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.

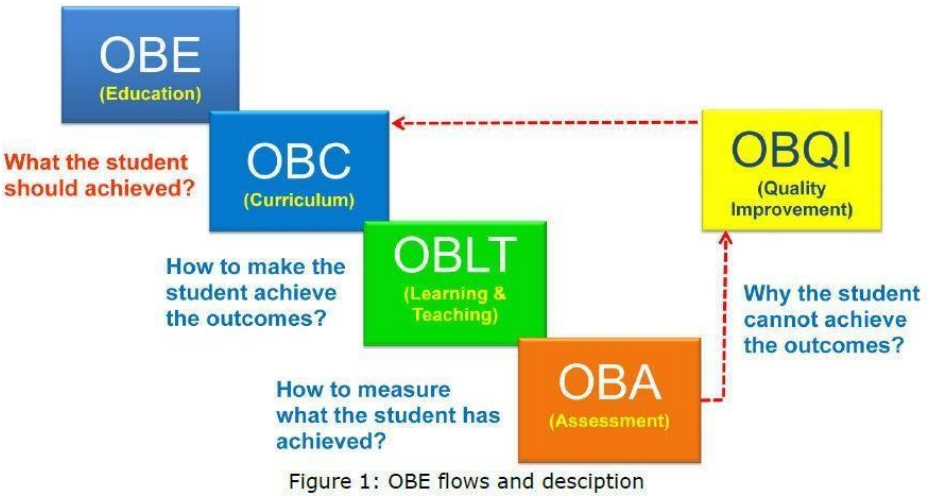
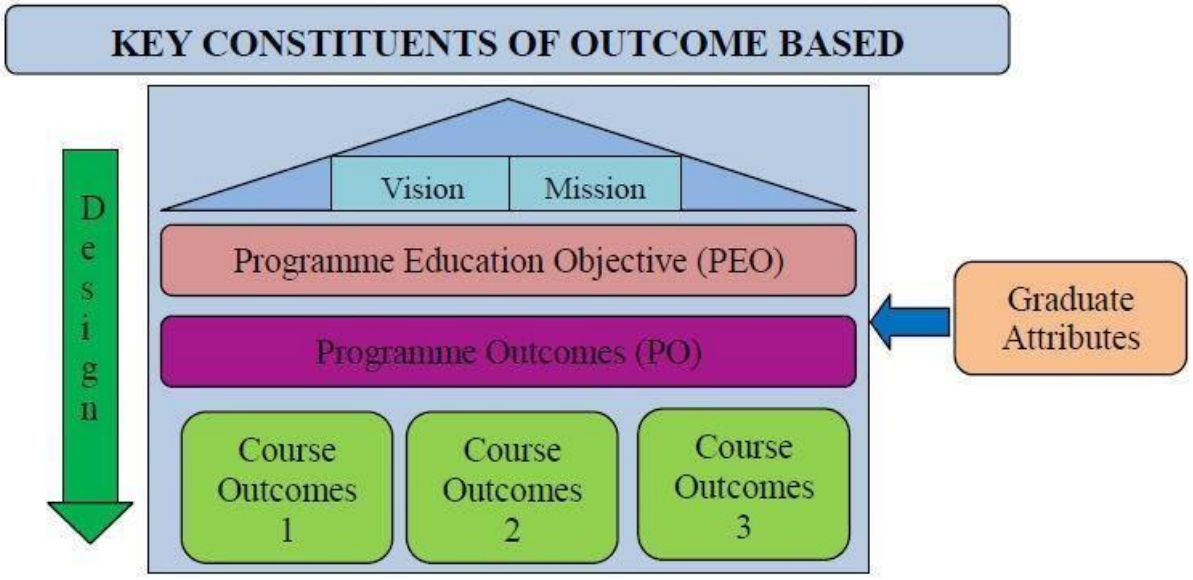


