGPA greater than or equal to 5.00 for the award of degree.<br>iv. Should have passed in all the prescribed mandatory courses.<br>v. Should have earned the desired number of activity points as per the AICTE' activity point programme as per clause 27<br>vi. Should not have any pending disciplinary proceedings.<br>vii. Should not have dues to the institute. |
| | 20.2 | | For award of B.E. (Honours) degree<br>A student shall be declared to have completed the Programme B.E. degree and shall be eligible to get B.E. degree with Honours, provided,<br>i. Should have undergone the stipulated Course work of all the semesters under the same scheme of Teaching and Examinations and has earned prescribed number of credits as per clause 4<br>ii. Should have maintained CGPA ≥ 8.5 without any backlogs.<br>iii. Has earned additional 18 or more credits by earning final score ≥ 60% through University approved online courses like Swayam. NPTEL etc. |
| 21 | | | Academic Counselling Cell<br>After the first test, the faculty in-charge reports to the HoD, about the students who have scored less than the minimum requirement of 40% in first two quizzes and first test. HoD, faculty in-charge and proctor counsel such students and advise them regarding the course to be dropped so that, he/she can concentrate on other courses and perform better. The HoD and proctor takes an undertaking from such students to the effect that he/she:<br>- Shall attend all lectures, tutorials and laboratory classes regularly.<br>- Shall not miss any quizzes and Tests.<br>- Shall submit assignments regularly.<br>- Shall work hard to improve his/her academic performance. |
| 22 | | | Students Counselling Cell<br>The functions of Students Counselling Cell are to, |

i. Identify academically deficient and disturbed/distressed students through proctors and counsel them. Monitoring of such students with the help of psychiatrist and medical officer.

ii. Explore ways and means to help the students to come out psychological issues.

iii. Assign student mentor for regular monitoring of academic activities

23

**Malpractice in Examinations**

Penalties and punishments to the students involved in malpractice during the examination.

| Sl. No. | Nature of Malpractice | Penalty to be imposed |
|---|---|---|
| 1. | Any form of revealing the identity of the candidate in the answer script of Semester End | Fine of Rs. 2500/- and award of F grade for that course. |
| 2. | Possession of Manuscript printed or typed matter, Books or notes and written matter on Calculator / Instrument Box / electronic / wireless devices / Mobile phones, pen drives etc., or having any other written matter on the person (For Example, Palm, Hand, Leg, Cloths, Socks etc.,). | To deny the benefit of performance of the examination of all the courses for which the candidate has appeared by awarding **'F' Grade** in all the courses (both attended and to be attended of the particular examination conducted including arrear course if any), debar them for a further number of chances extending up to two semesters of examinations in all the courses including the arrears courses. |
| 3. | Detection of identical answers in the answer scripts of different Candidates or allowing a candidate to copy from his/her answer script. | To deny the benefit of performance of the examinations of all the courses for which the candidate has appeared by awarding **'F' Grade** in all the courses (both attended and to be attended of the particular examination conducted including arrear course if any), debar them for a further number of chances extending up to two semesters of examinations in all the courses including the arrears courses. |
| 4. | Appeal to the examiner with or without money as enclosures to the SEE answer book / use of abusive / obscene language or threatening remarks in the SEE answer book. | To deny the benefit of performance of the examinations of all the courses for which the candidate has appeared by awarding **'F' Grade** in all the courses (both attended and to be attended of the particular examination conducted including arrear course if any), debar them for a further number of chances extending up to two semesters of examinations in all the courses |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | including the arrears courses. |
| | | | | 5. | Found giving or receiving assistance at the examination, passing the question paper with written answer / formulae / answer script / additional sheet / Graph Sheet / Drawing Sheet for purpose of copying. | To deny the benefit of performance of the examinations of all the courses for which the candidate has appeared by awarding 'F' Grade in all the courses (both attended and to be attended of the particular examination conducted including arrear course if any), debar them for a further number of chances extending up to two semesters of examinations in all the courses including the arrears courses. |
| | | | | 6. | Destroying the documentary evidence of malpractice. | To deny the benefit of performances of the examination of all the courses for which the candidate has appeared (both attended and to be attended of the particular examination conducted including arrear examinations) and debar him/her for a further number of chances extending up to Two more examinations. |
| | | | | 7. | Insertion of additional sheets / Graph Sheets / Drawing Sheets, use of answer book which is not issued at the examination hall on that particular examination date. | To deny the benefit of performances of the examination of all the courses for which the candidate has appeared (both attended and to be attended of the particular examination conducted including arrear examinations) and debar him/her for a further number of chances extending up to Two more examinations. |
| | | | | 8. | In case of Impersonation or found guilty of deliberate prior arrangement to cheat in the examination. | To deny the benefit of performances of the examination of all the courses for which the candidate has appeared and who has arranged another person to impersonate (both attended and to be attended of the particular examination conducted including arrear examinations to both the candidates) & debar him/her for a minimum of six more examinations. (for the person who has impersonated and on whom impersonation is done for both persons, the punishment shall extend up to reprimanding and also booking a case under Indian Penal |

| | | |
|---|---|---|
| | | Code-IPC. |
| 9. | Abusing, threatening, and manhandling the examination authorities at the examination hall or in the premises of the examination centre / outside the centre as well as misconduct of a very serious nature. | To deny the benefit of performances of the examination of all the courses for which the candidate has appeared and who has arranged another person to impersonate (both attended and to be attended of the particular examination conducted including arrear examinations to both the candidates) & debar him/her for a minimum of six more examinations. (for the person who has impersonated and on whom impersonation is done for both persons, the punishment shall extend up to reprimanding and also booking a case under Indian Penal Code-IPC. |
| 10. | Any other Malpractices not defined above but connected with the Examination. | Committee can recommend suitable penalties as deem fit. |

The Chief superintendent shall allow the candidate to write all subsequent examinations and send the answer books to the office of the Controller of Examinations (CoE) on the following day.

The Examiner shall, if he / she suspects' malpractice while valuing the answer scripts or other material such as insertion of answer sheets, revealing of identity or enclosures, such as currency, shall return the answer scripts with reason in writing to the CoE by name and desist from further valuation. If already valued, marks shall not be entered in the regular marks list in which the marks awarded to other candidates are furnished but enter them in a separate list which shall be enclosed in a sealed cover and forwarded to the CoE.

The decision pertaining to above Penalties and Punishments may be communicated to all the concerned.

Enquiry under Malpractice Cases Consideration Committee is independent of the criminal proceedings. If any, in the appropriate court of law.

**Malpractice in Quizzes / Tests**

| | |
|---|---|
| If a student is involved in malpractices as defined for SEE in any course(s) of quiz / I test / | 'NE' graded will be awarded for that course in that semester. He /She will not be permitted to appear for SEE for that |

| | | | | |
|---|---|---|---|---|
| | | | II test / compensatory test. | course.<br>He /She will not be permitted to Drop / Withdraw that course. |
| | | | *However, depending on severity of malpractice, MPEC will impose penalty as deem fit, other than the one mentioned above.* | |
| 24 | | | Rules and Discipline<br>In order to maintain the sanctity and decorum in the campus and hostels, the following rules of discipline are observed by students:<br>- The students should behave courteously with the members of the staff.<br>- They should maintain silence in the library, classrooms and work quietly in drawing halls, laboratories and workshops.<br>- Students coming late to the classes are not permitted to enter the class rooms.<br>- They should not meddle with the machines, equipment and tools in the laboratories and workshops without the permission of the staff members in charge. They will be responsible for the damages and will have to pay for their replacement.<br>- They should not absent themselves from the classes without the prior permission of the Principal.<br>- Students should take the entire test without fail.<br>- Students are forbidden from pasting posters in the institute premises and causing any damage to the property of the institute.<br>- Smoking, consumption of alcoholic beverages and drugs are strictly forbidden.<br>- Students are not to affix any notice or remove any office notice from the notice boards.<br>- Use of Cell Phone is banned in classrooms, laboratories, library and in academic corridor.<br>- Students using vehicles are required to leave them in parking places provided and are forbidden from parking in other places inside the campus causing disturbance to the classes. | |
| 25 | | | Ragging and Punishment | |

| | | | |
|---|---|---|---|
| | 25.1 | | **Ragging**: Ragging means causing, inducing, compelling, forcing a student either by way of practical joke or otherwise, to do any act which detracts from human dignity or violates his/her person or exposes him/her to ridicule or to forebear from doing any lawful act by intimidating, wrongfully restraining, wrongfully confining, or injuring him/her or by using criminal force, extortion.<br>The following perverse actions also constitute the ragging.<br>i) Forcing to:<br>Address seniors as SIRs, perform mass drills, copy class notes and practical records for seniors, and carry out various errands. Do menial jobs for seniors, Drink alcohol and consume drugs. Do acts with sexual overtones and homosexual acts leading to physical injury/mental torture or death.<br>ii) Stripping / Kissing<br>**iii)** Any other related or allied acts of commission would also from ragging. |
| | 25.2 | | Punishment for Errant Students (Raggers)<br>i) Filing of First Information Report (FIR) with the local police as per the Supreme Court direction.<br>ii) Publishing the photographs of errant students (raggers) on the Notice Boards and in Local Newspapers.<br>iii) Imprisonment for a term extendable up to one year or a fine of Rs. 2000/- or both.<br>iv) Rustication, dismissal and expulsion from the Institute.<br>v) Embossment on marks cards and other academic certificates that he/she was indulged in ragging.<br>vi) Non eligibility for getting passport or visa.<br>**vii)** Non eligibility for campus recruitment/cancellation, if selected already. |
| 26 | | | Disciplinary Actions and Related Matters<br>i. Violation of code of conduct and disciplinary rules of the institute will be referred to the disciplinary committee.<br>**ii.** Violation of code of conduct shall attract disciplinary action which may include punishment such as reprimand, disciplinary probation, fine, debarring from the examination, withdrawal of placement facilities, withholding grades/degree, cancellation of registration and even rustication from the institute. |

27

**Activity Point Programme**

To enhance student's skills sets and along with an entrepreneurial capabilities and societal commitment to be apart from his/her Technical knowledge and skills to become successful as professionals, AICTE has brought a comprehensive activity programme for the award of Degree.

AICTE has framed a unique mechanism of awarding activity points over and above the academic programme grades and is mandatory for the student to earn desired number of activity points, where every student can choose activities as per likings in order to earn the AICTE activity points. These activities can spread over the years during the entire program as per the convenience of the student.

**Table No. 27 Number of activity points to be earned**

| Sl. No | Level entry in the degree | Minimum Points to be earned |
|---|---|---|
| 1 | Day college Student admitted to 4 years Degree Programme | 100 |
| 2 | Student entering 3 years Degree programme through lateral entry | 75 |
| 3 | Students transferred from other Universities to fifth Semester | 50 |

i. Activity points (non-credit) have no effect on SGPA/CGPA and will not be considered for vertical progression
ii. Activity points earned by the student will be reflected in the 8$^{th}$ semester Grade Card
iii. In case student fail to earn the minimum prescribed activity points before the commencement of 8$^{th}$ semester examinations, the eight semester grade card will be issued only after earning the minimum prescribed activity points.
iv. Students will be considered for the award of degree only after the release of 8$^{th}$ semester Grade Card.

28

**Termination from the Program**

A student is required to withdraw from the program and leave the Institute on the following grounds;

i. Failure (securing F grade) in any credit course/s for five consecutive attempts.
ii. Failure to secure a CGPA $\geq$ 5.0 at the end each academic year,for the first time attracts a warning before approval to continue in the following semester. However, a student failing to secure CGPA $\geq$ 5.0 in five consecutive semesters has to withdraw from the engineering program. However, the student can take re-admission to 1st year.

| | | | |
|---|---|---|---|
| | | | iii. Failure to meet the standards of discipline as prescribed by the Institute from time to time. |
| 29 | | | **Migration of Students** |
| | 29.1 | | **Change of branch**<br>Change of branch shall be during the beginning of III semester as per VTU/AICTE norms with permission of Registrar, VTU. |
| | 29.2 | | **Change of College**<br>A. Autonomous to another Autonomous College<br>i. Students shall seek Change of College at beginning of 3rd and 5th semester from an autonomous college to another autonomous college subject to the availability of seats within the approved intake.<br>ii. The students seeking transfer as per clause 29.2 (A) (i) shall have to obtain No Objection certificate from the University by producing No Objection certificates from both the colleges during the period as notified by VTU.<br>iii. No transfer is permitted to $7^{th}$ semester B.E. programme.<br>iv. Must have passed in all courses of previous semesters<br>v. Complete additional course/s, if any, as per decision of Board of Studies on establishing matching equivalence between two schemes. Number of such additional courses shall not be more than four. A grade card shall be issued to that effect. Additional course/s shall not be considered for vertical progression, calculation of SGPA and CGPA. However, a pass in the additional course/s is mandatory for award of degree.<br>vi. Shall earn the credits and complete the program within the maximum duration as per clause 4<br>vii. If the number of credits earned is less than the prescribed after the completion of all semesters of the programme under prevailing scheme, student shall register for a course or courses which are not studied earlier and make up the credits earned equal to or greater than required for the award of degree<br>viii. If earned credits are more than prescribed, then CGPA shall be proportionally reduced to prescribed proramme credits.<br>B. Autonomous to Non- Autonomous College<br>i. Students shall seek Change of College at beginning of 3rd and 5th semester from an autonomous college to another autonomous college subject to the availability of seats within the approved intake.<br>ii. The students seeking transfer as per clause 29.2 (B) (i) shall have to obtain No Objection certificate from the University by producing No Objection |

| | | | |
|---|---|---|---|
| | | | certificates from both the colleges during the period as notified by VTU.<br>iii. No transfer is permitted to 7th semester B.E. programme.<br>iv. Must have passed in all courses of previous semesters<br>v. Shall adhere to the prevailing regulations governing transfer of students at the University |
| | 29.3 | | Change of University<br>i. Students seeking Change of College from one University (other than VTU) to an Autonomous college at beginning of 3rd and 5th semester subject to the availability of seats within the approved intake.<br>ii. The students seeking transfer as per clause 29.3 (i) shall have to obtain No Objection certificate from the University by producing No Objection certificates from both the colleges during the period as notified by VTU.<br>iii. No transfer is permitted to 7th semester B.E. programme.<br>iv. Must have passed in all courses of previous semesters<br>v. Complete additional course/s, if any, as per decision of Board of Studies on establishing matching equivalence between two schemes. Number of such additional courses shall not be more than four. A grade card shall be issued to that effect. Additional course/s shall not be considered for vertical progression, calculation of SGPA and CGPA. However, a pass in the additional course/s is mandatory for award of degree.<br>vi. Shall earn the credits and complete the program within the maximum duration as per clause 4<br>vii. If the number of credits earned is less than the prescribed after the completion of all semesters of the programme under prevailing scheme, student shall register for a course or courses which are not studied earlier and make up the credits earned equal to or greater than required for the award of degree<br>viii. If earned credits are more than prescribed, then CGPA shall be proportionally reduced to prescribed programme credits. |
| 30 | | | Award of Ranks, Medals and Prizes |
| | 30.1 | | i. For award of ranks in a specialization of B.E. the CGPA secured by the student from III to VIII semesters shall be considered<br>ii. The additional credits earned for award of Honours degree shall not have any bearing for the declaration of rank<br>iii. A student shall be eligible for a rank at the time of award of degree provided, the student, |

