SANJAY GHODAWAT UNIVERSITY
KOLHAPUR

Sanjay Ghodawat University (SGU) is established in the Academic Year 2017-18, as a State Private University under Govt. of Maharashtra Act No. XL of 2017 dated 3rd May 2017, with the approval of the UGC and the state Government. "For the true measure of giving is giving without measure." Spread across 150 Acres, Sou. Sushila Danchand Ghodawat Charitable Trust's Sanjay Ghodawat University (SGU) is situated in serene atmosphere amidst idyllic hills and lush green meadows to study in harmony with Nature. The Institution aspires to run along the lines of best-in- the-world education and become a world-class institution where teaching-learning process gets a far deeper meaning. SGU always stands as the guiding star of brilliance, quality and deliverance beyond expectations. Innovativeness and Creativity are the hallmarks of a genius enterprise and SGU stands to be a stage where these qualities would be nurtured, encouraged and blossomed.The genius is incomplete without the sense of social responsibility and SGU's ultimate goal remains the development of an attitude of gratitude that freely gives back without expectations.

The Sanjay Ghodawat University stands as a beacon of light to guide the younger generation of the day on the right path to fulfilment in career and life. The USP of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution orientedthinking promotion, stress on research and innovation,international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

The university will help students develop as a unique individual-to be educated as a whole person, intellectually, emotionally, socially, ethically, and spiritually.The educational program designs are worked out meticulously in line with best in class universities with special focus on:

- Flexible Choice Based Credit System

- OBE - Outcome Based Education System
- Experiential Learning
- Project Based Learning
- Case Based Learning
- Training need analysis based on Performance Appraisal System
- Active Learning tools for effective delivery
- Mentoring / Proctorship
- On line learning /Self learning platforms
- Flipped Classroom concept
- Effective Student Feedback Mechanism

VISION

Internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind.

MISSION

- To prepare students for life-long learning and leadership in a global academic culture
- To create intellectual manpower relevant to the industry and society at large
- To collaborate with institutions of international repute for academic excellence
- To promote research and development through conducive environment
- To encourage entrepreneurship and skill development programs

CORE VALUES

- Integrity
- Transparency
- Accountability
- Equality
- Empathy
- Stewardship

QUALITY POLICY

Sanjay Ghodawat University is committed to establish high standards in value-based quality education to enhance and nurture young minds to excel in their chosen profession and develop into socially responsible citizens through resourceful collaboration, innovation and research

CHOICE BASED CREDIT SYSTEM (CBCS)

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

University Grants Commission has come up with the Choice Based Credit System (CBCS) programme in which the students have a choice to choose from the prescribed courses, which are referred as core, elective or minor or soft skill courses and they can learn at their own pace and the entire assessment is graded-based on a credit system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

Where the students can choose the prescribed courses, as the core, and elective or soft skill courses, from a range of options, rather than to simply consume what the curriculum offers. They can learn at their own pace and the assessments are graded based on a credit system. It provides an opportunity for students to have a choice of courses or subjects within a programmed resembling a buffet, against the mostly fixed set of subjects now being offered (except for the limited choice of electives in professional degrees and postgraduate programmers) with the flexibility to complete the programmed by earning the required number of credits at a pace decided by the students.

The UGC has always initiated measures to bring efficiency and excellence in the Higher Education System of India. The basic motive is to expand academic quality in all aspects, right from the curriculum to the learning-teaching process to examination and evaluation systems. However, so far multiple methods are followed by different universities across the country towards examination, evaluation and grading system. Considering this diversity, the implementation of the choice based credit system seems to be a good system in assessing the overall performance of a student in a universal way of a single grading system.

OUTCOME BASED EDUCATION (OBE) MODEL

Sanjay Ghodawat University (SGU) has implemented OBE model of education, which is a learner centered approach. SGU has witnessed a sea change in the entire academic systems with implementation of all three components of OBE – Design, Delivery and Assessment. The SGU model of autonomy focuses on experiential learning which believes in learning by doing. This is achieved through hands on experience, industrial assignments, mini projects and live problem solving and collaboration with industries.

SGU is set in to dynamics of transformation and witnessing a shift in focus from teaching to learning and entire academic system of SGU is designed to provide multiple learning opportunities for students to acquire and demonstrate the Knowledge, Skills and Attitudes (KSA) for rewarding career.

The Vision and Mission of the Management, contribution from eminent BOG members and knowledgeable members of Academic Council and Board of Studies, the motivation and drive of the Director, the relentless efforts of the fellow Deans and Head of Departments and all teaching and non teaching staff along with commitment to learning of students made it possible to successfully transform the institute and stand out to carve a niche for itself as an Institute of repute.

OBE is an approach of curriculum design and teaching that focuses on what students should be able to do (attained) at the end of course/ program. Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes (KSA). Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behavior a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular degree is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

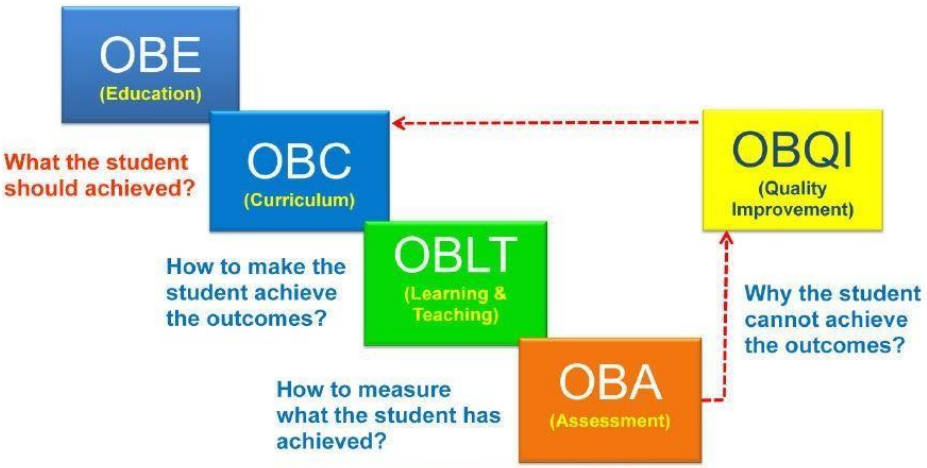
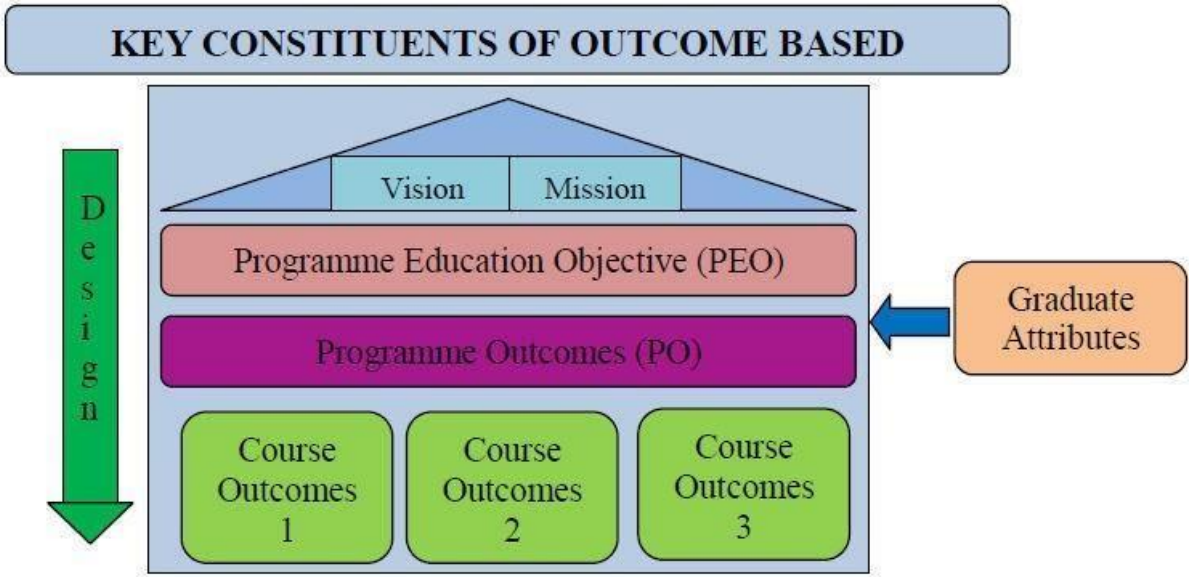


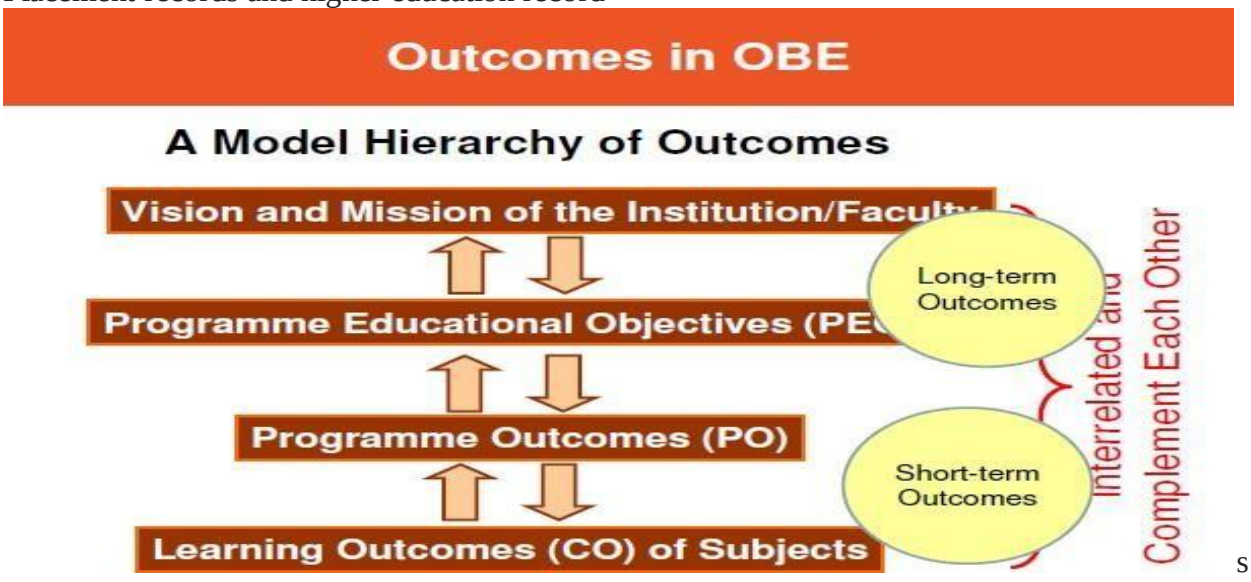
Figure 1: OBE flows and desciption



The OBE model measures the progress of the graduate in three parameters, which are

- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEO) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the Graduate attributes. Course outcomes are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester. The various assessment tools for measuring Course Outcomes include Tests and End Semester Examinations, Tutorials, Assignments, Project work,Labs, Presentations, Employer/Alumni Feedback etc., These course outcomes are mapped to Graduate attributes and Program outcomes based on relevance. This evaluation pattern helps Institutions to measure the Program Outcome. The Program Educational Objective is measurethrough Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education record



s

Special Features of OBE

- OBE is an educational process that focuses on what students **can do** or the **qualities** they should develop after they are taught.
- OBE involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.
- Both structures and curricula are designed to achieve those **capabilities** or **qualities**.
- Discourages traditional education approaches based on direct instruction of facts and standard methods.
- It requires that the students demonstrate that they have learnt the required skills and content.