Figure 1: OBE flows and desciption

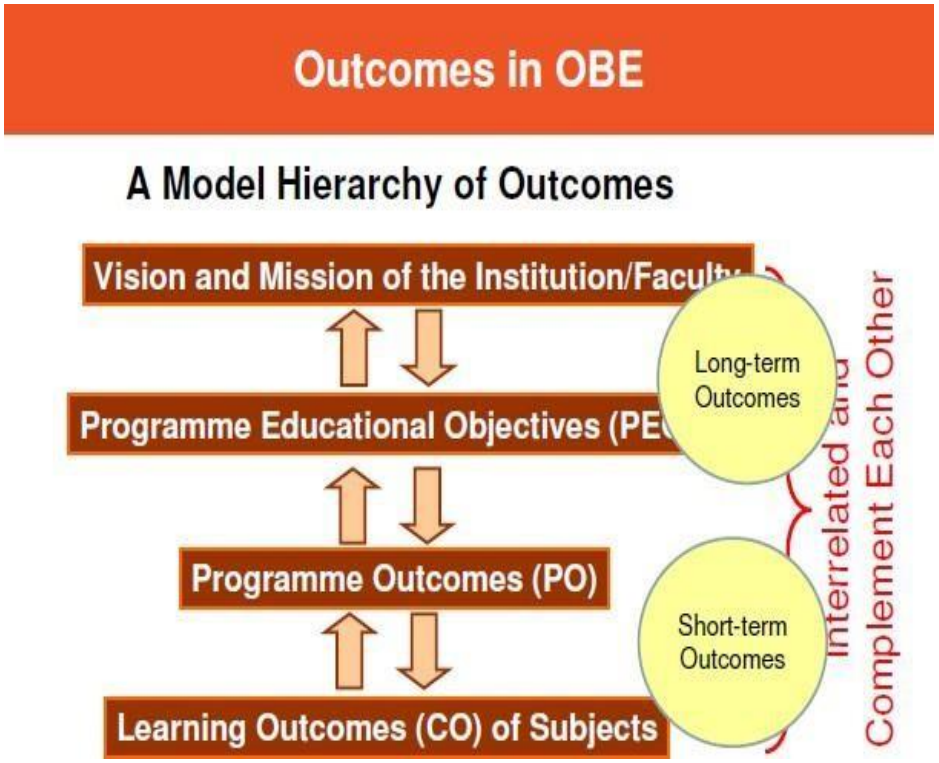


The OBE model measures the progress of the graduate in three parameters, which are

- 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 measure through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education records.



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 2020-21)

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 programmes 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.

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.

5 .0 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.

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.

7.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.

7 .2. 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.

8. 0 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.

9.0 Academic Calendar

The academic activities of the institute are regulated by Academic Calendar and is made available to the students/ 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.

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 FET, CAT1 and CAT2 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. ISE and MSE 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 Faculty Evaluation Theory (FET), Continuous Assessment Tests (CAT1 and CAT2) and End Semester Examination (ESE).

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

Table 10.1.2: Weightage for the theory courses in %

FET	CAT1	CAT 2	ESE
20	15	15	50

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

FET shall be based on student's performance in assignments, quizzes, seminars, Course projects and field assignments, term papers, etc. The mode of FET shall be decided and announced by the Course Instructor at the beginning of the course.

CAT1 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that Semester. The test will be based on first two units of the course.

CAT2 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that semester based on unit 3 and unit 4 of the syllabus.

ESE 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

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.

There shall be no re-examination for CAT1 and CAT2 of the courses having all the three components of evaluation viz. FET, CAT1 CAT2 and ESE. However, a student remaining absent for CAT1 and CAT2 for representing the institute in state level or university level sports/co-curricular activities (on prior recommendation and approval from) or on valid grounds such as illness, death in family or other emergency reason which is beyond control of a student (on approval by the head of department and dean of respective school shall be considered for Make- up examinations.

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 ISE and ESE separately shall be required to get the passing grade.

ESE 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 ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted along with ESEs 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 FET, CAT1, and CAT2 & ESE for a theory course and in PET & ESE for a laboratory course. A course shall then be eligible to apply for re-examination. A student failed in laboratory course shall be eligible to apply only for 100% examination conducted with the laboratory examinations of the subsequent semester. In both cases, a student has to suffer one 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 FET, CAT1 and CAT2 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 FET, CAT1 and CAT2 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 Performance Index (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 FET, CAT1 and CAT2 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 FET, CAT1, CAT2 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 FET, CAT1 ,CAT2 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 FET, CAT1 and CAT2 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 FET, CAT1 and CAT2 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.