| | | | |
|---|---|---|---|
| | | | a) Has passed all the courses of I to VIII semesters in first attempt only in case student admitted to I year of the programme<br>b) Has passed the courses (including mandatory non-credit) of III to VIII semesters in first attempt only in case student admitted to II year of the programme under lateral entry scheme.<br>c) Not a repeater in any semester due to rejection of result/shortage of attendance etc<br>d) Completed the course without any break/discontinuity<br>e) Has not been transferred from any autonomous/ non-autonomous/University<br>f) Total number of ranks awarded shall be 10% of the total students appeared for VIII the examination to a maximum of 10 ranks in a specialization<br>g) Ranks in a specialization shall be awarded only if a minimum of 10 should have appeared in the VIII semester examinations<br>h) In case fractional number of ranks, shall be rounded to higher integer only when the first decimal place is greater than or equal to 5. |
| | 30.2 | | i. Ranks will be awarded based on the merit of the students as determined by CGPA. If more than one candidate has the same CGPA, then tie shall be resolved by considering number of times student has obtained higher SGPA. If it is not resolved even at this stage, then the award of rank shall be based on number of S-grades/number of A-grades/any other relevant criteria.<br>ii. Ranks and awards are given for those students who were not involved in malpractice in test/quiz/examination and on whom no disciplinary action taken. |
| | 30.3 | | Medals and Prizes shall be awarded based on the conditions stipulated by the Donor subject to the provisions of regulations framed for such awards. |

# Department of Artificial Intelligence & Machine Learning

III SEMESTER B.E.(6 Theory,2 Labs,1 Kannada/CPH,1 MATDIP,1 AICTE Activity)

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| | Type | Code | | | L | T | P | | | | | |
| 1 | BSC | MVJ20MCS31 | Discrete Mathematical Structures And Probability | Mathematics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 2 | PCC | MVJ20CS32/ MVJ20AM32 | Data Structures and Applications | AM | 3 | 2 | 0 | 3 | 50 | 50 | 100 | 4 |
| 3 | PCC | MVJ20AM33 | Software Engineering | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 4 | PCC | MVJ20CS34/ MVJ20AM34 | Operating Systems | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 5 | PCC | MVJ20CS35/ MVJ20AM35 | Computer Organization and Architecture | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCC | MVJ20CS36/ MVJ20AM36 | Analog and Digital Electronics | ECE | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 7 | PCC | MVJ20CSL37/ MVJ20AML37 | Data Structures and Applications Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 8 | PCC | MVJ20CSL38/ MVJ20AML38 | Analog and Digital Electronics Laboratory | ECE | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 9 | HSMC | MVJ20KAN42 | Kannada | Humanities | 1 | 0 | 0 | 3 | 50 | 50 | 100 | 1 |
| | | MVJ20CPH43 | CPH | | | | | 3 | 50 | 50 | | |
| 10 | NCMC | MVJ20MATDIP31 | AdditionalMathematics-1 | Mathematics | | | | 3 | 50 | 50 | 100 | - |
| 11 | HSMC | MVJ20UHV302 | Universal Human Values I | Humanities | 1 | 0 | 0 | | | | | 1 |
| 12 | NCMC | AICTE Activity for 80-90 hours(20 points) | | - | - | - | - | - | - | - | - | - |
| | | | | Total | | | | 30 | 500 | 500 | 1000 | 25 |

Note: BSC: Basic Science, PCC: Professional Core Course, HSMC: Humanity and Social Science MVJ20MXXDIP31-Mandatory non-credit course. NCMC: Non-credit mandatory course

# Department of Artificial Intelligence & Machine Learning

IV SEMESTER B.E. (6 Theory, 2 Labs, 1 Kannada/CPH, 1 MATDIP, 1 AICTE Activity)

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| | Type | Code | | | L | T | P | | | | | |
| 1 | BSC | MVJ20MCS41 | Operations Research, Numerical and Statistical Methods | Mathematics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 2 | PCC | MVJ20CS42/ MVJ20AM42 | Analysis and Design of Algorithms | AM | 3 | 2 | 0 | 3 | 50 | 50 | 100 | 4 |
| 3 | PCC | MVJ20AM43 | Database Management Systems | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 4 | PCC | MVJ20AM44 | Artificial Intelligence | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 5 | PCC | MVJ20AM45 | Embedded Systems | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCC | MVJ20AM46 | Object Oriented Concepts | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 7 | PCC | MVJ20AML47 | Analysis and Design of Algorithms Lab | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 8 | PCC | MVJ20AML48 | Database Management Systems Lab | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 9 | HSMC | MVJ20KAN49 | Kannada | Humanities | 1 | 0 | 0 | 3 | 50 | 50 | 100 | 1 |
| | | MVJ20CPH49 | CPH | | | | | 3 | 50 | 50 | | |
| 10 | NCMC | MVJ20MATDIP41 | Additional Mathematics-2 | Mathematics | | | | 3 | 50 | 50 | 100 | - |
| 11 | NCMC | AICTE Activity for 80-90 hours(20 points) | | - | - | - | - | - | - | - | - | - |
| | | | | Total | | | | 30 | 500 | 500 | 1000 | 24 |

Note: BSC: Basic Science, PCC: Professional Core Course, HSMC: Humanity and Social Science MVJ20MXXDIP41-Mandatory non-credit course, NCMC: Non-credit mandatory course

# Department of Artificial Intelligence & Machine Learning

V SEMESTER B.E.(5 Theory,3 Labs,1 Environmental study,1 AICTE Activity)

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practica/ Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| | Type | Code | | | L | T | P | | | | | |
| 1 | HSMC | MVJ20TEM51 | Technical Management & Entrepreneurship | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 2 | PCC | MVJ20AM52 | Machine Learning | AM | 3 | 2 | 0 | 3 | 50 | 50 | 100 | 4 |
| 3 | PCC | MVJ20AM53 | Data Communication & Computer Networks | AM | 3 | 2 | 0 | 3 | 50 | 50 | 100 | 4 |
| 4 | PCC | MVJ20AM54 | Web Technologies | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 5 | PE | MVJ20AM55X | Professional Elective – I | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCC | MVJ20AML56 | Machine Learning Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 7 | PCC | MVJ20AML57 | Communication Network Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 8 | PCC | MVJ20AML58 | Web Technologies Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 9 | HSMC | MVJ20ENV59 | Environmental Studies | Humanities | 1 | 0 | 0 | 3 | 50 | 50 | 100 | 1 |
| 10 | HSMC | MVJ19UHV510 | UHV-2 | Humanities | 2 | 0 | 0 | | | | | 2 |
| | NCMC | AICTE Activity for 80-90 hours (20 points) | | - | - | - | - | - | - | - | - | - |
| Total | | | | | | | | 27 | 450 | 450 | 1000 | 26 |

Note: PCC: Professional Core Course, PE: Professional Elective, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course

| Course Code | Professional Elective-I |
|---|---|
| MVJ20AM551 | Sensors and Sensor Applications |
| MVJ20AM552 | Computer Graphics and Image Processing |
| MVJ20AM553 | Virtual Reality |
| MVJ20AM554 | Software Testing Methodologies |

# Department of Artificial Intelligence & Machine Learning

**VI SEMESTER B.E.(5 Theory,2 Labs,1 MiniProject,1 AICTE Activity)**

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| | Type | Code | | | L | T | P | | | | | |
| 1 | PCC | MVJ20AM61 | Foundations of Data Science | AM | 3 | 2 | 0 | 4 | 50 | 50 | 100 | 4 |
| 2 | PCC | MVJ20AM62 | Internet of Things | AM | 3 | 2 | 0 | 4 | 50 | 50 | 100 | 4 |
| 3 | PE | MVJ20AM63X | Professional Elective-II | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 4 | PE | MVJ20AM64X | Professional Elective-III | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 5 | OE | MVJ20AM65X | Open Elective-I | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCC | MVJ20AML66 | Internet of Things Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 7 | PCC | MVJ20AML67 | Data Science Laboratory | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 8 | Proj | MVJ20AMP68 | Mini-Project | AM | - | - | - | 3 | 50 | 50 | 100 | 3 |
| 9 | NCMC | AICTE Activity for 80-90 hours (20 points) | | . | . | . | . | . | . | . | . | . |
| | | | | Total | | | | 24 | 400 | 400 | 800 | 24 |

Note: PCC: Professional Core Course, PE: Professional Elective, OE: Open Elective, Proj: Project Work, NCMC: Non-credit mandatory course

| Course Code | Professional Elective-II | Course Code | Professional Elective-III | Course Code | Open Elective-I |
|---|---|---|---|---|---|
| MVJ20AM631 | Quantum Computing | MVJ20AM641 | Ethical Hacking | MVJ20AM651 | Artificial Intelligence |
| MVJ20CS632/ MVJ20AM632 | Cloud Computing | MVJ20AM642 | Cyber Security | MVJ20AM652 | Web Technologies |
| MVJ20AM633 | Introduction to Drones | MVJ20AM643 | Green Computing | MVJ20AM653 | Foundations of Data Science |
| MVJ20CS634/ MVJ20AM634 | Social Network Analysis | MVJ20AM644 | Computer Vision | MVJ20AM654 | Python Programming |

# Department of Artificial Intelligence & Machine Learning

**VII SEMESTER B.E.( 5 Theory,2 Labs, Project Phase-I, 1 AICTE Activity)**

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Code | | | Theory Lecture | Tutorial | Practical/ Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| 1 | PCC | MVJ20AM71 | Artificial Intelligence For Robotics | AM | 3 | 2 | 0 | 4 | 50 | 50 | 100 | 4 |
| 2 | PCC | MVJ20AM72 | Natural Language Processing | AM | 3 | 2 | 0 | 4 | 50 | 50 | 100 | 4 |
| 3 | PE | MVJ20AM73X | Professional Elective-IV | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 4 | PE | MVJ20AM74X | Professional Elective-V | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 5 | OE | MVJ20AM75X | Open Elective-II | AM | 3 | 0 | 0 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCC | MVJ20AML76 | Artificial Intelligence For Robotics Lab | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 7 | PCC | MVJ20AML77 | Natural Language Processing Lab | AM | 0 | 2 | 2 | 3 | 50 | 50 | 100 | 2 |
| 8 | Proj | MVJ20AMP78 | Project Phase-I | AM | - | - | - | - | 50 | - | 50 | 2 |
| 9 | NCMC | AICTE Activity for 80-90 hours (20 points) | | | - | - | - | - | - | - | - | - |
| | | | | Total | | | | 21 | 400 | 350 | 750 | 23 |

Note: PCC: Professional Core Course, PE: Professional Elective, OE: Open Elective, Proj: Project Work, NCMC: Non-credit mandatory course

| Course Code | Professional Elective-IV | Course Code | Professional Elective-V | Course Code | Open Elective-II |
|---|---|---|---|---|---|
| MVJ20AM731 | High Performance Computing | MVJ20CS741/ MVJ20AM741 | Deep Learning | MVJ20AM751 | Internet of Things |
| MVJ20AM732 | Big Data Analytics | MVJ20AM742 | Robotic Process Automation | MVJ20AM752 | Cyber Forensics |
| MVJ20AM733 | Pervasive Computing | MVJ20AM743 | Human Computer Interaction | MVJ20AM753 | Introduction to Drones |
| MVJ20AM734 | Cognitive Science | MVJ20AM744 | AI in Block chain | MVJ20AM754 | Big Data Analytics |

VIII SEMESTER B.E.( 2 Theory, Project Phase- II, Internship, 1 Technical Seminar,1 Certification course,1 AICTE Activity)

| S No | Course | | Course Title | Teaching Department | Teaching hours/week | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/Drawing | Duration in Hours | CIE Marks | SEE Marks | Total marks | |
| | Type | Code | | | L | T | P | | | | | |
| 1 | Proj | MVJ20AMP81 | ProjectPhase-2 | AM | - | - | - | 3 | 50 | 50 | 100 | 8 |
| 2 | Int | MVJ20AM82 | Internship | AM | - | - | - | 3 | 50 | 50 | 100 | 3 |
| 3 | Sem | MVJ20AM83 | Seminar | AM | - | - | - | 3 | 50 | 50 | 100 | 1 |
| 4 | CRT | MVJ20AM84 | *Certification course | Industry/Institute | - | - | - | - | - | - | - | 2 |
| 5 | NCMC | AICTE Activity for 80-90 hours (20 points) | | | . | . | . | . | . | . | . | . |
| | | | | Total | | | | 15 | | | | 14 |

Note: Proj: Project Work, Int.: Internship, Sem: Seminar ,CRT: Certification Course (Can be carried out during the program period but same will reflect in the final semester grade card) NCMC: Non-credit mandatory course

Students can opt maximum 2 certification courses covering minimum total of 30 Hours (for scoring 2 Credits in VIII sem). Students can opt either 1 course covering 30 Hours or maximum 2 courses covering 15 Hours by each course. Students can start certification course from V sem itself instead of waiting till VIII sem. Once they complete VIII sem, based on number of Hours of certification (Min. 30 Hours) Credit will be awarded.

| List of proposed Coursera Certification Courses | Course duration (Hours) | Link for the Course |
|---|---|---|
| Agile Software Development | 12.8 | https://www.coursera.org/learn/agile-software-development |
| Text Mining and Analytics | 15.4 | https://www.coursera.org/learn/text-mining |
| Web Application Development with JavaScript and MongoDB | 18.4 | https://www.coursera.org/learn/web-application-development |

| | | |
|---|---|---|
| Using Python to Interact with the Operating System | 29.6 | https://www.coursera.org/learn/python-operating-system |
| Python for Data Science and AI | 11.4 | https://www.coursera.org/learn/python-for-applied-data-science-ai |
| R Programming | 19.5 | https://www.coursera.org/learn/r-programming |
| Multiplatform Mobile App Development with React Native | 22.3 | https://www.coursera.org/learn/react-native |
| Data Structures and Design Patterns for Game Developers | 15.1 | https://www.coursera.org/learn/data-structures-design-patterns |
| DevOps Culture and Mindset | 15.2 | https://www.coursera.org/learn/devops-culture-and-mindset |

B.E, III SEMESTER, ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| | | | |
|---|---|---|---|
| Course Title | DISCRETE MATHEMATICAL STRUCTURES AND PROBABILITY | Semester | 03 |
| Course Code | MVJ20MCS31/IS31 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 ( L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to:

- Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.
- Understand and apply mathematical induction, combinatorics, discrete probability, sequence and recurrence, elementary number theory.
- Understand and apply probability distribution, sampling theory and joint probability distributions.

| Module-1 | L1,L2 & L3 | 8 Hrs. |
|---|---|---|

**Properties of the Integers**: The Well Ordering Principle – Mathematical Induction.

**Principles of Counting**: Fundamental Principles of Counting, The Rules of Sumand Product, Permutations, Combinations – The Binomial and Multinomial Theorem, Combinations with Repetition.