SANJAY GHODAWAT UNIVERSITY
KOLHAPUR

(Established as a State University under Government of Maharashtra Act No XL dated 3rd May 2017)

Academic and Examination Rules and Regulations

Sanjay Ghodawat University Kolhapur

Kolhapur - Sangli Highway, A/p Atigre - 416 118,
Tal. - Hatkanangale, Dist. Kolhapur,
Maharashtra, India

(Implemented from Academic year 2023-24)

Academic and Examination Rules and Regulations

1.0 Preamble

The Sanjay Ghodawat University (SGU) stands as a beacon of light to guide the younger generation of the day on the right path to fulfillment in career and life. Outcome Based Education (OBE) model is adopted to enhance the effectiveness of teaching learning process and Credit Based semester system is implemented.

The focus of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

Vision of SGU is internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind. To achieve the vision SGU will develop state-of-the-art infrastructure that promotes conducive ambience promoting innovation and research. Create intellectual manpower relevant to the industry and society at large. Foster mutually beneficial partnership with alumni, industry and academia. Inculcate ethics and values to develop socially responsible citizens and promote entrepreneurship.

SGU is offering various programs through schools such as School of Technology, School of Commerce and Management, School of Sciences and School of Arts.

SGU has implemented the outcome based Education (OBE) system and Credit based Evaluation System in all the schools.

The rules and regulations mentioned in this document are applicable to all the Under Graduate (UG) and Post Graduate programs offered by the Sanjay Ghodawat University from the academic year 2018-19. The rules and regulations stated here under are subjected to revisions / refinements, updates and modifications and amendments by academic council (AC) from time to time and applicable to all batches including those already undergoing programs at different year and are binding on all stakeholders including students, faculty, parents and University authorities.

The academic programs of the University shall be governed by rules and regulations approved by the academic council from time to time. Academic council is the supreme and statutory academic body that governs all academic matters of the university and the decisions of the academic council are final and binding in the matters related to academics.

Definition of Terms

1. University: University means Sanjay Ghodawat University, Kolhapur
2. Academic Year: The period of the year during which students attend university for all academic activities, usually it starts from first of July and ends on 30th of June next year.
3. Semester**:** Academic Year is divided in to 2 parts called Semester, Odd Semester which starts from July and Even Semester which starts from January.

4. Duration of Semester: Total duration of semester is usually 20 weeks per semester including instructions, examination and evaluation. Total instructional days are 90 per semester.
5. **Course:** It is a Subject that is offered in a semester. The course may consist of Theory/Practical/Project/Seminar during semester. Usually taught by instructor in a class. e.g. Physics, Chemistry, Engineering Mechanics, Workshop etc.
6. **Program:** Collection of Courses is called Program. For example B Tech in Mechanical Engineering, M Tech in Civil Engineering, Bachelor of Business Administration. Bachelor of Science etc.
7. **Department:** Department is a unit of the school which offers one or more programs.
8. **Contact Hours:** Time of students in class/laboratory with instructor. Usually in the range of 20-30 Hrs./Week. For the purpose of uniformity one contact hour is measured as 60 minutes
9. **Academic Council (AC):** Means apex academic body governing the academic programs responsible for framing policy , rules and regulations.
10. Board of Examination (BOE): Central body responsible for framing policy, rules and regulations for Examination.
11. Board of Studies (BOS): Departmental academic body to govern the academics of programs (BOS) offered by department.

Curriculum:

Every program has a prescribed structure which, in general, is known as Curriculum. It prescribes courses to be studied in each semester. The booklet containing courses structure along with detail syllabus for each course of each program is updated periodically and made available on the website.

Semesters:

SGU implements a credit based semester system. The academic year is divided into two regular semesters. The semesters that begin in July are known as Odd semester and the semester that begin in January are known as Even semesters. Total duration of each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

Course Credit System/Structure:

In general, a certain quantum of work measured in terms of credits is laid down as the requirement for a particular program. Calculation of number of credits for a course in any semester is as per Table 3.1

Table 3.1: Calculation of number of credits for a course

Sr. No.	Course	Credits
1	Lecture of 1 hour/week	**1**
2	Tutorial of 1 hour/week	**1**
3	Practical / Laboratory / Drawing/mini-project of two hours/ week	**1**
4	Seminar (1 hour per week)	**1**

There are mainly two types of courses- viz. Theory courses and Laboratory courses. Generally, a theory course consists of Lecture hours (L) and Tutorial hours (T). Tutorial hours may not be assigned to a particular theory course if it has a separate laboratory course. Laboratory course consists of practical hours (P) for which a student works in a Laboratory/Drawing Hall/Workshop. The other courses required to be taken by a student include seminar, mini project, and project at various levels of the program.

A student shall earn credits for a particular course by fulfilling the minimum academic requirements for attendance and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum evaluation requirements.

The total number of credits required for completing a program shall be mentioned in the course structure. The total number of credits in a semester which a student registers shall generally be 20--25. The maximum number of credits per semester shall not exceed 30

Audit Course:

A student may have to register for an audit course in a semester which could be institute requirement or department requirement.

An audit course may include either a) a regular course required to be done as per structure or required as pre-requisite of any higher level course or b) the programmers like practical training, industry visits, societal activities etc.

Audit course shall not carry any credits but shall be reflected in Grade Card as "PP"/"NP" depending upon the satisfactory performance in the semester evaluation as per the course curriculum structure.

2. Course Registration:

Every student must register for the courses that he/she wants to study for earning credits at the beginning of each semester on the prescribed dates announced from time to time and shall be mandatory for every student till he/she completes the program. Only after registration his/her name shall appear in the roll list of each of such courses.

Students shall be required to fill up a Course Registration Form which shall be made available to them by the Student section of Administration office after payment of required fees.

Registration, according to rules, should be carried out as per the schedule given in academic calendar. Late registration may be permitted only for valid reasons and on payment of late registration fees. In any case, registration must be completed before the prescribed last date for registration, failing which his/her studentship shall be liable to be cancelled. Students having dues outstanding towards the institute or hostel shall be permitted to register only after clearing such dues.

In-absentia registration may be allowed only in rare cases at the discretion of the Dean Academics and with prior permission.

For registration in an odd semester, the student must have earned all the credits of the pre-previous year and at least 75% 2/3rd of the credits previous year. For example, for registration of the 5th semester courses (i.e. 3rd year of program), a student must have earned all the credits of the first year and 2/3rd of the credit second year. Similarly, for registration of the 7th semester courses (i.e. 4th year of program), a student must have earned all the credits of the second year and 2/3rd of the credits third year. However, if 2/3rd of the calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for taking decision related with this clause.

A student registered in odd semester shall be eligible to register for the courses offered in the even semester of that year irrespective of his/her SGPA or the number of credits earned by him/her in that odd semester.

3 Lateral Entry for B Tech Programs

Post diploma students in engineering and B.Sc. Graduates can have lateral entry at third semester of the program. Such admissions are governed by the rules of regulatory bodies like AICTE New Delhi and Directorate of Technical Education Maharashtra state and Sanjay Ghodawat University for Admission criteria and shall undergo all academic requirements as specified by the Academic council.

For such students there shall not be First Year Performance Index (FYPI). Semester Performance Index (SGPA) and Cumulative Performance Index (CGPA) shall be calculated from the third semester onwards taking into consideration the courses undergone by them at Sanjay Ghodawat University Kolhapur.

Registration of the students not covered by the cases mentioned above shall be decided by the Academic Council. Such students shall undergo the academic program as specified by the Academic Council. Such odd entry students shall not be eligible for any medals or awards instituted by the institute.

4.Change of Program:

This is applicable to B Tech Programs only. Students shall be eligible to apply for Change of Program after completing the first two semesters. The following rules/ guidelines shall be used for considering their applications for change:

The change of program shall be permitted strictly on merit basis subject to the rules of admissions prevailing at the time of such change.

Students without fail grades and/or backlogs shall be eligible to apply for change of program and can give their choices in the order of preference.

The request for change of program by a student from program A to program B shall be considered if number of students of program B does not exceed the sanctioned capacity of program B and also the minimum strength required to run the program as decided by Academic Council.

All such transfers can be effected only once at the beginning of the second academic year of the 4-year UG program. No application for change of program during subsequent academic years shall be entertained.