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

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 $\geq$ 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 $1/3^{rd}$ 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 courses of that semester.

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 from Batch-2020-2021 TO 2023-24)

Structure for B. Tech AIML Final Year: Semester VII

Course Code	Course Title	L	T	P	C	Component	Evaluation Scheme		
							Exam	WT %	Min. Pass %
AMT1701	Nature Inspired Computing	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT-II	15	
							ESE	50	40
AMT1702	Optimization Techniques	3		-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AMT1703	Deep Learning	3		-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AMT1704	Program Elective III	3		-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AMT1705	Nature Inspired Computing Laboratory	-	-	2	1	Practical	FEP	100	40
AMT1706	Optimization Techniques Laboratory	-	-	2	1	Practical	FEP	50	40
AMT1707	Deep learning Laboratory			2	1	Practical	FEP	50	40
							POE	50	40
AMT1708	Program Elective III Laboratory	-	-	2	1	Practical	FEP	100	40
AMT1709	Software Proficiency Program III - Julia	-		2	2	Practical	FEP	50	40
							POE	50	40
AMT1710	Mini Project			2	1				

Semester – VIII

B Tech (Common to all Programs) Semester – VIII

TRACK – I : Industry Internship Program (IIP-II) with Project

Track	Course Code	Course Title	L	T	P	C	Evaluation Scheme for Theory and Practical			
							Compone nt	Exam	% WT	Pass
I	AMT1801	Industry Internship II	-	-	-	6	Practical Training (OJT)	ISE	50	Min 50
								ESE	50	
	AMT1802	Industrial Project	-	-	-	6	Project	ISE	50	Min 50
								ESE	50	
	AMT1803	Online Course in Advanced Technology (domain area)	-	-	-	4	--	Certifi-cation	100	Min 50
	AMT1804	Self-Study Course (Non-Instruc tional)	-	-	-	4	Report & Presenta-tion	FET	100	Min 50
		Total	-	-	-	**20**	Total Credits: **20**			

Note

Students are required to spend entire semester-VIII in industry allotted and complete the project individually in the company where the students are doing his internship.

Course Codes:
II – Industrial Internship Program with Project;
ED – Entrepreneurship Venture Scheme; RE – Undergraduate Research Opportunity Program;CP – Capstone Project; UE – University Open Elective

TRACK – II : Capstone Project with Program Verticals & University Open Electives

Track	Course Code	Course Title	L	T	P	C	Evaluation Scheme for Theory and Practical			
							Compone nt	Exam	WT	Pass
IV	AMT180X	Programme Elective – IV (as per Vertical)	03	-	-	03	Theory	FET	20	Min 40
								CAT I	15	
								CAT II	15	
								ESE	50	
	UE-2851	University Open Elective I	03	-	-	03	Theory	FET	20	Min 40
								CAT I	15	
								CAT II	15	
								ESE	50	Min 40
	UE-2871	University Open Elective II	02	-	-	02	Theory	FET	20	Min 40
								CAT	30	
								ESE	50	Min 40
	CP-2801	Capstone Project	-	-	12	06	Project	ISE	50	Min 40
								ESE	50	
	CP-2802	Career Planning & Corporate Readiness Program	-	-	-	02	Student Portfolio Grading	FET	100	Min 40
	CP-2803	Online Course in Advance technology(Domain Area)				**04**		FET	100	Min 40
		Total	**08**	**-**	**12**	**20**	Total Hrs: **20**, Total Credits: **20**			

Note

Students arerequired tospendminimum 12hours onproject undertheinstructions fromsupervisor asperthetimetable. Course Codes : II – Industrial Internship Program with Project;
ED – Entrepreneurship Venture Scheme; RE – Undergraduate Research Opportunity Program;CP – Capstone Project; UE – University Open Elective

AMT1701: Nature Inspired Computing							
Ver. 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Soft Computing

Course Description:

To understand the theoretical foundations of Nature Inspired Computing techniques, how they can be used to solve problems and in which areas are most useful and effective.