**Application:** Distribution with repetition.

**Video Link**:

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

| Module-2 | L1,L2 & L3 | 8 Hrs. |
|---|---|---|

**The Principle of Inclusion and Exclusion**: The Principle of Inclusion and Exclusion, Generalizations of the Principle. Derangements – Nothing is in its Right Place, Rook

Polynomials.

**Recurrence Relations:** First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.

**Application:** Arrangement with forbidden position.

**Video Link:**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

| Module-3 | L1,L2 & L3 | 8 Hrs. |
|---|---|---|

**Relations:** Cartesian Products, Relations, Properties of Relations, Equivalence Relations. Zero-One Matrices and Directed Graphs. Partial Orders–Hasse Diagrams and extreme elements.

**Functions:** Plain and One to One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.

**Application:** Zero-one matrix and Hasse diagram

**Video Link:**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

| Module-4 | L1,L2 & L3 | 8 Hrs. |
|---|---|---|

**Probability Distributions:** Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.

**Joint probability distribution:** Joint Probability distribution for two discrete random variables ,expectation, covariance, correlation coefficient.

**Application:** Finding correlation between random variables.

**Video Link:**

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/

| Module-5 | L1,L2 & L3 | 8 Hrs. |
|---|---|---|

| |
|---|
| **Sampling Theory**: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution and Chi-square distribution |
| **Coding Theory**: Coding of binary information and error detection.<br>**Application**: Testing the level of significance & the goodness of fit for large sample and small sample.<br>**Video Link**:<br>• http://nptel.ac.in/courses.php?disciplineID=111<br>• http://www.class-central.com/subject/math(MOOCs)<br>• http://academicearth.org/ |

Course Outcomes:

| | |
|---|---|
| CO1 | Demonstrate the application of discrete structures in different fields of computerScience. |
| CO2 | Solve problems using recurrence relations and generating functions. |
| CO3 | Solving logical problem using concepts of relations and functions. |
| CO4 | Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory andDesign engineering. |
| CO5 | Demonstrate testing of hypothesis of sampling distributions. |

Text Books:

| | |
|---|---|
| 1. | B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition,2013. |
| 2. | Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, , 5th Edition, PearsonEducation. 2004. |

Reference Books:

| | |
|---|---|
| 1. | Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006. |
| 2. | Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition |
| 3 | Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept |

| | |
|---|---|
| | based approach, Universities Press, 2016 |
| 4 | Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007 |

| CIE Assessment: |
|---|
| CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests<br>- Quizzes/mini tests (4 marks)<br>- Mini Project / Case Studies (8 Marks)<br>- Activities/Experimentations related to courses (8 Marks) |
| SEE Assessment: |
| i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit. The duration of examination is 3 hours. |

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | - | 3 | - | - | - | - | - | - | 1 | 1 | 2 | - |
| CO2 | 2 | 3 | - | 3 | - | - | - | - | - | - | 1 | 1 | 1 | - |
| CO3 | 2 | 3 | - | 3 | - | - | - | - | - | - | 1 | 1 | 2 | 3 |
| CO4 | 3 | 3 | - | 3 | - | - | - | - | - | - | 1 | 1 | 2 | - |
| CO5 | 3 | 3 | - | 3 | - | - | - | - | - | - | 1 | 1 | 2 | 2 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | DATA STRUCTURES AND APPLICATIONS | Semester | 03 |
| Course Code | MVJ20AM32/MVJ20CS32 | CIE | 50 |
| Total No. of Contact Hours | 50 | SEE | 50 |
| No. of Contact Hours/week | 4 (L : T : P :: 3 : 2 : 0) | Total | 100 |
| Credits | 4 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Identify the importance of data structures & memory allocation.
- Perform operations on stacks and queues and its applications.
- Apply the operations of linked list, Trees & Graphs in various applications.
- Apply searching and sorting operations in real time applications.

| Module-1 | L1,L2, L3 | Hours 10 |
|---|---|---|

**Introduction:** Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays.

**Abstract Data Type, Array Operations:** Traversing, inserting, deleting, searching, and sorting,

**Array ADT** :Multidimensional Arrays, Polynomials and Sparse Matrices.

**Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.

**Laboratory Sessions/ Experimental learning:**

1. Create an array of structure which has the following members Student name, Student USN, Marks1, Marks2, Marks3. Allocate memory to store 5 students details initially. When a new student details need to be entered or to be deleted in this array, dynamically change the array size. Write a program to implement this scenario and display the result.
2. Find the bug for the following code and then Debug it

```
int minval(int *A, int n) {
```

```
        int currmin;
        for (int i=0; i<n; i++)
          if (A[i] < currmin)
            currmin = A[i];
         return currmin;
       }
```

3. Compile the following code and debug it.

```
    #include <stdio.h>
    #include <string.h>
    struct student
   {
     int id;
     char name[30];
     float percentage;
   };
 int main()
{
     int i;
     struct student record1 = {1, "Raju", 90.5};
     struct student *ptr;
        printf("Records of STUDENT1: \n");
        printf("  Id is: %d \n", ptr->id);
        printf("  Name is: %s \n", ptr->name);
        printf("  Percentage is: %f \n\n", ptr->percentage);
      return 0;
}
```

Real Time Applications: System memory allocation

Video link / Additional online information (related to module if any):

1. https://nptel.ac.in/courses/106106130/
2. https://nptel.ac.in/courses/106105085/
3. https://nptel.ac.in/courses/106/106/106106127/

4. https://www.coursera.org/lecture/data-structures/arrays-OsBSF

| Module-2 | L1,L2, L3 | Hours 10 |
|---|---|---|

**Stacks:** Definition, Stack Operations, Stack ADT, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression.

**Recursion** - GCD, Tower of Hanoi.

**Queues:** Definition, Array Representation, Queue Operations, Queue ADT, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Programming Examples.

**Laboratory Sessions/ Experimental learning:**

Design, Develop and Implement a menu driven Program in C for the following operations on DEQUEUE of Integers (Array Implementation of Queue with maximum size MAX)

a. Insert an Element on to DEQUEUE
b. Delete an Element from DEQUEUE
c. Demonstrate Overflow and Underflow situations on DEQUEUE
d. Display the status of DEQUEUE
e. Exit Support the program with appropriate functions for each of the above operations

**Real Time Applications: Game applications, Ticket booking applications (Eg: Train, restaurant etc)**

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106130/
- https://nptel.ac.in/courses/106102064/
- https://nptel.ac.in/courses/106105085/
- https://nptel.ac.in/courses/106/106/106106127/

| Module-3 | L1,L2, L3 | Hours 10 |
|---|---|---|

**Linked Lists:** Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials. Programming Examples

**Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

**Laboratory Sessions/ Experimental learning:**

1.Design, Develop and Implement a Program in C for the following operations on Singly

Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2 y 2 z-4yz5 +3x3 yz+2xy5 z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations

2. Debug the following code and explain the process

```
//Insert a value into an ordered linked list
void insert(lnode*& curr, int val) {
  if (curr == NULL)
    curr = new lnode(val, NULL);
  else if (lnode->val > val)
    curr = new lnode(val, curr->next);
  else {
    curr = curr->next;
    insert(curr, val);
  }
}
```

Real Time Applications: Music Player, Image Viewer, Web browser, Process Management, Mechanical field

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106130/
- https://nptel.ac.in/courses/106102064/
- https://nptel.ac.in/courses/106105085/

| Module-4 | L1,L2, L3 | Hours 10 |
|---|---|---|

**Trees**: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, AVL Trees, Splay Trees, B-Tree, Programming Examples

**Laboratory Sessions/ Experimental learning:**

Design, Develop and Implement a menu driven Program in C for the following operations on AVL Trees

i) Construct an AVL tree by inserting the following elements in the given order.

63, 9, 19, 27, 18, 108, 99, 81.

ii)searching for a node

iii)Deleting a node

**Real Time Applications:** Indexing in databases, Programming Languages, Computer chess games, Computer file system, Undo function in text editor, representing city region telehone network etc.

**Video link:**

- https://nptel.ac.in/courses/106102064/
- http://www.digimat.in/nptel/courses/video/106106127/L50.html
- https://www.youtube.com/watch?v=ffgg_zmbaxw

| Module-5 | L1,L2, L3 | Hours 10 |
|---|---|---|

**Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search, Topological Sort.

**Sorting and Searching:** Quick sort,Insertion Sort, Radix sort, Merge Sort, Address Calculation Sort.

**Laboratory Sessions/ Experimental learning:**

Sort a given set of elements using the sorting Method which divides input array in two halves, calls itself for the two halves and then merges the two sorted halves" and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

**Real Time Applications:** Graph Theory, E-Commerce websites, Google Maps, Face book

**Video link:**

- https://www.youtube.com/watch?v=hk5rQs7TQ7E&feature=youtu.be
- https://nptel.ac.in/courses/106/102/106102064/

**Course outcomes:**

| | |
|---|---|
| CO1 | Identify the necessity of data structure and its storage process. |
| CO2 | Analyse the various operations performed on stack and queues for different applications. |

| | |
|---|---|
| CO3 | Perform various operations on linked list for different applications. |
| CO4 | Learn Trees and its applications. |
| CO5 | Analyse the concepts of Graphs, searching, sorting & hashing in real time. |

| Text Books: | |
|---|---|
| 1 | Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014. |
| 2 | Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014. |

| Reference Books: | |
|---|---|
| 1 | Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012. |
| 2 | Mark Allen Weiss, —Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997. |
| 3 | Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014. |
| 4 | Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Ed, McGraw Hill, 2013 |
| 5 | A M Tenenbaum, Data Structures using C, PHI, 1989 |
| 6 | Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2

marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | - | - | - | 1 | - | - | - | - | - | - | 2 | 2 | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 1 | 2 | 1 | - |
| CO3 | 2 | 2 | 2 | 1 | 3 | - | - | - | - | - | 1 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 2 | 2 | - |
| CO5 | 3 | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 2 | 2 | 2 |

High-3, Medium-2, Low-1

| Course Title | SOFTWARE ENGINEERING | Semester | 03 |
|---|---|---|---|
| Course Code | MVJ20AM33 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Understand principles, concepts, methods, and techniques of the software engineering approach to producing quality software (particularly for large, complex systems).
- Impart skills in the design and implementation of efficient software systems across disciplines.
- Familiarize engineering practices and standards used in developing software products and components.
- Gather knowledge on various software testing, maintenance methods.

| Module-1 | L1,L2, L3 | Hours 8 |
|---|---|---|

**INTRODUCTION TO SOFTWARE ENGINEERING:** The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes, Software Myths.

**PROCESS MODELS:** A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process, Personal and Team Process Models, the Capability Maturity Model Integration (CMMI).

**Laboratory Sessions/ Experimental learning:**

To write the SRS for the given real time application using report writing tools.

**Applications:** In Software development process.

**Video link / Additional online information:** https://nptel.ac.in/courses/106105182/

| Module-2 | L1,L2, L3 | Hours 8 |
|---|---|---|

**REQUIREMENTS ENGINEERING:** Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management, System Modeling: Context Models, Interaction Models,

Structural Models, Behavioral Model, Model-Driven Engineering.

**DESIGN CONCEPTS:** The Design Process, Design Concepts, The Design Models, Architectural Design: Software Architecture, Architectural Genres, Architectural Styles.

**Applications:** In Software development process.

**Video link / Additional online information:**

- https://www.coursera.org/lecture/client-needs-and-software-requirements/3-2-4-use-cases-bZNCr

| Module-3 | L1,L2, L3 | Hours 8 |
|---|---|---|

**DESIGN AND IMPLEMENTATION:** The Object Oriented Design with UML, Design Patterns, Implementation Issues, Open Source Development. User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation. **SOFTWARE TESTING STRATEGIES:** A Strategic approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging, White-Box Testing, Black Box Testing.

**Laboratory Sessions/ Experimental learning:**

Using Selenium IDE write a test suite containing minimum 4 test cases.

**Applications:** In Software development process.

**Video link / Additional online information:**

https://www.youtube.com/watch?v=T3q6QcCQZQg

| Module-4 | L1,L2, L3 | Hours 8 |
|---|---|---|

**PRODUCT METRICS:** A Frame Work for Product Metrics, Metrics for the Requirements Model, Metrics for Design Model, Metrics for Source Code, Metrics for Testing.

**PROCESS AND PROJECT METRICES:** Metrics in the Process and Project Domains, Software Measurements, Metrics for Software Quality, Risk Management: Risk verses Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation Monitoring and Management (RMMM), The RMMM Plan.