5.Facilitation to Students: Faculty Advisor:

On joining the institute, a student or a group of students shall be assigned to a faculty advisor who shall be mentor for a student throughout his/her tenure in the institute. A student shall be expected to consult the faculty advisor on any matter relating to his/her academic performance and the courses he/she may take in various semesters / summer term. A faculty advisor shall be the person to whom the parents/guardians should contact for performance related issues of their ward. The role of a faculty advisor is as outlined below:

The role of the Faculty Adviser is outlined below:

a. Guide the students about the rules and regulations governing the courses of study for a particular degree.
b. Advise the students for registering courses as per curriculum given. For this purpose, the Faculty Adviser has to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which He/She can register during the semester as per the curriculum.
c. Approve the registration of the students.
d. Advice students to overload/ drop one or more courses/activities based on her/his academic performance as per the prescribed rules.
e. At the end of the first semester/year, the Faculty Adviser may even advise a reduced load program for a poorly performing student.
f. Pay special attention to weak students and carefully monitor performance of students recommended for slow track option.
g. Advice students for Course Adjustment / Dropping of courses during the Semester within the stipulated time frame given in the Academic calendar.
h. Advice students seeking semester drop either during the ongoing semester or before the commencement of the semester. FA has to ensure strict compliance of rules and regulations laid down for this purpose. Recommend the cases to the appropriate authorities for consideration.
i. Make revised plan of study for weak/bright students based on their semester wise performance.
j. Suggest modalities for course/credit requirements for the students recommended for exchange program.
k. Guidance and liaison with parents of students for their performance.
l. To ensure that students are not permitted to reregister for courses, which they have already passed.
m. Inform students that any academic activity (course / Lab. / seminar / project / noncredit requirement etc.) undergone without proper registration will not be counted towards the requirements of his/her degree.
n. Strictly warn students that if she/he fails to register during any semester without prior approval, his/her studentship is liable to be cancelled.
o. Keep the students updated about the Academic Administration of the University.

6. Helping Weaker Students:

A student with backlog/s should continuously seek help from his/her faculty advisor, Head of the Department and the Dean of respective schools. Additionally, he/she must also be in constant touch with his/her parents/local guardians for keeping them informed about academic performance. The university also shall communicate to the parents/guardians of such student at-least once during each semester regarding his/her performance in in-in various tests and examination and also about his/her attendance. It shall be expected that the parents/guardians too keep constant touch with the concerned faculty advisor or Head of the Department, and if necessary - the Dean of the respective school.

7. Discipline and Conduct:

Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the university.

Any act of indiscipline of a student reported to the Dean, Student Development, shall be discussed in a Disciplinary Action Committee of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated.

If a student while studying in the university is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, he/she shall be liable to be expelled from the institute without any notice.

If a student is involved in any kind of ragging, the student shall be liable for strict action as per provisions in the Maharashtra anti-ragging act.

If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the university and fees paid shall be forfeited.

If a student is found guilty of malpractice in examinations, then he/she shall be punished as per the recommendations of the Grievance Redressed Committee (CRC) constituted by Board of Examinations.

Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Sanjay Ghodawat University Kolhapur. The student must have valid ID card with him/her while in the University Campus.

Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another, student shall be subjected to disciplinary action.

The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

Students should switch off the Mobiles during the Instructional hours and in the academic areas of university Building, Library, Reading room etc. Strict action will be taken if students do not adhere to this.

During the conduct of any Tests and Examination students must not bring their mobiles. A student in possession of the mobile whether in use or switched off condition will face disciplinary action and will be debarred from appearing for the Test / Examination.

8.0 Academic Calendar

The academic activities of the institute are regulated by Academic Calendar and is made available to the student's/ faculty members and all other concerned in electronic form or hard copy. It shall be mandatory for students / faculty to strictly adhere to the academic calendar for completion of academic activities.

9.0. Attendance:

Regular 100% attendance is expected from all students for every registered course in lectures, tutorial, laboratory, projects, mini-projects and other courses mentioned in program curriculum. Hence, attendance is compulsory and shall be monitored during the semester rigorously. Students shall be informed at the end of every month if they are failing short of attendance requirements.

A Maximum of 25% absence for the attendance may be permitted only on valid grounds such as illness, death in family of blood relations (Father, Mother, Sister, and Brother) and any other emergency reason which is beyond the control of the student and shall be approved by the authorities in respective departments.

If a student fails to put up 75% attendance individually in each course, the student will be put under X grade category and student will be debarred form attending the End Semester Examination (ESE) and Re-Exam for that semester in that course. However, student has an option to re-register for the course whenever it is offered next time or he can appear for 100% examination for which he will be awarded two grade penalties. Student's FA marks are treated as null and void.

The maximum number of days of absence for students participating in Co- curricular activities /Sports/ Cultural events during a semester shall not exceed 10. Any waiver in this context shall be on the approval of the Academic council only after the recommendation by Dean Academics of the university.

The HOD and Dean of the respective school shall report and recommend to Academic council the cases of students not having 75% attendance as per the records of course instructor. After rigorously analyzing these cases AC may take a decision to debar such student from End-Semester Examination (ESE) for that course. Such a student shall re-register for that course as and when it is offered next. FA & SA evaluations of such a student for this course during regular semester shall be treated as null & void.

A student remaining absent during ESE of a course either on medical ground (Accident and/or hospitalization of a student) or any other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing University at university/state level in sports/co- curricular activities shall be treated as per the rules of Sec 12.6.2 and 11.1.2

The critical cases of absenteeism which are not covered by any of the above clauses shall be reported by concerned Head of Department to Academic dean and all such cases the decision of Academic council is final**.**

10.Modes of Assessment:

Assessment of Theory Courses:

A student shall be evaluated for his/her academic performance in a theory course through Formative assessment(FA) and Summative Assessment (SA).

The relative weightage for the All courses having shall be generally as shown in the Table 10.1.2

Table 10.1.2: Weightage for the theory courses in %

FA	SA
50	50

The details of the weightage of each course shall be listed in the structures of each program.

Formative Assessment(FA): shall be based on student's performance in assignments, quizzes, seminars, oral, practical performance, Course projects and field assignments, term papers, etc. The mode of FA shall be decided and announced by the Course Instructor at the beginning of the course.

Summative Assessment(SA): is of three hours' comprehensive examination having the weightage of 60% for unit 5 and 6 and 40% to unit 1 to unit 4. It is of 100 marks and POE for the practical subjects. Marks distribution of ESE & POE announced by the Course Instructor at the beginning of the course

All examinations and evaluations shall be compulsory. Credits for a course shall be awarded only if a student satisfies evaluation criteria and acquires the necessary minimum grade.

A student remaining absent for ESE of a course either due to medical reason (Accident and/or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing college at university/state level in sports/co-curricular activities shall be awarded with grade "I". Such a student shall be allowed to appear for make-up examination scheduled along with re-examinations of other courses. The student shall apply to COE with proper documentary evidence to appear for make-up examination. After make-up examination, a student shall be entitled to an appropriate grade as per Table I of Sec. 10.1.2 based on his/her performance during the regular semester and in make-up examination.

Assessment of Laboratory Courses:

The assessment of laboratory course shall be continuous and based on turn-by- turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in viva-voce examinations uniformly distributed throughout the semester. Where ESE for the laboratory course is specified ESE shall be based on performing an experiment followed by an oral examination. The relative weightage for FEP and ESE for assessment of laboratory courses shall be 50%

each for FEP and ESE and a minimum performance of 40% in both FA & SA separately shall be required to get the passing grade.

POE for laboratory course shall normally be held before the ESE for theory courses and shall be conducted by a panel of examiners appointed by COE from the panel of experts approved by BOS. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with HOD of the respective department.

Student failed in POE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted along with POE of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to POE i.e. Practical-Oral- Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He/She shall suffer one grade penalty.

11.0 The Grading System:

Absolute Grading System (AGS) is adopted based on absolute numerical marks obtained by the student during all stages of evaluation for a course.

Award of Grade (Regular Semester):

For every course registered by a student in a semester, he/she shall be assigned a grade based on his/her combined performance in all components of evaluation scheme of a course as per the structure. The grade indicates an assessment of the student's performance and shall be associated with equivalent number called a grade point.

The academic performance of a student shall be graded on a ten point scale. The Absolute Grading System is followed. Letter grades, the guidelines for conversion of marks to letter grades and their equivalent grade points are as given in Table.

Table 11.1.2: Grade Table for Regular Semester

Marks Obtained	Grade Letter GL	Grade Point GP	Performance Description
90-100	**O**	**10**	Outstanding
80-89	**A+**	**09**	Excellent
70-79	**A**	**08**	Very Good
60-69	**B+**	**07**	Good
50-59	**B**	**06**	Above Average
45-49	**C**	**05**	Average
40-44	**P**	**04**	Pass
00-39	**F**	**00**	Fail
-	**Ab**	**00**	Absent
-	**X**	**00**	Detained (Failed)
-	**Satisfactory**	**-**	Pass in Non Credit Courses
-	**Un Satisfactory**	**-**	Failed in Non Credit Courses

A student shall pass the course if he/she gets any grade in the range "O" to "P". "FF" grade shall be awarded to a student in a course if he/she gets less than 40% marks jointly in the FA & SA for a theory courseand in PET & ESE for a laboratory course. A course shall then be eligible toapply for re-examination. A student failed in laboratory course shall be eligibleto apply only for 100%examination conducted with the laboratory examinations of the subsequent semester. In both cases, a student has to sufferone grade penalty.

12. Assignment of X Grade

Grade "X" in a regular course shall be given to a student if he/she falls in any of the following categories.

A student does not maintain the minimum 75% attendance in any of the theory or laboratory courses.

A student has not completed most of the Evaluations like FA due to non-medical reasons (for example when a student has missed all or most of the components of internal evaluation conducted by the instructor in that semester).

The performance of a student is less than 40% in FA Combined.

A student is guilty of any academic malpractice during semester (Such cases shall be dealt by Grievance Redressed and Discipline Committee).

In above four cases grade "X" shall be declared one week before ESE and intimated to the Academic Office and COE immediately thereafter. Such a student shall not be permitted to take the ESE of that course.

Grade "X" may be given to a student if

A student eligible for ESE remains absent for ESE of a course with no written intimation to Exam Cell within four days after the respective ESE is over.

A student is guilty of any academic malpractice during examination. (Such cases shall be dealt by Grievance Redressal Committee).

In 12.5.2 grade "X" in that course shall be declared after Grievance Redressed Committee confirms the academic malpractice.

In above two cases when a student gets "X " grade in a course, then this shall be treated as "FF" for the purpose of calculation of Semester Performance Index (SGPI) and First Year Performance Index (FYPI) or Cumulative PerformanceIndex (CGPI).

Following rules apply to the student who has obtained grade "X" in a regular semester:

A student obtaining grade "X" in a course in a regular semester or during examination shall be not be allowed to appear for End semester examination and also Re ESE conducted before the beginning of the next semester. His/her FA evaluations for all courses shall be treated as null and void. He/She needs to re-register for courses of that semester in the next academic year whenever they are offered and undergo all evaluations along with fresh regular students for which he will get one grade penalty.