**Laboratory Sessions/ Experimental learning:** Create a project using MS projects for any real time scenario.

**Applications:** In Software development process.

**Video link / Additional online information:** https://youtu.be/tIZ1dg4pxCE

| Module-5 | L1,L2, L3 | Hours 8 |
|---|---|---|

**QUALITY MANAGEMENT:** Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality, Review Techniques, Reviews: A Formal spectrum,

| |
|---|
| Informal Reviews, Formal Technical Reviews,<br>**SOFTWARE QUALITY ASSURANCE:** Background Issues, Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability, the ISO 9000 Quality Standards.<br>**Laboratory Sessions/ Experimental learning:** Estimation of test coverage metrics using manual test metrics.<br>**Applications:** In Software development process.<br>**Video link / Additional online information:** https://nptel.ac.in/courses/110105039/ |

| Course Outcomes: | |
|---|---|
| CO1 | Understand various Process Models. |
| CO2 | Investigate various requirements engineering and apply design concepts. |
| CO3 | Identify numerous Software Testing Strategies. |
| CO4 | Evaluate Process and Project Metrices. |
| CO5 | Illustrate Quality Management and Software Quality Assurance Concepts |

| Text Books: | |
|---|---|
| 1 | Roger S. Pressman (2011), Software Engineering, A Practitioner's approach, 7 th edition, McGraw Hill International Edition, New Delhi |
| 2 | Sommerville (2001), Software Engineering, 9 th edition, Pearson education, India |
| **Reference Books:** | |
| 1 | K. K. Agarval, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India. |
| 2 | Lames F. Peters, Witold Pedrycz(2000), Software Engineering an Engineering approach, John Wiely & Sons, New Delhi, India |
| 3 | Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, India |

| CIE Assessment: |
|---|

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 2 | 2 | 2 | - | - | 1 | 2 | 2 | 2 | - | 2 | - |
| CO2 | 2 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | 2 | 2 | 1 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | 2 | 2 | - | 3 | - |
| CO4 | 1 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | 2 | 2 | 1 | 2 | 2 |
| CO5 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | - |

High-3, Medium-2, Low-1

| Course Title | OPERATING SYSTEMS | Semester | 03 |
|---|---|---|---|
| Course Code | MVJ20AM34/MVJ20CS34 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students*

- Introduce concepts and terminology used in OS.
- Explain threading and multithreaded systems.
- Illustrate process synchronization and concept of Deadlock.
- Introduce Memory and Virtual memory management, File system and storage techniques.

| Module-1 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Introduction**: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; System boot.

**Process Management**: Process concept; Process scheduling; Operations on processes; Inter process communication.

| Module-2 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Multi-threaded Programming**: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling.

**Process Synchronization**: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

| Module-3 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Deadlocks** : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery

| | | |
|---|---|---|
| from deadlock.<br>**Memory Management**: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation | | |
| **Module-4** | L1,L2, L3 | **Hours 8** |
| **Virtual Memory Management**: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.<br>**File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing;<br>**Implementing File system**: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. | | |
| **Module-5** | L1,L2, L3 | **Hours 8** |
| **Mass Storage Structure**-Disk Structure-Disk Attachment-Disk Scheduling-Disk Management- Swap-Space Management.<br>**Protection**: Domain of protection, Access matrix, Implementation of access matrix, Access control,Revocation of access rights, Capability- Based systems.<br>**Case Studies**: Windows, Unix, Linux,Android. | | |

| Course Outcomes: | |
|---|---|
| CO1 | Illustrate the fundamental concepts of operating systems |
| CO2 | Compare and illustrate various process scheduling algorithms. |
| CO3 | Ability to recognize and resolve Deadlock problems, Memory Management techniques. |
| CO4 | Apply appropriate memory and file management schemes. |
| CO5 | Appreciate the need of access control and protection in Operating System and illustrate various disk scheduling algorithms. |

| Text Books: | |
|---|---|
| 1 | Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts 7th edition,Wiley-India, 2006 |
| 2 | D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013. |

| Reference Books: |
|---|

| | |
|---|---|
| 1 | Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India. 2004 |
| 2 | P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,Prentice-Hall of India. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

**CO-PO/PSO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| CO5 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | COMPUTER ORGANIZATION AND ARCHITECTURE | Semester | 03 |
| Course Code | MVJ20AM35/MVJ20CS35 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Learn the basic structure and operations of a computer.
- Learn the arithmetic and logic unit.
- Learn the different ways of communication with I/O devices & memories, memory hierarchies, cache memories and virtual memories.
- Understand & implement arithmetic process.
- Understand the processor and pipelining concepts.
- Understand parallelism and multi-core processors.

| Module-1 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Basic Structure of Computers**: Basic Operational Concepts, Bus Structures, Performance –Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

**Machine Instructions and Programs**: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.

**Arithmetic**: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division.

**Text book 1: Chapter 1 – 1.1 to 1.9,Chapter2 – 2.1 to 2.10**

**Text book 1: Chapter6 – 6.1 to 6.7**

**Laboratory Sessions/ Experimental learning**: 0.Study of peripherals, components of a Computer System

**Applications**: Basic Computer Devices

**Video link** : https://nptel.ac.in/courses/106105163/

| Module-2 | L2 ,L3 | Hours 8 |
|---|---|---|

**Input/output Organization**: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory

Access, Buses, Interface Circuits.Standard I/O Interfaces – PCI Bus, SCSI Bus, USB

**Text book 1: Chapter4 – 4.1 to 4.7**

**Laboratory Sessions/ Experimental learning**:Design of ALU

**Applications**: input /output operations

**Videolink**:https://www.youtube.com/watch?v=RkAE4zE4uSE&list=PL13FD5F00C21BBC0B&index=11

| Module-3 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Memory**: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Types of cache ,Cache miss management Mapping Functions, Replacement Algorithms, Performance Considerations,(ARM Cache and Pentium cache).

**Text book 1: Chapter5 – 5.1 to 5.4, 5.5**

**Laboratory Sessions/ Experimental learning**:Design of Memory

**Applications**: Different Types of Memory

**Video link** : https://nptel.ac.in/courses/106105163/

| Module-4 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Processor** : A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards –Exceptions.

**Text book 2: Chapter 4**.

**Laboratory Sessions**: Instruction scheduling

**Applications**: Types of processor

**Video link**: https://nptel.ac.in/courses/106106166/

| Module-5 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Parallelism**: Parallel processing challenges –Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**Text book 2: Chapter 6**.

Laboratory Sessions : Process Scheduling

**Applications**:Grid and Cloud Computing

**Video link**: https://nptel.ac.in/courses/106102114/

Course Outcomes:

| | |
|---|---|
| CO1 | Explain the basic organization of a computer system. |
| CO2 | Demonstrate functioning of different sub systems, such as processor, Input/output, and memory. |
| CO3 | Design and analyses simple arithmetic and logical units. |
| CO4 | Illustrate hardwired control and micro programmed control, pipelining, embedded and |

| | |
|---|---|
| | other Computing systems. |
| CO5 | Design and analyses of simple Parallelism and Multithread. |

| Text Books: | |
|---|---|
| 1 | Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, and 6). |
| 2 | David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.(Listed topics only from Chapters 4and 6). |

| Reference Books: | |
|---|---|
| 1 | John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012. |
| 2 | John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012. |
| 3 | http://vlabs.iitkgp.ac.in/coa/ |

| CIE Assessment: |
|---|
| CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests<br>- Quizzes/mini tests (4 marks)<br>- Mini Project / Case Studies (8 Marks)<br>- Activities/Experimentations related to courses (8 Marks) |
| SEE Assessment: |
| i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit. The duration of examination is 3 hours. |

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | - | -- | - | 2 | 1 |
| CO3 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 2 | - |
| CO4 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 2 | 3 |
| CO5 | 1 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | ANALOG AND DIGITAL ELECTRONICS | Semester | 03 |
| Course Code | MVJ20AM36/MVJ20CS36 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Analyse the working of oscillators and use of regulators.
- Make use of simplifying techniques in the design of combinational circuits.
- Illustrate combinational and sequential digital circuits.
- Demonstrate the use of flipflops and design registers and counters.
- Design and test Analog-to-Digital and Digital-to-Analog conversion techniques.

| Module-1 | L2 | 8 Hrs. |
|---|---|---|

**Prerequisites** : Basic analog Circuits

**Metal Oxide Semiconductor Field Effect transistor(MOSFET):** Structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier, CMOS and its applications.

**Oscillators:** Basic working and applications of RC Phase shift oscillator, Wien Bridge oscillator, LC oscillator, Colpitt oscillator, Crystal Oscillator.

**Linear Power Supplies:** Constituents of a Linear Power Supply, Designing Mains Transformer, Linear IC voltage regulators, Regulated Power Supply Parameters

| Module-2 | L2,L3 | 8 Hrs. |
|---|---|---|

**Prerequisites**:Digital Electronic Fundamentals

**Karnaugh maps**:Minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables

**Activity**: Writing and Analyzing C program for K-maps.

| Module-3 | L2,L3 | 8 Hrs. |
|---|---|---|

**Combinational Circuits:** Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU-Design and popular MSI chips, digital

| | | |
|---|---|---|
| comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices,<br>**Activity:** Designing a 32-bit ALU | | |
| **Module-4** | L2,L3 | **8 Hrs.** |
| **Flip-Flops and Registers:**<br>**Flip Flops:** S-R,J-K,D and T flip flops,Edge-triggered JK FLIP-FLOPs<br>**Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers.<br>**Counters:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus, Decade Counters, Applications of Counters.<br>**Activity:** Implementing 2 digit counters using seven segment display | | |
| **Module-5** | L2 | **8 Hrs.** |
| **D/A Conversion and A/D Conversion:**<br>**Digital to Analog converters:** weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit.<br>**Analog to digital converters:** quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D Converter ICs<br>**Activity:** Demonstration of CODEC which houses both ADC and DAC. | | |
| Laboratory Sessions | | |
| • Plotting the V-I characteristics of MOSFET<br>• Implementing adders and subtracters<br>• Implementing the simplified equation obtained from K-maps and verify with the truth table | | |
| Course Outcomes: | | |
| CO1 | Design and analyze analog circuits using transistors,power supply, MOSFETS,regulator IC and opamp. | |
| CO2 | Simplify digital circuits using Karnaugh Map , POS and Quine-McClusky Methods | |
| CO3 | Explain construction and working of data processing circuits | |

| | |
|---|---|
| CO4 | Understanding the various types of latches and flip flops and building the registers and counters using flip flops. |
| CO5 | Explain the basic principles of A/D and D/A conversion circuits and develop the same. |

| Text Books: | |
|---|---|
| 1. | Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012. |
| 2. | Charles H Roth and Larry L Kinney, Fundamentals of Logic design, Cengage Learning,2019. |

| Reference Books: | |
|---|---|
| 1. | Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015. |
| 2. | M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008. |
| 3. | David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008 |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 1 | 1 | 2 |

High-3, Medium-2, Low-1

<table>
<tr><td>Course Title</td><td>DATA STRUCTURES AND APPLICATIONS LABORATORY</td><td>Semester</td><td>03</td></tr>
<tr><td>Course Code</td><td>MVJ20AML37/MVJ20CSL37</td><td>CIE</td><td>50</td></tr>
<tr><td>Total No. of Contact Hours</td><td>30</td><td>SEE</td><td>50</td></tr>
<tr><td>No. of Contact Hours/week</td><td>3 (L : T : P :: 0 : 2 : 2)</td><td>Total</td><td>100</td></tr>
<tr><td>Credits</td><td>2</td><td>Exam. Duration</td><td>3 Hours</td></tr>
<tr><td colspan="4">Course objective is to:<br>The students will be able to get practical experience in design, develop, implement, analyze and evaluation of<br>• Linear data structures and their applications such as stacks, queues and lists,<br>• Non-Linear data structures and their applications such as Trees &Graphs<br>• Sorting and Hashing techniques.</td></tr>
</table>

<table>
<tr><th>S No</th><th>Experiment Name</th><th>RBT Level</th><th>Hours</th></tr>
<tr><td>1</td><td>A courier company has number of items to be delivered to its intended customers through its salesman. The salesman visits the following cities to deliver the respective items. Write a C program,
<table>
<tr><td>S.No</td><td>Cities</td><td>Number of items</td></tr>
<tr><td>1</td><td>Agra</td><td>25</td></tr>
<tr><td>2</td><td>Chennai</td><td>50</td></tr>
<tr><td>3</td><td>Kolkata</td><td>59</td></tr>
<tr><td>4</td><td>Mumbai</td><td>72</td></tr>
<tr><td>5</td><td>Delhi</td><td>12</td></tr>
</table>
a) To display name of cities where salesman has delivered maximum and minimum number of items<br>b) To search the number of items to be delivered of a user supplied city.</td><td>L3</td><td>3</td></tr>
<tr><td>2</td><td>Implement Knuth-Morris- Pratt pattern matching algorithm using C program.</td><td>L3</td><td>3</td></tr>
<tr><td>3</td><td>Design, Develop and Implement a menu driven Program in</td><td>L3</td><td>3</td></tr>
</table>

| | | | |
|---|---|---|---|
| | C with the listed operations for the data structure which follows Last In First Out (LIFO) order. (Use Array Implementation of specified DS with maximum size MAX).<br>a. Push an Element<br>b. Pop an Element<br>c. Demonstrate how it can be used to check Palindrome<br>d. Demonstrate Overflow and Underflow situations<br>e. Display the status<br>f. Exit<br>Support the program with appropriate functions for each of the above operations | | |
| 4 | Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands. | L3 | 3 |
| 5 | Design, Develop and Implement a menu driven Program in C for the following operations on Ring Buffer of Integers (Use Array Implementation)<br>a. Insert an Element on to Ring Buffer<br>b. Delete an Element from Ring Buffer<br>c. Demonstrate Overflow and Underflow situations on Ring Buffer<br>d. Display the status of Ring Buffer<br>e. Exit<br>Support the program with appropriate functions for each of the above operations | L3 | 3 |
| 6 | Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo<br>a. Create a SLL of N Students Data by using front insertion<br>b. Display the status of SLL and count the number of nodes | L3 | 3 |

| | | | |
|---|---|---|---|
| | in it<br>c. Perform Insertion / Deletion at End of SLL<br>d. Perform Insertion / Deletion at Front of SLL<br>e. Exit | | |
| 7 | Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo.<br>a. Create a DLL of N Employees Data by using end insertion.<br>b. Display the status of DLL and count the number of nodes in it.<br>c. Perform Insertion and Deletion at End of DLL .<br>d. Perform Insertion and Deletion at Front of DLL .<br>e. Demonstrate how this DLL can be used as Double Ended Queue.<br>f. Exit | L3 | 3 |
| 8 | Design, Develop and Implement a menu driven C Program for the following operations on Binary Search Tree (BST) of Integers.<br>a) Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2.<br>b) Traverse the BST recursively in inorder, preorder & postorder<br>c) Search the BST for a given element (KEY) and report the appropriate message | L3 | 3 |
| 9 | Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities<br>a. Create a Graph of N cities using Adjacency Matrix.<br>b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method | L3 | 3 |
| 10 | Develop a C program to sort a given set of n integer elements using Quick Sort method. Run the program for | L3 | 3 |

| | | | |
|---|---|---|---|
| | varied values of n and show the results of each iteration. | | |
| 11 | Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2- digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing. | L3 | 3 |

| Course Outcomes: | |
|---|---|
| CO1 | Analyze and Compare various linear data structures. |
| CO2 | Code, debug and demonstrate the working nature of different types of data structures and their applications. |
| CO3 | Implement, analyse and evaluate the searching and sorting algorithms. |
| CO4 | Choose the appropriate data structure for solving real world problems. |

| Reference Books: | |
|---|---|
| 1. | A M Tenenbaum, Data Structures using C, PHI, 1989 |
| 2. | Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996. |
| 3. | http://opendatastructures.org, https://donsheehy.github.io/datastructures |

| CIE Assessment: |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| SEE Assessment: |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be, |

i. Writeup : 20 marks
ii. Conduction : 40 marks
iii. Analysis of results : 20 marks
iv. Viva : 20