Grade "I" shall be declared in a theory/laboratory course if a student has satisfactory performance FA and has fulfilled the 75% attendance requirement, but has not appeared for ESE due to genuine reasons. Such students shall be eligible for the make-up examination of ESE only on medical grounds/valid reasons and on production of authentic medical certificate or other supporting document/s (as required by the University) to the COE within ten days after the respective examination is over. The application form with requisite amount of fees must be submitted to the Exam Cell before the last date of filling such application forms for make-up examinations. These examinations shall be based on 100% syllabus and shall be scheduled before the commencement of the subsequent semester for theory courses and along with ESEs of laboratory courses of the subsequent semester. A student with "I" grade when appears for the make-up examination shall be eligible to obtain a regular performance grade ("O" to "F") as per Table 11.1.2 depending on his/her overall performance in FA and make-up examination. If a student fails to appear for make-up examination too, a grade "XX" shall be awarded to him/her. Thus "I" is only a temporary grade and shall be replaced by a valid grade only after make-up examination.

There shall be a few audit courses as per the policies of the institute or as decided by DPC of respective program. The grade "PP" (Passed)/ "NP" (Not Passed) shall be awarded for such courses depending upon the performance of a student evaluated by the faculty in-charge. No grade points shall be associated with these grades and performance in these courses shall be not taken into account in the calculation of the performance indices (SGPI, CGPI). However, the award of the degree shall be subject to obtaining a "PP" grade in all such courses.

13. Award of Grades for Re-Examination:

A student who has obtained grade "F" in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester. In such cases FA marks are carried forward and a student has to suffer one grade penalty A student shall apply for re-examination before the last date of such application and shall appear for re-examination.

50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

A student who has obtained "F" grade in ESE of a regular semester and has not availed re-examination option or a student who has obtained "F" grade in both ESE and re-examination shall be eligible to choose one of the two options below to clear his/her backlog:

- Re-registration for the next regular semester course whenever that course is offered.
- Appearing for ESE of the course when conducted...
  A student detained in a regular semester due to either a) by obtaining "X" grade or b) by involvement in academic malpractice or c) by breaking the institute code of conduct and discipline can re-register for the course when offered next

Following rules apply for these cases:

In first case i.e. Re- registration the earlier performance of a student in all the evaluations of that course shall be treated as null and void. The student has to undergo all the evaluations after re-registration.

14. Grades for Third and Subsequent attempts:

If A student opts for ESE or Re ESE who previously had obtained grade "F" in a course in two attempts, his/her FA performance of the regular semester shall be considered for evaluation and He/She has to suffer two grade penalty for the third attempt and for 4^{th} and subsequent attempts shall be awarded a grade "P" or "F" or "X" based on his/her performance.. However, if a student takes more than three chances (regular examination being the first chance, re-examination being the second chance, to clear a course, then the maximum passing grade that he/she can get shall be only "P". Thus a student has to suffer a grade penalty by accepting a lower grade than that obtained in the regular examination, re-examination, or examination for a re-registered course.

15. CALCULATION OF PERFORMANCE INDICES:

15.1. Semester Grade Point Average (SGPA)

The performance of a student in a one specific semester is indicated by SGPA. SGPA is a weighted average of the grade points obtained in all courses registered by the students during the semester. SGPA can be calculated by following equation.

$$SGPA = S_i = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where, i = 1,2,3…….n are number of courses during semesters. C = No of credits associated with that course and P = Grade point earned in that course. SGPA will be rounded off to two decimal places.

Cumulative Grade Point Average (CGPA)

The total cumulative performance of a student at the end of specific semester isindicated by CGPA. An up-to-date assessment of the overall performance of a student for the courses from the first semester onwards till completion of the program shall be obtained by calculating Cumulative Grade Point Average (CGPA).

CGPA is a weighted average of the SGPA obtained in all semesters by the students during the semesters. CGPA can be calculated by following equation.

$$CGPA = \frac{\sum_{j=1}^{n} C_j S_j}{\sum_{j=1}^{n} C_j}$$

Where, j = 1,2,3…….n are number of semester during program. C = Total No of credits in the semester for which CGPA is to be calculated.

CGPA will be rounded off to two decimal places.

Conversion of CGPA to percentage marks for CGPA ≥ 4.5 can be obtained using equations. Percentage marks = (CGPA x 10) – 7.5.

For the students acquiring "I" grade (which is only a temporary grade) in any of the courses, SGPA, CGPA shall be calculated only after make-up examination.

16. First Year Performance Index (FYPI): (Applicable For B. Tech Programs Only)

For a student registered in Sanjay Ghodawat University Kolhapur right from the First semester, First-Year-Performance-Index (FYPI) shall be calculated as weighted average of the grade points obtained in all the courses registered by him/her in semesters I and II only.

$$\text{FYPI} = \frac{\sum_{1} C_i g_i}{\sum_{1} C_i}$$

Where summation is for all the courses registered by a student in first two semesters. FYPI shall be calculated when for the second semester is calculated. FYPI shall be rounded off to two decimal places.

FYPI shall reflect all the courses undergone by a student in the first year including the courses in which he/she has failed. FYPI may get modified in the subsequent semesters whenever a student clears his/her first year backlog courses.

If a student has been awarded "I" grade in the regular semester course of the first year then, FYPI shall be calculated after the make-up examination on the basis of the grade obtained by that student in a make-up examination.

If a student has obtained grade "F" or "X" at any time in any of the courses registered by him, then zero grade points corresponding to these grades shall be taken into consideration for calculation of FYPI.

17. Maximum Duration for Completing the Program

Maximum duration for completing any program UG/PG offered by Sanjay Ghodawat University is respective program duration plus two additional years.

Maximum duration for getting the B. Tech degree for students admitted in the first semester of UG program is, program duration plus two additional years (i.e. 12 Semesters and 6 academic years) For lateral entry student academic admitted in the third semester shall be (10 Semester and 5 Years).

The maximum duration of the program includes the period of withdrawal, absence and different kind of leaves permission to student but excludes the period of rustication of the student from the university however genuine case an confidential of valid reason may be referred to academic council for extending this limit by additional criteria

18. NFTE (Not Fit For Technical Education) (Applicable to B Tech program only)

It is mandatory for the student to earn all credits of first year specified for semester I & II or eligible for ATKT as per the rules to seek admission to semester III of second year in three years from the date of admission to avoid NFTE. If a student fails to become eligible for admission to Semester III in three year from the date of his admission, he shall be declared as “Not Fit for Technical Education” leading to discontinuation of his/her registration with the university. Such cases should be put up in the academic council.

19. Academic Progress Rules (ATKT Rules):

A student shall be allowed to register for the courses of the next year's odd semester only if he/she has earned all the credits of the previous year and has earned at least 2/3rd credits of the current year. If 2/3rd calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for deciding the eligibility for ATKT.

At the end of 1st year a student shall be allowed to keep terms (ATKT) to 2nd year of study provided he/she attends course work prescribed for 1st year with prescribed attendance and successfully earned at least 2/3rd of the total credits specified for 1st year program.

For Example: Total credits for B. Tech first year 2017-18, are 45 (Total of Semester I and II). A Student should earn minimum 2/3rd of the 45 Credits i.e. A student can go to next higher class with a maximum backlog of 1/3rd credits of semester I & II of the first year.

Student, who fails to earn those credits, cannot register for next semester, either it can re-registrar for the course and credits or can use the next opportunity to earn the credits when exams are conducted. **.**

(b) At the end of 2nd year a candidate shall be allowed to keep terms to 3rd year of study provided he/she attends course work prescribed for 2nd year with prescribed attendance, and successfully cleared 1st year program and at least 2/3rd of total credits prescribed for 2nd year program.

(c) At the end of 3rd year a candidate shall be allowed to keep terms to final year of study provided he/she attendants course work prescribed for 3rd year with prescribed attendance, and should have completed 2nd year program and 2/3rd of total credits prescribed for 3rd year program.

All such candidates fulfilling the above criteria shall be declared as FAILED, ATKT.

A student shall be allowed to take admission for odd semester of next academic year only if he/ she have earned all the credits of the previous year and 2/3rd happens to be a decimal, it is rounded to only integer part.

20. Semester Grade Report:

Semester grade report reflects the performance of a student in that semester (SGPI) and also his/her cumulative performance for the first year (FYPI) and also the cumulative performance since the third semester of his/her study (CGPA).

The semester grade card issued at the end of each semester/ summer term to each student shall contain the following.

- The credits for each course registered for that semester.
- Any audit course/s undertaken by a student in a Semester.
- The letter grade obtained in each course.
- The total number of credits earned by a student for the first year separately.
- The total number of credits earned by a student since the 3rd semester onwards.
- SGPI, FYPI, CGPI.
- A list of backlog courses, if any.
- Remarks regarding eligibility of registration for the next semester.

Semester grade card shall not indicate class or division or rank however a conversion from grade point index to percentage based on CGPI shall be indicated on the final grade card of the program.

21. Award of Degree:

Following rules prevail for the award of degree.

- A student has registered and passed all the prescribed courses under the general institutional and departmental requirements.
- A student has obtained CGPI ≥ 4.75.
- A student has paid all the institute dues and satisfied all the requirements prescribed.
- A student has no case of indiscipline pending against him/her.
- Academic Council shall recommend the award of degree to a student who is declared to be eligible and qualified for above norms.

22. Grace Marks

- Maximum total grace marks will be 1 % of the total theory credit courses x 100 subjected
- To maximum 6 marks in that semester.
- Grace marks will be given candidate for change in grades for theory credit courses i.e. from
- Fail to pass grade only and will be reflected in final ESE marks.
- The grace marks are applicable only for maximum 1/3rd courses (rounded to higher Integer part i.e. if there are 4 theory courses then 4/3 = 1.33 = 2 courses).
- Maximum grace marks will be distributed in maximum courses
- Benefit of grace marks is not applicable for any medal/award.
- Applicable to theory and (Theory + Practical Courses). If is not applicablefor Practical courses.
- Scheme for grace marks only can be used when the student will pass in all coursesof that semester.

23. 23. CGPA Improvement Policy for Award of Degree:

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.75 to improve his/her grade by allowing him/her to appear for ESE examinations of maximum two theory courses of seventh semester. Such examinations shall be scheduled along with re-examinations/make-up examinations. However, CGPA shall be limited to 4.75 even though the performance of a student as calculated through modified CGPA becomes greater than 4.75.

Conclusions:

The academic policies regarding conduct of programs in Sanjay Ghodawat University Kolhapur are published in this document. The Academic Council shall reserve the right to modify these policies as and when required from the point of view of achieving academic excellence. In special and abnormal cases (i.e. the cases not covered through above rules) the decision of the (Chairman, Academic Council shall be final and shall be binding on all concerned.