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | 3 | 3 | - | - | 3 | - | 3 | 2 | 1 | - |
| CO2 | 3 | 3 | 2 | - | 3 | 3 | - | - | 3 | - | 3 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 | - | 3 | 3 | - | - | 3 | - | 3 | 2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | - | 3 | 3 | - | - | 3 | - | 3 | 2 | 2 | 2 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | ANALOG AND DIGITAL ELECTRONICSLABORATORY | Semester | 03 |
| Course Code | MVJ20AML38/MVJ20CSL38 | CIE | 50 |
| Total No. of Contact Hours | 30 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 0 : 2 : 2) | Total | 100 |
| Credits | 2 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Analog components and circuits including transistor, regulator, etc.
- Combinational logic circuits.
- Flip - Flops and their operations
- Counters and Registers using Flip-flops.
- Synchronous and Asynchronous Sequential Circuits

| S No | Experiment Name | RBT Level | Hours |
|---|---|---|---|
| 1 | Study of transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value. | L2 | 3 |
| 2 | Design and test IC 723 voltage regulator | L3 | 3 |
| 3 | Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC. | L2 | 3 |
| 4 | Design and implement a faster way3 to add binary numbers using carry look ahead adders. | L3 | 3 |
| 5 | a) Realization and implementation of 2-bit comparator using logic gates.<br>b) Implementation of 4-bit magnitude comparator using IC 7485. | L3 | 3 |
| 6 | To design and construct basic flip-flops R-S ,J-K,J-K Master slave flip-flops using gates and verify their truth table | L3 | 3 |

| | | | |
|---|---|---|---|
| 7 | Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops | L3 | 3 |
| 8 | Design and implementation of 3-bit synchronous up/down counter | L3 | 3 |
| 9 | Design and implement a ring counter and Johnson counter using 4-bit shift register and demonstrate its working. | L3 | 3 |
| 10 | Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working. | L3 | 3 |
| 11 | Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate on 7-segment display (using IC-7447). | L3 | 3 |
| 12 | Design 4 bit r-2r ladder DAC using opamp. | L3 | 3 |

| Course Outcomes: | |
|---|---|
| CO1 | Demonstrate various Electronic Devices like Cathode ray Oscilloscope, Signal generators, Digital Trainer Kit, Multimeters and components like Resistors, Capacitors, Op amp and Integrated Circuit |
| CO2 | Examine and verify different analog circuits. |
| CO3 | Design and demonstrate various combinational logic circuits. |
| CO4 | Design and demonstrate various types of counters and Registers using Flip-flops |
| CO5 | Design and demonstrate the working of DAC |

Reference Books:


| | |
|---|---|
| 1. | Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015. |
| 2. | M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008. |
| 3. | David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008 |

| CIE Assessment: |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| SEE Assessment: |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,<br>i. Writeup : 20 marks<br>ii. Conduction : 40 marks<br>iii. Analysis of results : 20 marks<br>iv. Viva : 20 |

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 2 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 2 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW | Semester | III/IV |
| Course Code | MVJ20CPH39/49 | CIE | 50 |
| Total No. of Contact Hours | 20 | SEE | 50 |
| No. of Contact Hours/week | 01 (L : T : P :: 1 :0 : 0) | Total | 100 |
| Credits | 01 | Exam. Duration | 2 hrs |

Course objective is to:

- To know the fundamental political codes, structure, procedures, powers, and duties of Indian constitution, Indian government institutions, fundamental rights, directive principles and the duties of the citizens.
- To provide overall legal literacy to the young technocrats to manage complex societal issues in the present scenario.
- To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.

| Module-1 | L1,L2,L3 | 03 Hours |
|---|---|---|

**Introduction to Indian Constitution**

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian Constitution, The Making of the Constitution, The role of the Constituent Assembly – Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and Limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and Significance in Nation Building.

| Module – II | L1,L2,L3 | 03 Hours |
|---|---|---|

**Union Executive and State Executive**

Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial

| | | |
|---|---|---|
| Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370, 371, 371J) for some States. | | |
| **Module – III** | L1,L2,L3 | 03 Hours |
| **Elections, Amendments and Emergency Provisions**<br>Elections, Electoral Process, and Election Commission of India, Election Laws.<br>Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements).<br>Emergency Provisions, types of Emergencies and it's consequences.<br>**Constitutional Special Provisions:**<br>Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes. | | |
| **Module – IV** | L1,L2,L3 | 03 Hours |
| **Professional / Engineering Ethics**<br>Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India) : Profession, Professionalism, Professional Responsibility. Clash of Ethics, Conflicts of Interest.<br>**Responsibilities in Engineering** - Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. | | |
| **Module – V** | L1,L2,L3 | 03 Hours |
| **Internet Laws, Cyber Crimes and Cyber Laws:**<br>Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship, Cybercrimes | | |

| | |
|---|---|
| and enforcement agencies. | |
| **Course Outcomes:** On completion of this course, students will be able to | |
| CO1 | Have constitutional knowledge and legal literacy |
| CO2 | Understand Engineering and Professional ethics and responsibilities of Engineers. |
| CO3 | Understand the cyber crimes and cyber laws for cyber safety measure. |

| | |
|---|---|
| **Text Books:** | |
| 1. | Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher |
| **Reference Books:** | |
| 1. | Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.)Prentice –Hall EEE, 19th/20th Edn., (Latest Edition) or 2008. |
| 2. | Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018. |
| 3 | M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004. |
| 4. | M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002. |
| 5. | Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and

may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

| | | | |
|---|---|---|---|
| Course Title | ADDITIONAL MATHEMATICS-I | Semester | 03 |
| Course Code | MVJ20MATDIP31 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 4 | Total | 100 |
| Credits | - | Exam. Duration | 3 HOURS |

Course objective is to: *This course aims to prepare the students*:

To familiarize the important and basic concepts of Differential calculus and Differential Equation, ordinary/partial differential equations and Vector calculus and analyse the engineering problems.

| Module-1 | L1,L2 | 8 Hrs. |
|---|---|---|

**Differential calculus**: Recapitulation of successive differentiation -nth derivative - Leibnitz theorem and Problems, Taylor's and Maclaurin's theorem for function of one variable.

**Video Link:** https://users.math.msu.edu/users/gnagy/teaching/ode.pdf

| Module-2 | L1,L2 | 8 Hrs. |
|---|---|---|

**Integral Calculus:**

Review of elementary Integral calculus, Reduction formula

$\int_0^{\frac{\pi}{2}} sin^m x\,dx$ $\int_0^{\frac{\pi}{2}} cos^m x\,dx$ $\int_0^{\frac{\pi}{2}} sin^m cos^n x\,dx$ and problems.

Evaluation of double and triple integrals and Simple Problems.

**Video Link**

- https://www.youtube.com/watch?v=rCWOdfQ3cwQ
- https://nptel.ac.in/courses/111/105/111105122/

| Module-3 | L1,L2 | 8 Hrs. |
|---|---|---|

**Vector Calculus**: Derivative of vector valued functions, Velocity, Acceleration and related problems, Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. Vector identities-div( φA), curl (φA), curl(grad φ),

div(curl A)

**Video Links:**

- https://www.whitman.edu/mathematics/calculus_online/chapter16.html
- https://www.math.ust.hk/~machas/vector-calculus-for-engineers.pdf

| Module-4 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

**Probability:**

Introduction - Conditional Probability, Multiplication theorem, Independent events, Baye's theorem and Problems

**Video Links:**

- https://www.khanacademy.org/math/statistics-probability/probability-library
- https://nptel.ac.in/courses/111/105/111105041/

| Module-5 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

**Differential equation:** Homogeneous differential equation, Linear differential equation, Bernoulli's differential equation and Exact differential equation.

**Video Link:** https://www.mathsisfun.com/calculus/differential-equations.html

**Course Outcomes:**

| | |
|---|---|
| CO1 | Apply the knowledge of Differential calculus in the modeling of various physical and engineering phenomena |
| CO2 | Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes. |
| CO3 | Study on Vector calculus to understand the various solution of the Application to Engineering problems. |
| CO4 | Understand the basic Concepts of Probability |
| CO5 | Solve first order linear differential equation analytically using standard methods. |

**Text Books:**


| | |
|---|---|
| 1. | B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013. |
| 2. | Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006. |

| Reference Books: | |
|---|---|
| 1. | Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014. |
| 2. | G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19 |

| Course Title | UNIVERSAL HUMAN VALUES I | Semester | 03 |
|---|---|---|---|
| Course Code | MVJ20UHV310 | CIE | 50 |
| Total No. of Contact Hours | 15 | SEE | 50 |
| No. of Contact Hours/week | 1 (L: T : P :1 : 0 :0) | Total | 100 |
| Credits | 1 | Exam. Duration | 2 Hrs. |

Course objective is to: *This course will enable the students to*

- Perceive the need for developing a holistic perspective of life
- Sensitise the scope of life – individual, family (inter-personal relationship), society and nature/existence, Strengthening self-reflection
- Develop more confidence and commitment to understand, learn and act accordingly

| Module-1 | L1,L2 | 3 Hrs |
|---|---|---|

**Welcome and Introductions:** Getting to know each other (Self-exploration)

**Aspirations and Concerns:** Individual academic, career, Expectations of family, peers, society, nation, Fixing one's goals (Basic human aspirations Need for a holistic perspective Role of UHV)

**Self-Management:**Self-confidence, peer pressure, time management, anger, stress, Personality development, self-improvement (Harmony in the human Being)

**Health:** Health issues, healthy diet, healthy lifestyle, Hostel life (Harmony of the Self and Body Mental and physical health)

**Relationships:** Home sickness, gratitude, towards parents, teachers and, others Ragging and interaction, Competition and cooperation, Peer pressure (Harmony in relationship Feelings of trust, respect, gratitude, glory, love)

**Society:** Participation in society (Harmony in the society)

**Natural Environment:** Participation in nature (Harmony in nature/existence)

**Video link:**

- https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV
- https://youtube.com/playlist?list=PLYwzG2fd7hzcZz1DkrAegkKF4TseekPFv

**Presentation:** https://fdp-si.aicte-india.org/AicteSipUHV_download.php

| Module-2 | L1,L2 | 3 Hrs |
|---|---|---|

**Introduction to Value Education:** Right Understanding, Relationship and Physical

Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario.

**Video link:**

- https://www.youtube.com/watch?v=85XCw8SU084
- https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

| Module-3 | L1,L2 | 3 Hrs |
|---|---|---|

**Introduction to Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body.

**Video link:**

- https://www.youtube.com/watch?v=GpuZo495F24
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

| Module-4 | L1,L2 | 3 Hrs |
|---|---|---|

**Introduction to Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society.

**Video link:**

- https://www.youtube.com/watch?v=F2KVW4WNnS8
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

| Module-5 | L1,L2 | 3 Hrs |
|---|---|---|

**Introduction to Implications of the Holistic Understanding:** Natural Acceptance of Human Values,Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies.

**Video link:**

- https://www.youtube.com/watch?v=BikdYub6RY0
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

**Course Outcomes:** On completion of the course, students would be able to

| | |
|---|---|
| CO1 | Develop a holistic perspective about life |

| | |
|---|---|
| CO2 | Explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society as an unit in nature |
| CO3 | Become more responsible in life, and in handling problems with sustainable solutions |
| CO4 | Have better critical ability |
| CO5 | Become sensitive to their commitment |

| Text Books: | |
|---|---|
| 1. | AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php |
| 2. | A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 |
| 3. | Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 |
| Reference Books: | |
| 1. | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 |
| 2. | Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. |
| 3. | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 4. | The Story of Stuff (Book). |
| 5. | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi |

Scheme of Evaluation:

| Details | | Marks |
|---|---|---|
| Assessment by Faculty mentor (Class Room Evaluation) | CIE(50) | 10 |
| Self-Assessment + Assessment by peers | | 20 |
| Activities / Experimentations related to courses/Assignment | | 10 |

| | | |
|---|---|---|
| Mini Projects / Case Studies | | 10 |
| Semester End Examination | SEE (50) | 50 |
| | Total | 100 |

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | - | 1 | - | - | - | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | - |
| CO2 | - | 1 | - | - | - | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | - |
| CO3 | - | 1 | - | - | - | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 2 |
| CO4 | - | 1 | - | - | - | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 3 | 2 |
| CO5 | - | 1 | - | - | - | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 3 | 3 |

High-3, Medium-2, Low-1

B.E, IV SEMESTER, ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| Course Title | OPERATIONS RESEARCH, NUMERICAL AND STATISTICAL METHODS | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20MCS41/MIS41 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 HOURS |

**Course objective is to:**

The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory Operational research emerging in science and engineering.

| Module-1 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

**Numerical Methods-1** : Numerical solution of Ordinary Differential Equations of first order and first degree: Modified Euler's method, Taylor's series method, Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams-Bash forth Method.

**Application:** Solving Ordinary Differential Equations.

**Video Links:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

| Module-2 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

**Numerical Methods-2**: Numerical solution of Ordinary Differential Equations of second order:Runge-Kutta method of fourth order, Predictor and Corrector method: Milne's Method and Adams Bash forth Method.

**Calculus of Variations:** Variation of function and Functional, variational problems. Euler's equation, Geodesics.

**Application:** Hanging chain problem.

**Video Links:**

1. http://nptel.ac.in/courses.php?disciplineID=111

2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

| Module-3 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

Operations Research-1: Introduction to Linear Programming Problem (LPP): Assumptions of LPP, Formulation of LPP and Graphical method various examples. The simplex method, Big M method and dual simplex method.

**Application:** Graphical solution procedure.

**Video Links:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

| Module-4 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

Operations Research-2

**The transportation problem:** Initial Basic Feasible Solution(IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method.

**Game Theory:** The formulation of two persons, zero sum games; saddle point, maxmin and minmax principle, Solving simple games-a prototype example, Games with mixed strategies.