Chairman Academic Council

Sanjay Ghodawat University, Kolhapur

(Established as a State University under Government of Maharashtra Act No XL dated 3rd May 2017)

Curriculum Structure and Contents

Sanjay Ghodawat University Kolhapur

Kolhapur - Sangli Highway, A/p Atigre - 416 118, Tal. - Hatkanangale, Dist. Kolhapur, Maharashtra, India

(Implemented for Batch 2022-26)

Sanjay Ghodawat University, Kolhapur

School of Technology

Department of Computer Science and Engineering

Structure and Contents for S. Y. B. Tech.Artificial Intelligence and Machine Learning Program (AY 2023-24)

Structure for B. Tech AIML Second Year :Semester – III

Course Code	Course Title	L	T	P	Cr	Evaluation Scheme					
						Component	Exam	Marks	Wt. %	Min Pass (%)	Pass (%)
UAM301	Transform Calculus, Fourier Series and Numerical Techniques	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM302	Operating Systems	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM303	Software Engineering	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM304	Object Oriented Programming Using C++	2	-	4	4	Practical	FA	50	50	40	40
							SA	50	50	40	
UAM305	Database ManagementSystems	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UNM004	Environmental Studies	-	-	-	NC	-	-		-	-	
Total		**14**	**-**	**12**	**20**	**Total Hours: 26 Hrs.; Total Credits: 20**					

FA – Formative Assessment; SA-Summative assessment; FC –Fundamental Core; PC – Program Core; PE - Program Elective; UC - University Core; UNCMC- University Mandatory Non- Credit Course

Structure for B. Tech AIML Second Year :Semester – IV

Course Code	Course Title	L	T	P	Cr	Evaluation Scheme					
						Component	Exam	Marks	Wt. %	Min Pass(%)	Pass (%)
UAM401 (PC)	Complex Analysis, Probability & StatisticalMethods	3	1	-	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM402 (PC)	Python Programming	2	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM403 __ (PE)	Program Elective I	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UAM404	Introduction to ArtificialIntelligence	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UCM001	Foreign Language	3	-	2	4	Theory & Practical	FA	50	50	40	40
							SA	50	50	40	
UNM007	Sustainable Development Goals	-	-	-	NC	-	-		-	-	-
Total		**15**	**1**	**8**	**20**	**Total Hours: 24 Hrs.; Total Credits: 20**					

FA – Formative Assessment; SA-Summative assessment; FC –Fundamental Core; PC – Program Core; PE - Program Elective; UC - University Core; UNCMC- University Mandatory Non- Credit Course

UAM301: Transform Calculus, Fourier Series and Numerical Techniques								
Program Core, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	

Course Description:
This course will cover all the concepts of Laplace Transforms, Fourier Series, Fourier Transforms & Z-transforms & Numerical Solutions of Ordinary Differential Equations under the Engineering Mathematics syllabus. This course is specially designed to help you understand the concepts you need help in. This course will help you in solving numerical problem

Prerequisite: - Matrices, Calculus, multivariable calculus and Complex numbers

Course Outcomes: After the end of this course students will able to

CO1 Find numerical solution of equation $f(x)=0$.
CO2 Evaluate derivative and integration for tabular values of x and y.
CO3 Find Laplace and Inverse Laplace transforms
CO4 Express the given functions as a combination of sine and cosines series.

Syllabus (Theory)

Units	Description	Hours
I	**Solution of Algebraic and Trancdental Equation:** Roots of Equation by Bisection Method, False position method, Secant method, Newton-Raphson method.	07
II	**Numerical Differentiation:** Newton forward and backward difference formulae for equally spaced data, Derivative using stirling's formula, Newton's divided difference formula for unequally spaced data.	07
III	**Numerical Integration:** Newton's cotes quadrature formula, Trapezoidal rule, Simpson one third rule, Simpsons three eight rule, waddles' formula, Romberg Integration.	07
IV	**Laplace Transform:** Definition, Transforms of elementary functions, Properties of Laplace transform, Laplace Transform of Periodic function (statement only), Effect of multiplication by t and division by t, transforms of derivatives and integral.	07

V	**Inverse Laplace Transform:** Standard formulae, Inverse Laplace transforms by using standard results, partial fractions and Convolution theorem. Solution of Linear differential equation with constants coefficients by Laplace Transforms method.	**07**
VI	**Fourier Series:** Definition, Euler's Formulae, Dirichlet's Condition, Functions having points of discontinuity, Change of interval, Expansion of odd and even periodic functions, Half range series	**07**

Textbooks:

1. Computer Based Numerical and Statistical Techniques by Manish Goyal, Laxmi Publications(P) Ltd, Third edition.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers, Delhi.

References :

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd.
2. Numerical Methods by E. Balguruswamy, Tata McgrawHill Publication Company Ltd., 8thEdition, 2002.
3. Numerical Methods by Dr. V.N. Vedamurthy, Vikas Publication
4. Numerical Methods by G. Haribaskaran, Laxmi Publications Pvt. Ltd, New Delhi, 1st Edition,2006.
5. Numerical Analysis Theory and Applications by R.L.Burden and J.D.Faires, Cengage Learning India Pvt.Ltd., New Delhi,1st Edition,2005.
6. M.Grabish, Sugeno, and Murofushi, Fuzzy Measures and Integrals: theory and Applications.
7. M. Hanss, Applied Fuzzy Arithmetic, An Introduction with Engineering Applications, Springer-Verlag Berlin Heidelberg 2005.

UAM302: Operating Systems								
Program Core, Artificial Intelligence and Machine Learning								
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**				
				Component	**Exam**	**Weightage**	**Mini Pass %**	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	

Course Description:

Covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and device management. Considers the unifying concept of the operating system as a collection of cooperating sequential processes. Covers topics including file systems, virtual memory, disk request scheduling, concurrent processes, deadlocks, security, and integrity.

Prerequisite: - Fundamentals of computer systems and usages of its resources.

Course Outcomes: After the end of this course students will able to

CLO1 Understand[2] different types of operating system

CLO2 **Analyse[4]** process management, scheduling and synchronization techniques

CLO3 **Compare[4]** different scheduling algorithms.

CLO4 Explain[2] deadlock management, memory management

Syllabus (Theory)

Units	Description	Hours
I	Operating Systems Overview Concept of operating system, services given by operating system, types of operating systems: Batch processing system, Multi programming system, Time sharing system, Real time operating system, Multiprocessor systems	**07**
II	Process concept and process management Process concept, difference between process and program, process state transition diagram, process control Block, context switching, concept of process scheduling, scheduling criteria, types of schedulers.	**07**

III	Process Scheduling Basic concept, scheduling criteria, scheduling algorithms, FCFS scheduling algorithm, shortest job first scheduling algorithm, Round robin FCFS scheduling algorithm, priority scheduling algorithm, problems on scheduling algorithms.	**07**
IV	Process synchronization Introduction to Inter-process communication, general structure of process, Need of process synchronization, critical section problem, semaphore and its types, implementation of semaphore, classical problems of synchronization (The Dining-Philosophers Problem).	**07**
V	Deadlocks System model, deadlock characterization, necessary conditions for deadlocks, Resource allocation graph, deadlock detection, deadlock prevention, deadlock avoidance, , recovery from deadlock	**07**
VI	**Memory Management** Address binding, Logical versus Physical address space, contiguous memory allocation, single partition, multiple partitions, noncontiguous Memory allocation, Paging ,Paging Hardware, Segmentation, hardware for segmentation ,Swapping,	**07**

Textbooks:

1. Silberschatz, Galvin, Operating System concepts, 8th Edition, John Wiley.
2. Dhananjay M Dhamdhere, Operating Systems a concept based approach, TMGH.

References:

1. Harvey M. Deitel, “Operating Systems”, Second Edition, Pearson Education Pvt. Ltd.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall of India Pvt. Ltd.

Practical Syllabus

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines

Sr. no	Experiment Description
1	Case study LINUX operating system.
2	Different commands on LINUX operating system.
3	Simulation of CP command
4	Use of chmod command
5	Process scheduling algorithms
6	Program on Process management.

7 Program to demonstrate file system management
8 Program to implement fork() system call
9 Program to simulate process synchronization
10. Demonstrate key terms of Deadlock and its prevention

UAM303: Software Engineering								
Ver 1.0, Program Core, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	

Description:

This course introduces students to the different software development lifecycle (SDLC) phases used in developing, delivering, and maintaining software products. Students will also acquire basic software development skills and understand common terminology used in the software engineering profession

Prerequisite: - Knowledge of Programming Languages.

Course Outcomes: After the end of this course students will able to

CO1 **Explain**[2] the requirement of software engineering.

CO2 **Select**[4] the software life cycle models based on the type of applications

CO3 **Design**[5] the SRS document.

CO4 **Compare**[4] Function Oriented Design & Object Oriented Design.

Syllabus (Theory)

Units	Description	Hours
I	**Introduction to Software Engineering:** Introduction ,the problem domain, software engineering challenges, software engineering approach, Software Process ,characteristics of Software Process, project management process, inspection process, software configuration management process, requirements change management process,	07
II	**Software Development Models:**	07

Software development life cycle, Waterfall Model, Prototyping, Model, Iterative model, Time boxing model, Spiral Model, Incremental Model, Time boxing Model, and V Model.

Practical Syllabus

III	**Software Requirements Analysis and specification:** Need of SRS, requirement process, characteristics of SRS, components of SRS, requirement elicitation, specification language, structure of a requirement document, requirement validation,	**07**
IV	Software Architecture and Design Role of Software Architecture, architecture views, components and connector views, architectural styles, function oriented design, design principles, module level concepts, coupling, Cohesion, design notation and specification, object oriented design with OO concept.	**07**
V	Software Coding Programming principles and guidelines, coding errors, structural programming, information hiding, programming practices, coding standards, coding process, an incremental coding, test driven development, pair programming source control and build.	**07**
VI	**Software testing** Testing fundamentals, unit testing, black box testing, white box testing, integration testing, system testing	**07**

Textbooks:

3. Software Engineering: A precise Approach - Pankaj Jalote (Wiley India)
4. Software Engineering Principles & Practices by Rohit Khurana ITLESL (2nd Edition) Vikas Publishing House Pvt. Ltd.