**Application:** Transportation problem.

**Video Links:**

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/

| Module-5 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

Statistical Methods

**Correlation and Regression:** Correlation, Regression coefficients, line of regression problems.

**Curve fitting:** Fitting of the curves of the form $y=ax+b, y=ax^2+bx+c, y=ae^{bx}$ by the method of least squares.

**Application:** Finding the best fit between two variables.

**Video Links:**

1. http://nptel.ac.in/courses.php?disciplineID=111

| | |
|---|---|
| 2. http://www.class-central.com/subject/math(MOOCs)<br>3. http://academicearth.org/ | |
| Course outcomes: | |
| CO1 | Solve first and second order ordinary differential equation arising in flow problems using single step and multistep numerical methods. |
| CO2 | Determine the extremals of functionals and solve the simple problems of the calculus of variations. |
| CO3 | Solve the mathematical formulation of linear programming problem. |
| CO4 | Solve the applications of transport problems and theory of games. |
| CO5 | Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data. |
| Text Books: | |
| 1. | B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Editior 2013. |
| 2. | Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014. |

| Reference Books: | |
|---|---|
| 1. | Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006. |
| 2. | Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition |
| 3 | Jain R. K. & Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publishing House, 2002. |
| 4 | S. D. Sharma, "Operations Research", Kedar Nath and Ram NathPublishers, Seventh Revised Edition 2014. |

| CIE Assessment: |
|---|
| CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests<br>- Quizzes/mini tests (4 marks) |

- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO/PSO Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 1 | 1 | - |
| CO2 | 3 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| CO5 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 1 | 2 | - |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | ANALYSIS AND DESIGN OF ALGORITHMS | Semester | 04 |
| Course Code | MVJ20AM42/MVJ20CS42 | CIE | 50 |
| Total No. of Contact Hours | 50 | SEE | 50 |
| No. of Contact Hours/week | 4 (L : T : P :: 3 : 2 : 0) | Total | 100 |
| Credits | 4 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Identify the importance of different asymptotic notation.
- Determine the complexity of recursive and non-recursive algorithms.
- Compare the efficiency of various design techniques like greedy method, backtracking etc.
- Apply appropriate method to solve a given problem.

| Module-1 | L1,L2 , L3 | Hours 10 |
|---|---|---|

**Basic Concept of Algorithms:** Introduction-What is an Algorithm, Algorithm Specification, Analysis Framework, Performance Analysis: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples . Important Problem Types. Fundamental Data Structures.

**Applications:** developing computational tools and bioinformatics software, Mathematics.

**Video link / Additional online information (related to module if any):**

- http://www.nptelvideos.com/video.php?id=1442
- https://nptel.ac.in/courses/106105085/

| Module-2 | L2 , L3 | Hours 10 |
|---|---|---|

**Simple Design Techniques – Brute force** : Selection sort, Bubble sort, Sequential Search and Brute-Force String Matching , Exhaustive search –Traveling Salesman problem, Knapsack problem , Assignment Problem.

**Divide and Conquer:** General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum , Merge sort, Quick sort , Strassen's

matrix multiplication , Advantages and Disadvantages of divide and conquer.

**Applications:** power distribution (electrical field), Online shopping and delivery (real time)

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106102064/
- https://www.youtube.com/watch?v=MFfD57DTDQY

| Module-3 | L2,L3 , L4 | Hours 10 |
|---|---|---|

**Decrease and Conquer approach:** Topological Sort, Decrease-by-a-Constant-Factor Algorithms: Josephus Problem.

**Greedy Method**: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Huffman Trees and Codes.

**Laboratory Sessions/ Experimental learning:** Solving real time problems using Greedy Technique.

**Applications:** Optimization Problems.

**Video link :**https://nptel.ac.in/courses/106/106/106106131/

| Module-4 | L3,L4 , L6 | Hours 10 |
|---|---|---|

Dynamic Programming: General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm , Travelling Sales Person problem , Reliability design.

**Laboratory Sessions/ Experimental learning:** Solving real time problems using Dynamic Programming.

**Applications:** Computer Networks.

**Video link:**https://nptel.ac.in/courses/106/106/106106131/

| Module-5 | L4,L5 ,L6 | Hours 10 |
|---|---|---|

**Backtracking:** General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem.

**LC Programme and Bound solution** : FIFO Programme and Bound solution. NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.

**Laboratory Sessions/ Experimental learning:** Solving real time problems using

| | |
|---|---|
| Backtracking Technique.<br>**Applications:** To solve puzzles such as crosswords, Sudoku etc.<br>**Video link:** https://nptel.ac.in/courses/106/106/106106131/ | |
| **Course Outcomes:** | |
| CO1 | Describe the need of algorithm and the notations used in design analysis. |
| CO2 | Compare the efficiency of brute force, divide and conquer techniques for problem solving. |
| CO3 | Ability to apply greedy algorithms, hashing and string matching algorithms. |
| CO4 | Ability to design efficient algorithms using various design techniques. |
| CO5 | Ability to apply the knowledge of complexity classes P, NP, and NP Complete and prove certain problems are NP-Complete. |
| **Text Books:** | |
| 1 | Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. |
| 2 | Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI. |
| **Reference Books:** | |
| 1 | Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education). |
| 2 | http://jeffe.cs.illinois.edu/teaching/algorithms/ |
| 3 | Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | -- | -- | -- | 1 | -- | -- | -- | -- | -- | -- | 2 | 2 | - |
| CO2 | 2 | 3 | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | 2 | - |
| CO3 | 3 | 3 | 2 | 2 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | -- | -- | -- | -- | -- | 1 | -- | -- | 2 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 1 | 3 | -- | -- | -- | -- | -- | -- | 3 | 3 | 3 |

High-3, Medium-2, Low-1

| Course Title | DATABASE MANAGEMENT SYSTEM | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20AM43 | CIE | 50 |
| Total No. of Contact Hours | 40 L : T : P :: 40 : 0 : 0 | SEE | 50 |
| No. of Contact Hours/week | 3 | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Teach the basic database concepts, applications, data models, schemas and instances.
- Familiarize Entity Relationship model for a database.
- Demonstrate the use of constraints and relational algebra operations.
- Describe the basics of SQL and construct queries using SQL.
- Emphasize the importance of normalization in databases.
- Demonstrate the basic concepts of transaction processing and concurrency control.

| Module-1 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

**INTRODUCTION**: Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- Levels, Mappings, Database, users and **DBA DATABASE DESIGN**: Database Design Process, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, extended ER features, Generalization, Specialization, Aggregation, Conceptual design with the E-Rmodel.

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106093/
- https://nptel.ac.in/courses/106105175/
- https://www.youtube.com/watch?v=WSNqcYqByFk

| Module-2 | L2, L3 | Hours 8 |
|---|---|---|

**THE RELATIONAL MODEL**: Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views. **RELATIONAL ALGEBRA AND CALCULUS**: Preliminaries, relational algebra operators,

relational calculus - Tuple and domain relational calculus, expressive power of algebra and calculus.

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106093/
- https://nptel.ac.in/courses/106105175/
- https://www.youtube.com/watch?v=gGGHjYbQMvw
- https://www.youtube.com/watch?v=nc1yivH1Yac
- https://www.youtube.com/watch?v=64szTfLNu3o

| Module-3 | L2,L3, L4 | Hours 8 |
|---|---|---|

**SQL:** Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Save point, cursors, stored procedures,Triggers

**Video link / Additional online information (related to module if any):**

- https://www.youtube.com/watch?v=64szTfLNu3o
- https://www.digimat.in/nptel/courses/video/106105175/L11.html
- https://www.youtube.com/watch?v=sjzlr0EsZL4
- https://nptel.ac.in/courses/106106093/
- https://nptel.ac.in/courses/106105175/

| Module-4 | L3,L4 , L6 | Hours 8 |
|---|---|---|

**SCHEMA REFINEMENT AND NORMAL FORMS:** Introduction to schema refinement, functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization, schema refinement in database design, case studies.

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106093/
- https://nptel.ac.in/courses/106105175/
- https://www.youtube.com/watch?v=YD8dhOmuVnY

| Module-5 | L4,L5, L6 | Hours 8 |
|---|---|---|

**TRANSACTIONS MANAGEMENT:** Transaction concept, transaction state,

implementation of atomicity and durability, concurrent executions, Serializability, recoverability, implementation of isolation, transaction definition in SQL, testing for Serializability.

**CONCURRENCY CONTROL AND RECOVERY SYSTEM:** Concurrency control, lock based protocols, time-stamp based protocols, validation based protocols, multiple granularity. Recovery system - failure classification, storage structure, recovery and atomicity, log- based recovery, shadow paging, buffer management, failure with loss of non-volatile storage, advanced recovery techniques, remote backup systems.

**Video link / Additional online information (related to module if any):**

- https://nptel.ac.in/courses/106106093/
- https://nptel.ac.in/courses/106105175/
- https://www.youtube.com/watch?v=5ammL5KU4mo

**Course Outcomes:**

| | |
|---|---|
| CO1 | Use the basic concepts of Database Systems in Database design |
| CO2 | Apply SQL queries to interact with Database |
| CO3 | Design a Database using ER Modelling |
| CO4 | Apply normalization on database design to eliminate anomalies |
| CO5 | Analyze database transactions and can control them by applying ACID properties. |

**Text Books:**

| | |
|---|---|
| 1 | Raghu Rama Kirshna, Johannes Gehrk, –Database Management Systemll Tata McGraw Hill 3rd Edition. |
| 2 | Elmasri Navate, Fundamentals of Database Systems, Pearson Education,India |

**Reference Books:**

| | |
|---|---|
| 1 | Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5th edition, McGraw-Hill, New Delhi,India. |
| 2 | Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7thedition. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1 | 3 | 3 | 2 | 3 | - | - | - | 1 | - | - | 2 | 2 | - |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | 2 | 1 | - |
| CO3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | 2 | 2 | 2 |
| CO4 | 2 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | 2 | 2 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 3 | - | - | - | 2 | - | - | 2 | - | 1 |

High-3, Medium-2, Low-1

| Course Title | ARTIFICIAL INTELLIGENCE | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20AM44 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Understand fundamental concepts in Artificial Intelligence.
- Understand the problem solving techniques and knowledge representation.
- Design intelligent components or programs to meet desired needs.
- Implement, and evaluate a computer-based intelligent systems.

| Module-1 | L1,L2 , L3 | Hours 8 |
|---|---|---|

**Introduction:** AI problems, foundation of AI and history of AI, Intelligent agents: Agents and Environments, The concept of rationality, The nature of environments, Structure of agents, Problem solving agents, Problem formulation.

**Video link / Additional online information (related to module if any):** http://nptel.ac.in/courses/106106126/

| Module-2 | L2 , L3 | Hours 8 |
|---|---|---|

**Knowledge Representation & Reasons:** Knowledge – Based Agents, The Wumpus world. **Propositional Logic:** Reasoning patterns in propositional logic - Resolution, Forward & Backward Chaining.

**Inference in First order logic:** Propositional vs. first order inference, Unification & lifting, Forward chaining, Backward chaining, Resolution.

**Video link / Additional online information (related to module if any):**http://nptel.ac.in/video.php?subjectId=106105079

| Module-3 | L2,L3, L4 | Hours 8 |
|---|---|---|

**Searching:** Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search, Comparing uninformed search strategies. Search with partial information (Heuristic search), Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.

| | | |
|---|---|---|
| **Local search Algorithms:** Hill climbing, Simulated annealing search, Local beam search, Genetic algorithms.<br>**Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=6hmIKIWBVSI | | |
| **Module-4** | L3,L4 , L6 | **Hours 8** |
| **Constrain satisfaction problems:** Backtracking search for CSPs local search for constraint satisfaction problems.<br>**Game Playing:** Games, Minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, Cutting of search.<br>**Video link / Additional online information (related to module if any):**https://nptel.ac.in/courses/106/106/106106158/ | | |
| **Module-5** | L4,L5 , L6 | **Hours 8** |
| **Planning:** Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward state spare search, Backward state space search, Heuristics for state space search, Partial order planning Graphs, Planning graphs<br>**Learning:** what is learning, Forms of learning, Inductive learning, Learning Decision Trees.<br>**Video link / Additional online information (related to module if any):**https://www.youtube.com/watch?v=3C6ZLS-gfXU | | |

| Course Outcomes: | |
|---|---|
| CO1 | Recognize the various types and working units of an expert systems. |
| CO2 | Interpret the logic behind the building of knowledge base and knowledge representation. |
| CO3 | Deploy Searching Techniques to design intelligent agents |
| CO4 | Choose various Constraint Satisfaction Problem, Game Playing techniques to use in various intelligent system designs. |
| CO5 | Apply suitable learning methodology while designing systems based on their applications. |

| Text Books: | |
|---|---|
| 1 | Stuart Russel, Peter Norvig, (2009), Artificial Intelligence – A Modern Approach,3rd Edition, Pearson Education. |
| 2 | E.Rich and K.Knight, (2008), Artificial Intelligence , 3rd Edition, Tata McGraw Hill. |

| Reference Books: | |
|---|---|
| 1 | Patterson, (2009), Artificial Intelligence and Expert Systems, 2nd Edition, PHI. |
| 2 | Giarrantana/ Riley, (2004), Expert Systems: Principles and Programming,4th Edition, Thomson. |
| 3 | Ivan Bratka, (2000), PROLOG Programming for Artificial Intelligence. 3rdEdition – Pearson Education. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

**CO-PO/PSO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | - | 1 | 1 | 2 | - | - | - | - | - | 1 | - |
| CO2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| CO3 | 1 | - | - | 1 | 1 | - | 2 | 3 | 3 | 3 | 3 | - | 2 | - |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | 3 | 3 | 3 | 3 | 2 | 1 |

High-3, Medium-2, Low-1

| Course Title | EMBEDDED SYSTEMS | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20AM45 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Learn the architecture and programming of ARM processor.
- Become familiar with the embedded computing platform design and analysis.
- Get thorough knowledge in interfacing concepts.
- Design an embedded system and to develop programs.

| Module-1 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

**INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS** : Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

**Activity**:

- Comparison of Microprocessor and Microcontroller hardware Model
- Comparing the Microprocessor and Microcontroller Software Model

| Module-2 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

**EMBEDDED COMPUTING PLATFORM DESIGN** : The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis – Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**Activity**: Writing ARM Assembly program for Embedded System Applications

| Module-3 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

**SENSOR INTERFACING WITH ARDUINO**: Basics of hardware design and functions of basic passive components-sensors and actuators-Arduino code – library file for sensor

interfacing-construction of basic applications.

Activity:

- Use of External interrupt0 to turn ON/OFF led connected to Pin P1.25 of ARM Processor.
- Use of Software Interrupt SWI instruction in programming.
- Calculating physical memory address from logical address.

| Module-4 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

EMBEDDED FIRMWARE : Reset Circuit, Brown-out Protection Circuit-Oscillator Unit – Real Time Clock-Watchdog Timer – Embedded Firmware Design Approaches and Development Languages.

Case Study:Digital Clock, Battery operated Smartcard Reader

| Module-5 | L1,L2 ,L3 | Hours 8 |
|---|---|---|

EMBEDDED C PROGRAMMING

Introduction-Creating _hardware delays'using Timer 0 and Timer 1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout.

Case Study: Automated Meter Reading System (AMR) and Digital Camera, Real time concepts

Course Outcomes:

| | |
|---|---|
| CO1 | Describe the architecture and programming of ARM processor. |
| CO2 | Explain the concepts of embedded systems. |
| CO3 | Understand the Concepts of peripherals and interfacing of sensors. |
| CO4 | Capable of using the system design techniques to develop firmware. |
| CO5 | Illustrate the code for constructing a system. |

Text Books:

| | |
|---|---|
| 1 | Marilyn Wolf, —Computers as Components – Principles of Embedded Computing System Design, Third Edition —Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (unit I & II). |
| 2 | https://www.coursera.org/learn/interface-with-arduino#syllabus (Unit III) 3 .Michael J. Pont, —Embedded C, 2 nd Edition, Pearson Education, 2008.(Unit IV & V). |

| Reference Books: | |
|---|---|
| 1 | Shibu K.V, —Introduction to Embedded Systems, McGraw Hill.2014. |
| 2 | Jonathan W.Valvano, —Embedded Microcomputer Systems Real Time Interfacing, Third Edition Cengage Learning, 2012. |
| 3 | Raj Kamal, —Embedded Systems-Architecture,programming and design, 3 edition,TMH.2015. |
| 4 | Lyla, —Embedded Systems, Pearson , 2013 6. David E. Simon, —An Embedded Software Primer‖, Pearson Education,2000. |

**CIE Assessment:**

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

**SEE Assessment:**

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

**CO-PO/PSO Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 3 | 2 | 1 | 3 | 3 | 2 | - | - | 2 | - | 1 | - | 1 | 1 |
| CO3 | 3 | 2 | 1 | 3 | - | 2 | - | - | 2 | - | - | - | 2 | - |
| CO4 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | 2 | 2 | 2 | - | 1 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 2 | 2 | 2 | 2 | 1 | 1 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | OBJECT ORIENTED CONCEPTS | Semester | 04 |
| Course Code | MVJ20AM46 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 3 : 0 : 0) | Total | 100 |
| Credits | 3 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Learn fundamental features of object oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Create multi-threaded programs and event handling mechanisms.
- Introduce event driven Graphical User Interface (GUI) programming using applets and swings.

| Module-1 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Introduction to Object Oriented Concepts:** A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading.

**Class and Objects:** Introduction, member functions and data, objects and functions.

**Applications:** Develop a good program and connecting it with the real world

**Video Link:**https://nptel.ac.in/courses/106/105/106105191/

| Module-2 | L1,L2, L3 | Hours 8 |
|---|---|---|

**Class and Objects (contd):** Objects and arrays, Namespaces, Nested classes, Constructors, Destructors.

**Introduction to Java**: Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

**Applications:** Arrays in mathematical vectors, matrices.

**Video Link:** https://nptel.ac.in/courses/106/105/106105191/

| Module-3 | L1,L2 ,L3 | Hours 8 |
|---|---|---|
| **Classes, Inheritance, Exception Handling**<br>**Classes:** Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection.<br>**Inheritance:** inheritance basics, using super, creating multi level hierarchy, method overriding. **Exception handling:** Exception handling in Java.<br>**Applications:** Inheritance in Banking Sectors<br>**Video Link:** https://nptel.ac.in/courses/106/105/106105191/ | | |
| **Module-4** | **L1,L2 ,L3** | **Hours 8** |
| **Packages and Interfaces:** Packages, Access Protection, Importing Packages. Interfaces.<br>**Multi Threaded Programming:** Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing<br>**Applications:** Multithreads in Browsers, Servers<br>**Video Link:** https://nptel.ac.in/courses/106/105/106105191/ | | |
| **Module-5** | **L1,L2 ,L3** | **Hours 8** |
| **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.<br>**Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.<br>**Applications:** AWT , GUI Applications<br>**Video Link:**https://freevideolectures.com/course/4227/nptel-programming-in-java/43 | | |

| Course Outcomes: | |
|---|---|
| CO1 | Explain the object-oriented concepts and JAVA. |
| CO2 | Develop computer programs to solve real world problems in Java. |
| CO3 | Illustrate the use of classes, Exceptions and distinguish the usage of different types of Inheritance and constructors in real world. |
| CO4 | Demonstrate the use of packages and to create multi-threaded programs. |
| CO5 | Develop simple GUI interfaces for a computer program to interact with users, |

| | |
|---|---|
| | and to understand the event-based GUI handling principles using swings. |

| Text Books: | |
|---|---|
| 1 | Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006. |
| 2 | Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. |
| Reference Books: | |
| 1 | Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806. |
| 2 | Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. |
| 3 | Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. |
| 4 | Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. |
| 5 | Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. |
| 6 | E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. |

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer

five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO3 | 3 | 3 | 1 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | 2 | 2 | 2 | - | 3 | 2 | - |
| CO5 | 3 | 3 | 3 | 3 | - | - | 2 | 2 | 3 | 2 | - | 3 | 2 | 3 |

High-3, Medium-2, Low-1

| Course Title | ANALYSIS AND DESIGN OF ALGORITHMS LAB | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20AML47 | CIE | 50 |
| Total No. of Contact Hours | 30 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 0 : 2 : 2) | Total | 100 |
| Credits | 2 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Employ various design strategies for problem solving.
- Provide exposure to measure and compare the performance of different algorithms.
- Provide design and implement various Concepts in JAVA.

| S No | Experiment Name | RBT Level | Hours |
|---|---|---|---|
| 1 | Write a recursive program to<br>a. Solve Towers-of-Hanoi problem b.GCD | L3 | 3 |
| 2 | Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working. | L3 | 3 |
| 3 | Implement Recursive Binary search and Linear search and determine the time required to search an element. Repeat the experiment for different values of N and plot a graph of the time taken versus N. | L3 | 3 |
| 4 | Given a set of N integer elements which is to be sorted using Selection Sort technique. Write the program using C language as well as in Java for different values of N and observe the total time taken to sort the elements in both the languages. | L3 | 3 |
| 5 | Write program to do the following:<br>a. Print all the nodes reachable from a given starting node in a digraph using BFS method.<br>b. Check whether a given graph is connected or not using DFS method. | L3 | 3 |
| 6 | The Merge sort is one of the most common algorithms used to sort arrays. The class Merge sort implements this algorithm. However, there is a bug in the implementation of the method sort. Debug the | L3 | 3 |

| | | | |
|---|---|---|---|
| | previous implementation using the debugging options of your favourite IDE (e.g. eclipse), in order to find the error. | | |
| 7 | Sort a given set of N integer elements using Quick Sort technique and Run the program for different values of N and record the time taken to sort. | L3 | 3 |
| 8 | We are given a set of items, each with a weight and a value and we need to determine the number of each items to include in a collection so that the total weight is less than or equal to the given limit and the total value is as large as possible. Write a Java program by applying any reuse sub problem technique to find the solution. | L3 | 3 |
| 9 | Suppose you're trying to find the shortest path from your house to various locations like Movie theatre, Gas Station,Grocery Store and Petrol pump. If we let various locations be vertices and the routes between them are edges, we can create a weighted graph representing the situation. Write a Java program to find the shortest path from your house (source) to the remaining locations. | L3 | 3 |
| 10 | Write a Java program for the following Scenario,<br>You have a business with several offices and you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost and it should be a spanning tree. | L3 | 3 |
| 11 | Develop a program in Java with a given set of vertices V in a weighted graph where each edge w (u,v) can be negative, find the shortest path weights d(s,v) from every source s to all vertices in the graph. If the graph contains negative cycle, report it. | L3 | 3 |
| 12 | Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. Write a program to find the solution using dynamic programming method. | L3 | 3 |
| 13 | Given a set of positive integers and an integer ‘s' write a program in Java to determine whether there is any non-empty subset whose sum is ‘s'. | L3 | 3 |

| | | | |
|---|---|---|---|
| 14 | Write a Java program to find a path that traverses all the vertices of the given graph G exactly once and then ends at the starting vertex in a connected undirected Graph G of *n* vertices using backtracking principle. | L3 | 3 |

| Course Outcomes: | |
|---|---|
| CO1 | Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.) |
| CO2 | Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language. |
| CO3 | Analyze and compare the performance of algorithms using language features. |
| CO4 | Apply and implement learned algorithm design techniques and data structures to solve real-world problems. |
| CO5 | Employ various design strategies for problem solving and implement various algorithms in JAVA . |

| Reference Books: | |
|---|---|
| 1 | Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education). |
| 2 | http://jeffe.cs.illinois.edu/teaching/algorithms/ |

| CIE Assessment: |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| **SEE Assessment:** |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,<br>i. Writeup : 20 marks<br>ii. Conduction : 40 marks<br>iii. Analysis of results : 20 marks |

iv. Viva : 20

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 3 | - |
| CO4 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 2 | 3 |

High-3, Medium-2, Low-1

| | | | |
|---|---|---|---|
| Course Title | DATABASE MANAGEMENT SYSTEM LAB | Semester | 04 |
| Course Code | MVJ20AML48/MVJ20CSL48 | CIE | 50 |
| Total No. of Contact Hours | 30 | SEE | 50 |
| No. of Contact Hours/week | 3 (L : T : P :: 0 : 2 : 2) | Total | 100 |
| Credits | 2 | Exam. Duration | 3 Hours |

Course objective is to: *This course will enable students to*

- Learn to create and use a database.
- Be familiarized with a query language
- Have hands on experience on DDL Commands
- Have a good understanding of DML Commands and DCL commands
- Familiarize advanced SQL queries.
- Be Exposed to different applications

| S No | Experiment Name | RBT Level | Hours |
|---|---|---|---|
| 1 | Creation of a database and writing SQL queries to retrieve information from the database. | L3 | 3 |
| 2 | Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions. | L3 | 3 |
| 3 | Creation of Views, Synonyms, Sequence, Indexes, Save point. | L3 | 3 |
| 4 | Creating an Employee database to set various constraints. | L3 | 3 |
| 5 | Creating relationship between the databases. | L3 | 3 |
| 6 | Study of PL/SQL block. | L3 | 3 |
| 7 | Write a PL/SQL block to satisfy some conditions by accepting input from the user. | L3 | 3 |
| 8 | Write a PL/SQL block that handles all types of exceptions. | L3 | 3 |
| 9 | Creation of Procedures. | L3 | 3 |
| 10 | Creation of database triggers and functions | L3 | 3 |
| 11 | Mini project (Application Development using Oracle/ Mysql )<br>a) Inventory Control System. | L3 | 3 |

| | | | |
|---|---|---|---|
| | b) Material Requirement Processing.<br>c) Hospital Management System.<br>d) Railway Reservation System.<br>e) Personal Information System.<br>f) Web Based User Identification System.<br>g) Timetable Management System.<br>h) Hotel Management System | | |

| Course outcomes: | |
|---|---|
| CO1 | Design and implement a database schema for a given problem-domain |
| CO2 | Populate and query a database |
| CO3 | Create and maintain tables using PL/SQL. |
| CO4 | Prepare reports. |

| Reference Books: | |
|---|---|
| 1 | Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McG Hill,<br>2013. |
| 2 | Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012. |

| CIE Assessment: |
|---|
| Regular Lab work :20<br>Record writing :5<br>Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)<br>Viva 10 marks |
| **SEE Assessment:** |
| Examinations will be conducted for 100 marks and scaled-down to 50. The weightage shall be,<br>i. Writeup : 20 marks |

ii. Conduction : 40 marks

iii. Analysis of results : 20 marks

iv. Viva : 20

| CO-PO/PSO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 3 | - |
| CO4 | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 2 | 2 | 2 | 3 |

High-3, Medium-2, Low-1

| Course Title | BALIKE KANNADA | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20BK39 | CIE | 50 |
| Total No. of Contact Hours | 20 | SEE | 50 |
| No. of Contact Hours/week | 1 ( L: T: P 1:0:0) | Total | 100 |
| Credits | 1 | Exam. Duration | 2 Hrs |

**Course objective** :This course will enable students to understand Kannada and communicate in Kannada language

- Vyavharika Kannada –Parichaya (Introduction to Vyavharika kannada )
- Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronounciation.
- Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).
- Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)
- Activities in Kannada

| Module-1 | L1 & L2 | 1 Hour |
|---|---|---|

Vyavharika Kannada: Necessity of learning a local language, Tips to learn the language with easy methods, Hints for correct and polite conversation, About Kannada language (Kannada Bhase)

Experiential Learning:

1. Listen to Kannada news and watch Kannada movies

2. Use online applications (apps) for faster learning.

Video Links: https://youtu.be/fd966GC8Yko

| Module-2 | L1 & L2 | 5 Hours |
|---|---|---|

Kannada Alphabets And Pronounciation:Kannada Aksharamaale(Vowels, consonants & Unstructured consonants),Kannada stress letters, Kannada Khagunitha,Pronounciation (Swaragala Uchcharane,Vyanjangala Ucharane),Exercises

Experiential Learning: 1.Based on the above topics Exercises

Video Links: https://youtu.be/RuRmq7VyCaQ

| Module-3 | L1 & L2 | 5 Hours |
|---|---|---|

Sambhasanegaagi Kannada Padagalu:Introduction,Ekaavachana Mattu Bhavuvachana,Linga (Gender),Prashnarthaka padagalu(Interrogative words),Viruddha Padagalu (Antonyms),Asamanjasa Ucharane (Inappropriate Pronunciations),Sankya vyavasthe (Numbers System) , List of Vegetables,Bhinnamshagalu (Fractions) ,Menu of famous food items in Karnataka , aahara Padarthgala hesaragalu (Names of the Food Items),Samay /Kalakke Sambhandhisida padagalu (Words Relating to Time),Dikkugalige sambhasidhisida

padagalu(words Related to Directions),Manushyana Bhavanegalige sambhadhisida Padagalu (Words Related to Humen's Feelings and Emotions),Manushyana shareerada bhagagalu (Parts of the Human Body),Sambhandhisida sambhandhakke padagalu (Words Related to Relationship), Vasad stalakke sambhandhisida padagalu ( Words Related to Place of Living), Saamanya Sambhasaneyalli bhalasuvantha Padagala Patti (List of Words used in the general communication) & Colors in Kannada

Experiential Learning:1.Based on the above topics Exercises

Video Links: https://youtu.be/PoQ9m16d7QA

| Module-4 | L1 & L2 | 8 Hours |
|---|---|---|

Kannada Grammer in Conversations (Sambhasaneyalli Kannada Vyakarna):Introduction , Nouns (Naampadagalu), Pronoun (Sarvanaampadagalu) , Use of Pronouns in Kannada Sentences , Adjectives(Kannada nama Vishenegalu) , Kannada Verbs (Kriya Padagalu) , Adverbs in Kannada ( Kriya Vishenegalu), Conjuctions in Kannada (Sanyaga) , Preposition in Kannada (Poorvabhavi).