References:

1. Fundamentals of Software Engineering - Rapit Mall (3rd Edition)(PHI)
2. Software Engineering by Jan Sommerville (9th Edition) Pearson

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines

Sr no	Experiment Description
1	Study of Software development life cycle.
2	Understanding an SRS.
3	Development of problem statement.
4	Preparing Software Requirements Specifications.
5	Preparation of Software Configuration Management and Risk Management related documents.
6	To prepare DATA FLOW DIAGRAM for any project.
7	Steps to draw the Use Case Diagram u
8	To draw a sample activity diagram for real project or system.
9	Develop test cases for unit testing and integration testing
10	Develop test cases for various white box and black box testing techniques.

References:

1. Fundamentals of Software Engineering - Rapit Mall (3rd Edition)(PHI)
2. Software Engineering by Jan Sommerville (9th Edition) Pearson

UAM304: Object Oriented Programming Using C++							
Ver 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
2	-	2	4	Theory & Practical	FA	50	40
					SA	50	40

Course Description::

This course introduces advanced programming skills and focuses on the core concepts of object-oriented programming and design using a high-level language, the course focuses on the understanding and practical mastery of object-oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism

Prerequisite: Programming Knowledge of C Programming

Course Outcomes: After the end of this course students will be able to

CLO1 **Explain**[2] Data hiding, encapsulation, and code reusability concepts practically.

CLO2 **Implement**[3] overloading of different type of operators.

CLO3 **Demonstrate**[3] polymorphism and file and ling.

Syllabus (Theory)

Units	Description	Hours
I.	**Overview:** Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object-oriented programming language, C++ programming Basics, Data Types, Structures, Enumerations, control structures, Class, Object, class and data abstraction, class scope and accessing class members,	**07**

separating interface from implementation, controlling access to members.

II. Arrays and Pointers: **07**

Arrays of objects, Pointers to objects, Type 08 checking C++ Pointers, This Pointer, Pointers to derived types, Pointers to class members, Dynamic allocation operators- new & delete operators.

III. Functions: **07**

Function, function prototype, accessing function and utility function, Constructors and destructors, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function.

Inheritance: Single Inheritance, Multilevel Inheritance, Multiple Inheritances, Hybrid Inheritance, Hierarchical Inheritance, Virtual base classes.

IV. Polymorphism: **07**

Overloading - Function overloading, overloading constructor 05 function, copy constructors, Operator overloading using friend function, overloading new & delete operators, overloading some special operators like [], (), ->, Comma operator.

Virtual Functions- Pure virtual function, calling virtual function through a base class, Abstract classes, Early vs Late binding.

V. File and Streams: **07**

Streams, String I/O, Character I/O, Object I/O, I/O with 08 multiple objects, File pointers and redirections. C++ streams, C++ stream classes, RTTI, Namespace fundamentals, STL containers, STL algorithms, STL iterators. Templates: Templates - Generic classes, Generic functions, Applying generic functions, type name &export keyword, power of templates. Exception Handling– Fundamentals, handling derived class exceptions, exception handling options: catching, throwing & handling of the exception

Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Class with multiple objects and multiple member function with different access specifies.
2. Array of objects.
3. Function overloading, default argument.
4. Different Constructors, constructor overloading and destructor.
5. Arithmetic operator overloading.
6. Binary operator overloading.
7. Relational operator overloading.
8. Unary operator (pre and post) overloading.

NOTE: Code for pre and post operator is different. Explain the difference in code)

9. Multiple inheritance.
10. Multilevel inheritance.
11. Hybrid Inheritance. (Demonstrate virtual base class)

NOTE: In program no 9, 10, and 11 try to show execution of different type constructors and destructor sequences also. (Sequence of execution, how to call constructor from constructor)

12. File handling.

NOTE: Expected to show how OOPS supports random file accessing in C++

13. Pointers.

NOTE: Using pointer explain virtual member function concept.

14. Temples: function and class.

Text Book

1. The Complete Reference: C++ - Herbert Schildt (TMGH) Fourth Edition.
2. Object-Oriented Programming in C++ - Rajesh K. Shukla (Wiley) India Edition.

References

1. Object Oriented Programming in Turbo C++ - Robert Lafore (Galgotia).
2. Object Oriented Programming with C++ - Sourav Sahay (Oxford) Second Edition.

UAM305:Database Management System								
Program Core, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	40%

Description:

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on database design theory: E-R modeling, data definition and manipulation languages, database security and administration. It also covers essential concepts like Transaction Processing, Concurrency Control and. Students undertake the fundamental tasks involved with modeling, designing, and implementing a DBMS. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Prerequisites: Concepts of computer programming (like programming in C --Files concepts).

Course Outcomes: After the end of this course students will able to

CO1 **Describe**[1] fundamentals of DBMS, database design and normal forms.
CO2 **Understand**[2] the basics of SQL for retrieval and management of data.
CO3 **Explain**[2] basics of transaction processing and concurrency control.
CO4 **Analyze**[4] familiarity with database storage structures access techniques and recovery

Syllabus (Theory)

	Description	Hours
I	**Introduction:** Purpose of Database System – Views of data – Data Models – Database Languages–Database System Architecture–Database users and Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.	**07**
II	**Relational Model:** The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations-	**07**

SQL fundamentals - Integrity – Triggers – Security.

III	**Database Design:** Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce Normal Form Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.	**07**
IV	**Transaction Management and Concurrency Control:** Transaction- Concurrency Control- Concurrency Control with Locking Methods-Concurrency Control with Times tamping Methods- Concurrency Control with Optimistic Methods.	**07**
V	**Data Storage and Indexing:** File Organization- Organization of records in File- Data Dictionary Storage- Database Buffer- Basic Concepts indexing & hashing- Ordered Indices-Multiple- Key Access- Static Hashing- Dynamic Hashing- Bitmap Indices- Index Definition in SQL.	**07**
VI	**Recovery System:** Failure Classification- Storage-Recovery; atomicity-Recovery Algorithm-Buffer Management-Failure with loss of non-volatile Storage.	**07**

Textbooks:

5. Database Systems- A practical approach to Design, Implementation and Management by Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education.
6. Database System Concepts by A. Silberschatz, H.F. Korth, S. Sudarshan, 6 th edition, Mc Graw Hill Education.

References :

5. C. J. Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Program to implement Data Definition, Table Creation and Constraints.
2. Program to implement Insert, Select, Update & Delete Commands
3. Program to implement Nested Queries & Join Queries.
4. Program to implement Views.
5. Program to implement High level programming language extensions (Control structures, Procedures and Functions).
6. Program to implement Front end tools.

7. Program to implement Forms.
8. Program to implement Triggers.
9. Program to implement Menu Design.
10. Program to implement Reports.
11. Program to implement Database Design and implementation (Mini Project).

Textbooks

1. Database Systems- A practical approach to Design, Implementation and Management

by Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education.

2. Database System Concepts by A. Silberschatz, H.F. Korth, S. Sudarshan, 6 th edition, Mc Graw Hill Education.

References

1. C. J. Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

UNM004: Environmental Studies								
Ver 1.0, University Core (Non-Credit), School of Computer Science and Engineering								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini. Pass %	
-	-	2	NC	Theory	FA	50	40	40%

Course Description:

The course, Environmental Studies discuss basic concepts of ecology, pollution and biodiversity. It covers the fundamental knowledge of nature around us with special focus on natural resource management. The course also introduces environmental legislation to students along with different national and international environmental issues. The prime objective of this course is to make students aware and responsible in protection of environment at local to international level.

Course Learning Outcomes:

At the end of this course students will able to

CLO1 **Describe**[1] multidisciplinary nature and importance of Environmental Studies

CLO2 **Explain**[2] concept of ecosystem and natural resources

CLO3 **Recognize**[1] importance of biodiversity, threats and conservation practices

CLO4 **Explain**[2] concept of environmental pollution, causes, effects and control measure

SYLLABUS

UNITS	DESCRIPTION	HOURS
I	**a) Introduction to environmental studies**: Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. Renewable and non-renewable resources: **b) Natural resources and associated problems** **Forest resources:** Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. **Mineral Resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies. **Energy Resources:** Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources, case studies **c) Role of individual in conservation of natural resources.** **d) Equitable use of resources for sustainable life styles.**	6

II	**Concept of an eco-system** Structure and function of an eco-system. Producers, consumers, decomposers. Energy flow in the eco systems. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following eco systems: Forest ecosystem Grass land ecosystem Desert ecosystem. Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)	6
III	**Environmental Pollution** Definition Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution Solid waste Management: Causes, effects and control measures of urban and industrial wastes and study of E-waste Role of an individual in prevention of pollution Pollution case studies Disaster management: Floods, earth quake, cyclone and landslides.	6
IV	**Social Issues and environment** Form unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, water shed management Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Environment protection Act. Human Population and the environment. Growth and variation among nations. Population explosion- family welfare program, Environment and human health, Women and child welfare, Role of information technology in environment and human health, Case studies	6

Textbook:

1.Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2.Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.

References

1.Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge
2. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press

UAM401: Complex Analysis, Probability and Statistical Methods								
Ver 1.0, Program Core, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	

Prerequisite: - Matrices Complex numbers, Probability rules, Matrices, Vector operations.

Course Outcomes: After the end of this course students will able to

CO1 Evaluate complex integrations.
CO2 Find probability distribution
CO3 Find the curve of best fit for bivariate data.
CO4 Find vector differentiation.

Syllabus (Theory)

Units	Description	Hours
I	**Calculus of Complex functions and Construction of Analytic Functions:** Function of a complex variable, limits, continuity, differentiability, Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms (only statement). Harmonic function, Construction of analytic functions: Milne Thompson method.	07
II	**Conformal Transformation and Complex Integration:** Introduction, Bilinear transformations, Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula (Only statement).	07
III	**Statistics**: Introduction, Measures of central Tendency, Dispersion, Measures of Dispersion, Relation between measures of dispersion, Coefficient of dispersion.	07
IV	**Probability Distribution:** Random variable, discrete and continuous random variable, probability density function, Binomial distribution, Poisson distribution and Normal distribution.	07
V	**Curve Fitting and lines of Regressions:** Fitting of curves by method of least squares, Coefficient of correlation and lines of regression of bivariate data.	07
VI	**Vector Differentiation:** Differentiation of vectors, Gradient of scalarpoint function, Directional derivative, Divergence of vector point function, Curl of a vector point function, Irrotational and solenoidal vector field.	07

Textbooks:

1) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
2) N.P.Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications. Latest edition, 2014.