Experiential Learning: Questions constructing words in Kannada (Prashnarthaka Padagalu)
Simple Communicative Sentences in Kannada
Exercise for Practice
Enquiry Questions

Video Links: https://youtu.be/fd966GC8Yko

| Module-5 | L1 & L2 | 1 Hour |
|---|---|---|

Activies in Kannada (Kannadadalli Chatuvatikegalu): Activites –Vocubulry (Shabdakosh),Conversation (Shambhasane)

Experiential Learning: Try to communicate with each other in Kannada

Video Links: https://youtu.be/fd966GC8Yko

Course outcomes:

| | |
|---|---|
| CO1 | Understanding the advantage of learning a local language |
| CO2 | Understanding the difference between pronunciation of English and Kannada |
| CO3 | Understanding the word meaning in Kannada and frame the simple sentences if any difficulty can use any other language words to complete the conversation |
| CO4 | Understanding the word meaning and frame the sentences and try to translate Kannada to English vise versa |
| CO5 | Understanding the Kannada grammar and how to implement in Kannada sentences |

| | |
|---|---|
| | for communication |

| Text Books: | |
|---|---|
| 1 | Sankispta Kannada Nighantu (Parishkratha), Kannada sahitya Parishatha,Bangalore |
| 2 | Mysore vishwavidyalayada English –Kannada Nighantu (Parishkratha) samputa –(A inda Z varage) |
| 3 | Kacheri Kaipidi –Dr .Ha .Ma. Nayak, Kannada Adhyana samsthe . Mysorevishwavidyalayada ,1974 |
| Reference Books: | |
| 1 | Vyavharika Kannada Patya Pusthaka by L.Thimmesha |

| CIE Assessment: |
|---|
| CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests<br>- Quizzes/mini tests (4 marks)<br>- Mini Project / Case Studies (8 Marks)<br>- Activities/Experimentations related to courses (8 Marks) |
| SEE Assessment: |
| i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit. The duration of examination is 2 hours. |

| Course Title | SAMSKRUTHIKA KANNADA | Semester | 04 |
|---|---|---|---|
| Course Code | MVJ20SK39 | CIE | 50 |
| Total No. of Contact Hours | 20 | SEE | 50 |
| No. of Contact Hours/week | 1 (L: T: P 1:0:0) | Total | 100 |
| Credits | 1 | Exam. Duration | 2 Hrs |

**Course Objective** :This course will enable students to understand Kannada and communicate in Kannada language

- Samskruthika Kannada –Parichaya (Introduction to Adalitha kannada )
- Kannada Kavyagala parichaya (Kannada D Ra Bendre, Siddalingaiha)
- Adalithdalli Kannada Padagalu (Kannada Kagunitha Balake, Patra Lekhana, Prabhandha)
- Kannada Computer Gnyana (Kannada Shabdha Sangraha, Computer Paribashika padagalu)
- Activities in Kannada.

| Module 1 | L1 | 4 Hours |
|---|---|---|

ಕನ್ನಡ ಭಾಷೆ-ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಶ್ರಾವಣ ಮತ್ತು ಬೆಳ್ಚಿಯ ಹಾಡು (ಕವನಗಳು), ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡ, ಆಡಳಿತ ಭಾಷೆಯ ಲಕ್ಷಣಗಳು, ಆಡಳಿತ ಭಾಷೆಯ ಪ್ರಯೋಜನಗಳು.

ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ

ಕಾಗುಣಿತದ ತಪ್ಪು ಬಳಕೆ ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ, ಅಲ್ಪಪ್ರಾಣ ಮತ್ತು ಮಹಾಪ್ರಾಣ, ವಿಶೇಷಣ ಹಾಗೂ ವಿಶೇಷ್ಯ, ನಾಮಪದಗಳು, ಗೌರವ ಸೂಚಕಗಳ ಬಳಕೆ, ಅನಾವಶ್ಯಕ ಲಿಂಗ ಸೂಚಕ.

| Module 2 | L1 | 4 Hours |
|---|---|---|

ೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ

ಪೂರ್ಣ ವಿರಾಮ, ಅಲ್ಪವಿರಾಮ, ವಿವರಣ, ಅರ್ಧವಿರಾಮ, ಪ್ರಶ್ನಾರ್ಥಕ, ಭಾವಸೂಚಕ, ಉದ್ಧರಣ, ಅವಾರಣ ಚಿಹ್ನೆಗಳು

ಪತ್ರ ವ್ಯವಹಾರ.

ಅರ್ಜಿ, ಖಾಸಗಿ ಪತ್ರ, ವ್ಯವಹಾರಿಕ ಪತ್ರದ ಉದಾಹರಣೆಗಳು.

| Module 3 | L1 | 4 Hours |
|---|---|---|

ಆಡಳಿತ ಪತ್ರಗಳು.

ಸಾಮನ್ಯ ಪತ್ರಗಳು, ಸರ್ಕಾರಿ ಪತ್ರಗಳು, ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರಗಳು.

ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು

ಸರ್ಕಾರಿ ಆದೇಶದ ವಿವಧ ರೂಪಗಳು, ಸೂತ್ತೋಲೆ, ಕಛೇರಿ ಆದೇಶ ಪತ್ರ, ಅಧಿಸೂಚನೆ.

| Module 4 | L1 | 4 Hours |
|---|---|---|

ಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧರಚನೆ, ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ

ಪ್ರಬಂಧದ ವಿವಿಧ ಪ್ರಕಾರಗಳು, ಲಕ್ಷಣ ಮತ್ತು ಬರೆಯುವ ವಿಧಾನಗಳು, ಭಾಷಾಂತರದ ಪ್ರಯೋಜನಗಳು.

ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ

ಜೋಡುನುಡಿ, ಅನುಕರಣವಾಚಿಗಳು, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥಗಳು, ವಿರುದ್ಧ ಪದಗಳು, ತತ್ಸಮ-ತದ್ಭವಗಳು, ನುಡಿಗಟ್ಟು, ದ್ವಿರುಕ್ತಿ

| Module 5 | L1 | 4 Hours |
|---|---|---|

ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ

ಕನ್ನಡ ಕೀಲಿಮಣೆ, ಕನ್ನಡ ಟೈಪಿಂಗ್.

ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಪದಕೋಶ ಕೈಪಿಡಿ: ಕನ್ನಡದಿಂದ ಇಂಗ್ಲಿಷ್‌ಗೆ, ಇಂಗ್ಲಿಷ್‌ನಿಂದ ಕನ್ನಡಕ್ಕೆ.

ಆಕರ ಗ್ರಂಥ

| | |
|---|---|
| ೧. | ಆಡಳಿತ ಕನ್ನಡ (ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡದೊಂದಿಗೆ) —ಡಾ. ಎಂ ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ ಕೇಶವಮೂರ್ತಿ |

ಗ್ರಂಥ ಋಣ

| | |
|---|---|
| ೧. | ಕನ್ನಡ ನಿಘಂಟು (ಪರಿಷ್ಕೃತ), ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು. |
| ೨. | ಕಾನೂನು ಪದಕೋಶ (ಪರಿಷ್ಕೃತ) ಕನ್ನಡ-ಇಂಗ್ಲೀಷ್, ಕನ್ನಡ ಮತ್ತು ಸಂಸ್ಕೃತಿ ನಿರ್ದೇಶನಾಲಯ, ಬೆಂಗಳೂರು. |
| ೩. | ಸಂಕ್ಷಿಪ್ತ ಕನ್ನಡ ಭಾಷೆಯ ಚರಿತ್ರೆ, ಎಂ. ಎಚ್ ಕೃಷ್ಣಯ್ಯ -೧೯೯೩, ಸುವಿದ್ಯಾ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು. |
| ೪. | ಆಡಳಿತ ಕನ್ನಡ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು-೫೬೦೦೦೧, ಮತ್ತು ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ. |
| ೫. | ಕಂಪ್ಯೂಟರ್ —ತಂತ್ರಜ್ಞಾನ ಪದವಿವರಣ ಕೋಶ, ಟಿ.ಜಿ. ಶ್ರೀನಿಧಿ ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು-೫೬೦೦೦೧ |

ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು

| | |
|---|---|
| ೧. | ಕನ್ನಡ ಕವಿಗಳ ಪರಿಚಯ, ಕನ್ನಡ ಭಾಷಾ ಶ್ರೀಮಂತಿಕೆ ಹಾಗೂ ಸಾಹಿತ್ಯದ ಒಲವು, ಕನ್ನಡ ಬರವಣಿಗೆಯಲ್ಲಿನ ಶುದ್ಧತೆ. |
| ೨. | ಲೇಖನ ಚಿಹ್ನೆಗಳ ಪರಿಚಯ ಹಾಗೂ ಅವುಗಳ ಉಪಯೋಗ, ಪತ್ರ ವ್ಯವಹಾರದ ಅರಿವು. |
| ೩. | ಸರ್ಕಾರಿ ಪತ್ರಗಳು ಹಾಗೂ ಅವುಗಳ ಮಾಧರಿಗಳ ಪರಿಚಯ. |
| ೪. | ಶ್ರೇಷ್ಠ ವ್ಯಕ್ತಿಗಳ ಜೀವನ ಶೈಲಿಯ ಪರಿಚಯ ಹಾಗೂ ಸ್ಫೂರ್ತಿ, ಭಾಷಾಂತರದ ಮೌಲ್ಯದ ಅರಿವು. |
| ೫. | ತಂತ್ರಜ್ಞಾನದಲ್ಲಿ ಕನ್ನಡದ ಭಾಷ ಬಳಕೆ. |

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

| SEE Assessment: |
| --- |
| i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit. The duration of examination is 2 hours. |

| | | | |
|---|---|---|---|
| Course Title | ADDITIONAL MATHEMATICS-II | Semester | 04 |
| Course Code | MVJ20MATDIP41 | CIE | 50 |
| Total No. of Contact Hours | 40 | SEE | 50 |
| No. of Contact Hours/week | 4 | Total | 100 |
| Credits | - | Exam. Duration | 3 HOURS |

**Course objective is to:** This course viz., aims to prepare the students:

To familiarize the important tools Linear Algebra, differential Calculus, Beta and Gamma functions, 3-Dimentional Geometry and probability for analysing the engineering problems.

| Module-1 | L1,L2 | 8 Hrs. |
|---|---|---|

**Linear Algebra:**

Introduction, Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method and problems. Eigen values and Eigen vectors of square matrix of order two and Problems

**Video Link:**

- https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf
- https://nptel.ac.in/content/storage2/courses/122104018/node18.html

| Module-2 | L1,L2 | 8 Hrs. |
|---|---|---|

**Differential calculus:**

Tangent and normal, both Cartesian and polar forms. Increasing and decreasing functions, Maxima and Minima for a function of one variable. Point of inflections and Problems.

**Beta and Gamma functions:**

Beta and Gamma functions, Relation between Beta and Gamma function-simple problems.

**Video Link**

- https://www.youtube.com/watch?v=6RwOoPN2zqE
- https://www.youtube.com/watch?v=s6F5yjY6jWk&list=PLMLsjhQWWlUqBoTCQDtYlloI-o-9hxp11
- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx

| Module-3 | L1,L2 | 8 Hrs. |
|---|---|---|

**Analytical solid geometry :**

Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.

**Video Links:**

- https://www.toppr.com/guides/maths/three-dimensional-geometry/
- https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/

| Module-4 | L1,L2,L3 | 8 Hrs. |
|---|---|---|

**Probability:**

Random variable, Discrete probability distribution, Mean and variance of Random Variable, Theoretical distribution- Binomial distribution, Mean and variance Binomial distribution - Problems. Poisson distribution as a limiting case of Binomial distribution, Mean and variance of Poisson distribution.

Normal Distribution-Basic properties of Normal distribution –standard form of normal distribution and Problems

**Video Links:**

- https://nptel.ac.in/courses/111/105/111105041/
- https://www.mathsisfun.com/data/probability.html

| Module-5 | L1,L2 | 8 Hrs. |
|---|---|---|

**Partial Differential equation:**Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.

**Video Link:**

- http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx
- https://www.studyyaar.com/index.php/module-video/watch/233-cauchys-legendres-de-a-method- of- variation-of-parameters

**Course Outcomes:**

| | |
|---|---|
| CO1 | Apply the knowledge of Matrices to solve the system of linear equations and to understand the concepts of Eigen value and Eigen vectors for engineering problems. |

| | |
|---|---|
| CO2 | Demonstrate various physical models ,find Maxima and Minima for a function of one variable., Point of inflections and Problems .Understand Beta and Gamma function |
| CO3 | Understand the 3-Dimensional geometry basic, Equation of line in space- different forms,<br>Angle between two line and studying the shortest distance. |
| CO4 | Concepts of Probability related to engineering applications. |
| CO5 | Construct a variety of partial differential equations and solution by exact methods. |
| Reference Books: | |
| 1. | B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013. |
| 2. | Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014. |
| 3 | Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006. |
| 4 | G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19 |

| CIE Assessment: |
|---|
| CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests<br>- Quizzes/mini tests (10 marks)<br>- Assignment (10 marks) |
| SEE Assessment: |
| i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.<br>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.<br>iii. One question must be set from each unit. The duration of examination is 3 hours. |

| CO-PO Mapping | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | - | 2 | - | - | - | - | - | - | 1 | 1 |
| CO2 | 3 | 3 | - | 2 | - | - | - | - | - | - | 1 | 1 |
| CO3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 1 |
| CO4 | 2 | 2 | - | 3 | - | - | - | - | - | - | 1 | 1 |
| CO5 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 1 |

High-3, Medium-2, Low-1