References :

1) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed. (Reprint), 2017.
2) Srimanta Pal & Subobh C Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.
3) B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010
4) Chandrika Prasad and Reena Garg ,"Advanced Engineering Mathematics", Khanna Publishing, 2018.

UAM402: Python Programming							
Program Core, Artificial Intelligence and Machine Learning							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
2	-	2	4	Theory & Practical	FA	50	40
					SA	50	40

Course Description:

This course introduces computer programming using the Python programming language. Emphasis is placed on common algorithms and programming principles utilizing the standard library distributed with Python

Prerequisite: Object Oriented Programming concepts

Course Outcomes: After the end of this course students will be able to

CO1 **Explain**[2] data types and control statements in Python.
CO2 **Make use of**[3] functions and object oriented concepts to develop basic programs in Python.
CO3 **Apply3** file handling techniques and CRUD operations for given problems in Python**.**
CO4 **Construct**[3] solutions to different problems using NumPy and pandas.

Syllabus (Theory)

Units	Description	Hours
I.	**Basic concepts and functions in Python:** Introduction to Python, the application areas of Python, Python Basics, Data types and variables, Data input, Comments, String, List, Tuple, Dictionary, Set, Control Statements, Range, Strings, introduction to function, define a function, pass arguments, different type for arguments, Local and global variables, return a value from function, Return multiple values, Lambda Functions.	7
II.	**Object Oriented concepts in Python:** Class definition, creating objects, Constructors, accessing attributes, Built-in class attributes, Destructors, Inheritance, Overriding, Overloading, what is exception? Python built-in exceptions, Try-Except-Finally, raise exceptions, User defined exception.	7
III.	**File and Database Handling:** Reading, Writing, File manipulations, Directories, performing different database operations like Select, Insert, Update, Delete using MySql and Python connectivity.	7

IV.	**NumPy and Pandas:** Create, access, modify, and sort multidimensional NumPy arrays (ndarrays), Load and save ndarrays, Use slicing, Boolean indexing, and set operations to select or change subsets of an ndarray, understand difference between a view and a copy of ndarray, perform element-wise operations on ndarrays, Use broadcasting to perform operations on ndarrays of different sizes, Create, access, and modify the main objects in Pandas, Series and DataFrames, Perform arithmetic operations on Series and DataFrames, Load data into a DataFrame, Deal with Not a Number (NaN) values.	**7**

Practical(syllabus)

Four hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics. It should comprise of minimum of 13-15 experiments. Students of different batches should implement different programs based on following guidelines.

1. Introduction to Python, Setup, working in Python shell and Jupyter Notebook, Basic I/O.
2. Implement list, tuple, set and dictionary.
3. Implement String methods.
4. Implement Iterator, Conditionals and Loops.
5. Implement functions and recursive functions.
6. Implement lambda functions.
7. Implement a basic Object Oriented program using Classes, Objects.
8. Implement Inheritance and Method Overriding.
9. Implement Exception handling.
10. Implement File handling: Open, close, read, write and append data using file.
11. Implement programs based on Python and MySql Database connectivity.
12. Implement Python programs using NumPy. (e. g. Multiplication of two Matrices inSingle line)
13. Implement Python programs based on Pandas library.

Textbooks:

1. Charles R. Severance," Python for Everybody: Exploring Data using Python 3",1st edition, CreateSpace Independent Publishing Platform, 2016, (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf)(chapters 1-13,15)
2. Sandeep Rakshit, "R for beginners", Mcgraw Hill, ISBN: 9789352604555, 9352604555, Edition: 1, 2017, Pages:424, Manav Book Distributors

References:

1. Allen B.Downey, "Think python: How to Think like a computer Scientist" 2nd edition,Green Tea Press,2015

UAM4031:Busniess Intelligence								
Program Elective I, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	40%

Course Description:

Business Intelligence (BI) refers to technologies, applications, and practices for the collection, integration, analysis, and presentation of business information. The purpose of business intelligence is to support better business decision making.

Prerequisite: - Algorithms & Data Structures

Course Outcomes: After the end of this course students will able to

CO1 **Solve**[4] unstructured business problems using DSS
CO2 **Demonstrate**[3] different mathematical models for decision making
CO3 **Interpret**[3] data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
CO4 **Recommend**[2] alternatives for strategic decision making situations using expert systems and multi-criteria decision making systems.

Syllabus (Theory)

Units	Description	Hours
I	**Overview of business intelligence, analytics, and decision support** Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.	06
II	**Foundations and technologies for decision making** Decision Making: Introduction and Definitions, Phases of the Decision Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems: Capabilities, Classification, Components.	07
III	**Optimization And Multi-Criteria Decision Making Systems** Decision Support Systems Modelling, Structure of Mathematical Models for Decision Support, Decision Making Under Certainty, Uncertainty and Risk. DecisionModelling with Spreadsheets, Mathematical Programming Optimization Decision Analysis with Decision Tables and Decision Trees	07

Multi-Criteria Decision Making with Pairwise Comparisons.

IV	**Automated Decision Systems And Expert Systems** Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems, Location, Based Analytics for Organizations, Cloud Computing in Business	07
V	**Mathematical Models** Mathematical Model for Decision Making, Structure of Model, Classes of Models, Regression Models, Simple Linear & Multiple Linear Regression, Validation of Regression Models, Selection of Predictive Variables with Example	07
VI	**Classification & Clustering** Classification problems, evolution, Classification Tree, Clustering method, partition method, Hierarchical methods, Evaluation of clustering models.	07

Textbooks:

1. Carlo Vercellis "Business Intelligence- Data mining & optimization for Decision Making",Wiley

2. Ramesh Sharda, DursunDelen, Efraim Turban, J. E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10thEdition, Pearson Global Edition, 2013, ISBN: 9781292009209

References:

1. Vicki L. Sauter, "Decision Support Systems for Business Intelligence", 2nd Edition, 2011, Wiley, ISBN: 9780470433744.

Practical

Two hours per week per batch practical is to be utilized for writing to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum of 10-12 experiments. Students of different batches should implement different programs based on following guidelines

1. Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system.
2. Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver / Power BI.
3. Data Visualization from ETL Process
4. Creating a Cube in SQL server
5. Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
6. Implementation of Classification algorithm in R Programming.
7. Practical Implementation of Decision Tree using R Tool
8. Implementation of k-means clustering using R
9. Implementation of Prediction Using Linear Regression
10. Business analysis using different visualization.

UAM4032:Cloud Computing								
Program Elective I, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	40%

Course Description:
Cloud Computing is a branch of computer science that covers management, storage and processing of data on networks of the internet server. Cloud computing delivers on-demand IT resources over the internet.

Prerequisite: - Basic knowledge of Operating System

Course Outcomes: After the end of this course students will able to

CLO1 **Analyze**[4] the basic concepts and services of cloud computing.
CLO2 **Demonstrate**[2] large scale distributed systems and cloud applications
CLO3 **List**[1] the importance of cloud security
CLO4 **Design**[5] Cloud services for IOT Application

Syllabus (Theory)

Units	Description	Hrs.
I	**Introduction to Cloud Computing** Defining Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multitenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines.	07
II	**Virtualization, Server, Storage and Networking** Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of the virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V Different hypervisors and features, Containerization (Docker/Kubernetes)	07
III	**Virtualization** Introduction and benefits, Implementation Levels of Virtualization, Virtualization Structure, Full Virtualization, Para virtualization, Xen Virtualization Architecture, Hypervisors: KVM, Xen, Hyper V Different hypervisors and features, Containerization (Docker/Kubernetes)	07

IV	**Cloud Service Providers** Cloud Service Providers Companies, Difference between AWS, Azure, and Google Cloud Platform, Introduction to IBM Cloud Services, VMware Cloud, Red Hat Cloud, Aneka Cloud**.**	**07**
V	**Open Source and Commercial Cloud Implementation & Applications** Cloud Platforms: Introduction to Amazon EC2, Amazon S3 bucket, Cloud Watch, Lambda / Server less, Google Compute Engine, Microsoft Azure.	**07**
VI	**Cloud Security & Network** Infrastructure Security - Network level security, Host level security, Application-level security. Firewall in Cloud, Authentication in Cloud, VPC design, Load balancer, Types of load balancer, Auto-Scaling, Horizontal scaling, Vertical Scaling, VPN connectivity.	**07**

Practical

Four Hrs. per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Introduction to Amazon Web services AWS.
2. To create a free tire AWS account.
3. To launch an EC2 to instance.
4. To configure private and public key using Putty or Git Bash.
5. To connect EC2 instance using Putty / GitBash
6. To install Linux on EC2 instance and demonstrate Linux basic commands
7. To launch S3 bucket from AWS management console.
8. To configure S3 bucket public policy
9. To deploy a HTML sample page using S3 bucket
10. To install GitHub on EC2 instance and demonstrate GitHub basic operations.

Textbooks:

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley Publications
2. Gautham Shroff, “Enterprise Cloud Computing”, Cambridge University Press.

References:

1. Rajkumar Buyya, J.Broberg, A. Goscinski, “Cloud Computing Principles and Paradigms”, 1st Edition, Wiley Publications.
2. Ronald Krutz and Russell Dean Vines, “Cloud Security: Comprehensive guide to Secure Cloud Computing”, Wiley Publications.

UAM4032:Infromation Security								
Program Elective I, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	40%

Course Description:
This course introduces a variety of topics to build students' skills and understanding of networking, Windows Server, and Security Architecture. The course also introduces networking devices and the Cisco IOS software

Prerequisite: Computer Network fundamentals

Course Outcomes: After the end of this course students will be able to
CO1 Illustrate2 symmetric and asymmetric cryptographic algorithms
CO2 Demonstrate2 Message Authentication Methods
CO3 Examine4 Key Management, Distribution Techniques
CO4 Determine5 the need for security services at the transport, application layers

Syllabus (Theory)

Units	Description	Hrs.
I	**Introduction** Security goals, Cryptographic Attacks, Services and Mechanism, technique Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices Traditional. Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers.	07
II	**Data Encryption Standard** Introduction, DES Structure, DES Analysis, Security of DES, IDEA Advanced Encryption Standard: Introduction, Transformations, Key Expansion, and Analysis of AES.	07
III	**Mathematics of Asymmetric Key Cryptography** Primes, Primality testing, Factorization, Chinese remainder theorem, Asymmetric key cryptography: RSA Cryptosystem, Rabin Cryptosystem.	07
IV	**Message authentication** Message authentication and Hash functions- Authentication functions, MACs, HMAC, CMAC, Hash functions, Digital signatures and authentication protocols, Digital signature standard, Digital Signature Standard. Authentication Applications - Kerberos, X.509 Authentication Service, Public - Key Infrastructure	07
V	**Key management** Symmetric Key Distribution, Kerberos, Symmetric Key Agreement, Security at the Application Layer: Email, PGP: scenarios, key rings, PGP certificate, Trust model in PGP,	07

PGP Packet, PGP Messages, S/MIME:MIME,S/MIME

V I	**Security at the Transport Layer** SSL Architecture, Services, Key Exchange Algorithm, Encryption/Decryption Algorithm, Hash Algorithm SSL Message Formats, Security At the Network Layer: Two Modes, Two Security Protocol and ISAKMP	**07**

Textbooks:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, McGraw Hill Education, 2014

References:

1. William Stallings, “Cryptography and Network Security: Principles and Practice”, 5th Edition, Prentice Hall 2013
2. V.S. Bagad and I.A. Dhotre, “Cryptography and Network Security”, Technical Publications 2012

Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Implementation of Substitution Cipher
2. Implementation of Polyalphabetic Cipher (Vigenère Cipher and Vernam Cipher)
3. Implementation of Transposition Cipher
4. Implementation of Playfair Cipher
5. Implementation of DES algorithm
6. Implementation of AES algorithm
7. Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption)
8. Write a program to simulate RSA algorithm
9. Write a program to simulate any Authentication system.
10. Write a program to simulate the PGP.
11. Implementation the working Process of Kerberos
12. Implementation of Hash function

Textbooks:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security" 2nd Edition, McGraw Hill Education, 2014

References:

1. William Stallings, “Cryptography and Network Security: Principles and Practice” 5 th Edition, Prentice Hall 2013.
2. V.S. Bagad and I. A. Dhotre, “Cryptography and Network Security”, Technical Publications 2012.

UAM404:Introduction to Artificial Intelligence								
UOE, Artificial Intelligence and Machine Learning								
Lect.	Tut.	Pract.	Credits	Evaluation Scheme				
				Component	Exam	Weightage	Mini Pass %	
3	-	1	4	Theory & Practical	FA	50	40	40%
					SA	50	40	40%

Course Description:
In this course you will learn what Artificial Intelligence (AI) is, explore use cases and applications of AI, understand AI concepts and terms like machine learning, deep learning and neural networks.

Prerequisite: - Algorithms & Data Structures

Course Outcomes: After the end of this course students will able to

CO1 **Apply**[3]basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning

CO2 **Discuss**[2]applications in an 'AI language', Machine Learning, data mining tools

CO3 **Discuss**[2]current scope and limitations, and societal implications of AI

CO4 **Demonstrate**[4]applications of neural networks in AI agents.

Syllabus (Theory)

Units	Description	Hours
I	**Introduction:** Introduction to artificial intelligence, Artificial Intelligence is god or Evil,what is Intelligence, what is Artificial Intelligence, Classification of Artificial Intelligence History of AI, Proposing and evaluatingAI applications, Future of AI, AI in Action	07
II	**Search Optimization & Planning:** Problem spaces and search, Knowledge and rationality, Heuristic search-Informed (BFS, A*) & Uniformed Search (DFS, BFS) strategies, Search and optimization (gradient descent), Adversarial search, Planning and scheduling, Case studies: Playing chess, Manufacturingscheduling, Logic and inference,Ontologies, Bayesian reasoning, Temporalreasoning, Case study: Medical diagnosis	07
III	**Machine Learning:** What is machine learning? Supervised vs. unsupervised learning, Regression --linear, logistic, ridge, Classification – decision trees	07

IV	**Probabilistic Graphical Models& CSP:** Probability,Bayes Networks,Inference in Bayes Nets,Hidden Markov Models Dynamic Time Warping, Constraint Satisfaction Problem-Solving Sudoku With AIConstraint Satisfaction Problems. Case study: Bank failure Prediction	**07**
V	**Dimensionality reduction:**PCA, Clustering – k-means, hierarchical clustering, Semi-supervised methods, Reinforcement learning, Choosing among machinelearning techniques, Case study: Public health outcome clustering	**07**
VI	**Neural Networks:**Neural networks and back-propagation, Convolutionalneural networks, Recurrent neural networks and LSTMs	**07**

Textbooks:

1.Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010. Pearson Education, Inc. ISBN: 978-0-13-604259-4

2.Artifcial Intelligence,Elaine Rich, Kevin Knight, Shivashankar B Nair 2010. TataMac Graw hill,2009 Inc. Third Edition

References:

3. "Introduction to Artificial Intelligence": HTTPs://www.udacity.com/
4. https://www.coursera.org/learn/introduction-to-ai by IBM

Practical

Two hours per week per batch practical is to be utilized for writing programs to ensure that students have properly learnt the topics covered in the lectures. It should comprise of minimum 10-12 experiments. Students of different batches should implement different programs based on the following guidelines-

1. Study of PROLOG Programming language and its Functions
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4. Write a program to solve the Monkey Banana problem using Prolog.
5. WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
6. WAP to implement Factorial, Fibonacci of a given numbe:
using Prolog.
7.Write a program to solve 4-Queen problem using Prolog.
8. Write a Program to implement Traveling Salesman Problem using Prolog
9. Write a program to solve water jug problem using LISP.
10 Write a program to implement Hill climbing Algorithm.

Sanjay Ghodawat University, Kolhapur

School of Technology

Department of Computer Science and Engineering

Structure and Contents for S. Y. B. Tech.Artificial Intelligence and Machine Learning Program(AY 2023-24)

UCM001: Foreign Language							
Ver 1.0, University Core, School of Computer Science and Engineering							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
3	-	1	4	Theory & Practical	FA	50	40
					SA	50	40

Course Description:

This course focuses on basic grammar, vocabulary, basic reading, writing, speaking, and listening skills in German Language. This course will enable the students to communicate in simple German in basic day-to-day communication.

Course Learning Outcome(s)

At the end of this course students will able to:

CLO1 Use vocabulary to form basic sentences & questions.

CLO2 Construct grammatically correct and meaningful sentences.

CLO3 Compare nominative and accusative cases.

CLO4 Use techniques and strategies for effective reading and speaking.

UNIT	DESCRIPTION	HOURS
I	**Basics** Alphabets, Pronunciation rules, Numbers 1- 100, Basic day-to-day life Greetings, months, days of the week, Self-introduction, colors, professions	10
II	**Nominative Case, Question Formation & Verbs** **Nominative** – Personal Pronomen, Bestimmte , unbestimmte and negative Artikels, possesive artikels. **Question**- W- fragen and Ja / Nein Fragen **Verbs**- Regular verbs, irregular verbs, modal verbs, separable verbs.	15
III	**Listening Skills**: Importance of Listening, Barriers to Effective Listening. **Speaking Skills**: Situational Conversations: Greetings, Introduction and MeetingPeople introducing yourself and others, Simple Conversation in formal and informal patterns. **Reading Skills**: Types of Reading, Techniques for Effective Reading, Reading Comprehension, and answering questions on it. **Writing Skills**: Writing formal and informal letters. Writing about the daily routine	10

	and eating habits.	
IV	**Accusative Case, Timings, and Adjectives:** Personal Pronomen, Bestimmte , unbestimmte and negative Artikels, possessive artikels. **Timings:** Formal and Informal timings. **Adjectives**: Adjectives and their application.	**10**

References:

- Netzwerk A1 (Deutsch als Fremdsprache), Goyal Publischer.
- Netzwerk Neu A1 (Deutsch als Fremdsprache) Goyal Publischer.
- Studio D A1 Goyal Publischer.
- Tangram A1 Goyal Publischer.

Sanjay Ghodawat University, Kolhapur

School of Technology

Department of Computer Science and Engineering

Structure and Contents for S. Y. B. Tech.Artificial Intelligence and Machine Learning Program(AY 2023-24)

UNM007: Sustainable Development Goals							
University Core, School of Computer Science and Engineering							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
3	-	-	NC	Theory	FA		

Course Description:

The main objective of this course is to enhance students understanding of the SDGs to create a better-informed citizenry, which will lead to a more sustainable action by all and for all.

Course Learning Outcome(s)

At the end of this course students will able to:

CLO1 **Explain2** the necessity of introducing Sustainable Development Goals (SDGs)

CLO2 **Describe1** the types different SDGs and Importance

CLO3 **Analyze3** different remedial steps carried out to achieve the Goals of SDGs

Units	Description	Hrs.
I	**Sustainable Development Goals and Importance**: Members of UNGA, Necessity of Introducing Sustainable Development Goals.	**07**
II	Types of SDGs and importance: Eliminate Poverty, Erase Hunger, Establish Good Health and Well-Being, Provide Quality Education, Enforce Gender Equality, Improve Clean Water and Sanitation, Grow Affordable and Clean Energy, Create Decent Work and Economic Growth, Increase Industry, Innovation, and Infrastructure, Reduce Inequality, Mobilize Sustainable Cities and Communities, Influence Responsible Consumption and Production, Organize Climate Action, Develop Life Below Water, Advance Life On Land, Guarantee Peace, Justice, and Strong Institutions, Build Partnerships for the Goals	**07**
III	Progress of SDG1 to SDG 9: Details of United Nation Report in the year 2022. Development in world and India: Eliminate Poverty, Erase Hunger, Establish Good Health and Well-Being, Provide Quality Education, Enforce Gender Equality, Improve Clean Water and Sanitation, Grow Affordable and Clean Energy, Create Decent Work and Economic Growth, Increase Industry	**07**

IV	Progress of SDG10 to SDG 17: Development in world and India: Innovation, and Infrastructure, Reduce Inequality, Mobilize Sustainable Cities and Communities, Influence Responsible Consumption and Production, Organize Climate Action, Develop Life Below Water, Advance Life On Land, Guarantee Peace, Justice, and Strong Institutions, Build Partnerships for the Goals	**07**

Prescribed:

United Nation Report 2022: https://unstats.un.org/sdgs/report/2022/TheSustainable-Development-Goals-Report-2022.pdf

Recommended:

a. Home Page of SDGs: https://www.un.org/sustainabledevelopment/
b. Global Challenges in SDGs: https://worldtop20.org/global-movement/?gad=1