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Evaluate[4]** genetic algorithms

CO2 **Interpret[3]** Firefly algorithms & cuckoo search.

CO3 **Experiment[3]** Swarm Intelligence system & bat algorithm.

Syllabus (Theory)

Units	**Description**	**Hrs.**
I	**Analysis of algorithms:** Analysis of optimization algorithms, Nature Inspired Algorithms, Parameter tuning and parameter control: Parameter tuning, Hyper optimization, Multi objective view, parameter control, simulated annealing: algorithm, basic convergence properties	**07**
II	**Genetic Algorithms:** Introduction, Role of genetic operators, procedure of genetic algorithms, working of GA'S, Genetic algorithm applications. **Differential Evolution:** introduction, Differential evaluation, variants, choice of	**07**

parameters, convergence analysis.

III **Firefly Algorithms:** **Z**

Firefly Behavior, Standard firefly algorithms variations of light intensity and attractiveness, Controlling randomization, firefly algorithms in applications.

Cuckoo search:

Cuckoo breeding behavior, levy flights, Cuckoo Search: Special Cases of cuckoo search, Variants of cuckoo search, Global Convergence, applications.

IV **Swarm Intelligence System:** **07**

Introduction to swarm intelligence, background of swarm intelligence, ant colony system, working of ant colony optimization, application of ant colony optimization. Particle Swarm Optimization: Swarm Intelligence, PSO Algorithm, Accelerated PSO, Binary PSO.

V **Bat Algorithms:** **07**

Echolocations of bats: Behavior of microbats, Acoustics of echolocation, Bat algorithms: Movements of virtual Bats, Loudness and Pulse Emission, binary bat algorithm, variants of the Bat Algorithm, Convergence analysis, Application: Continuous optimization, combinatorial optimization and Scheduling, Inverse Problems and parameter estimation, classifications, clustering and Data mining, Image processing, Fuzzy logic and other applications.

VI **Flower Pollination Algorithms:** **07**

Introduction, Characteristics of flower pollination, flower pollination algorithms. Multi objective flower pollination algorithms, validation and numerical Experiments:Singal objective Test funcations,Multi-objective test functions,Applications:Single objective design Benchmarks,Multi objective Design Benchmarks.

Textbooks:

1. “Nature-Inspired Optimization Algorithms”-Yang, Xin-She, ElsevierScience,2014

2. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms andApplications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

References:

1. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies",MIT Press, Cambridge, MA, 2008.

2. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.

3. Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005

AMT1702:Optimization Techniques							
Ver. 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Linear Algebra and Numerical Methods

Course Description: Optimization is the search for the best and most effective solution. In this course, optimization techniques will be examined through a Business Analytics le ns. The students will be introduced to the theory, algorithms, and applications of optimization. Linear and integer programming will be applied to problems involving data.

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

CO1 **Apply**[3] the methods of optimization in real life situation
CO2 **Formulate**[4] optimization problems
CO3 **Analyze**[4] and appreciate variety of performance measures for various optimizationproblems

Syllabus (Theory)

Units	**Description**	**Hrs.**
I	**Introduction to Optimization:** Introduction, Methods of operation research, History of optimization, Decision variables, objective functions, Constraints, Objective function surfaces, Constraints surface. Engineering applications of Optimization	7
II	**Classical Optimization Techniques:** Introduction, Single variable Optimization,Multi-Variable Optimization with no constraints,Multi variable Optimization with Equality constraints,Multi-variable Optimization within Equality Constraints, Kuhn Tucker Conditions	7
III	**Linear Programming:** Introduction, Mathematical formulation of LLP, Solution of LLP: Solution by graphical method, simplex method, pivotal reduction of general system of equations	7
IV	**Assignment Problem**:	

Introduction, Mathematical representation of assignment model, Hungarian Assignment algorithm for solving minimal assignment problem, Assignment problem with non-square matrix, Restrictions on assignment, The Travelling salesman problem, A typical assignment problem.

V **Transportation Problem:** 7
Introduction, Difference between transportation and assignment problem, Important definitions, Salutations: Making a Transportation model in form of matrix, North-West corner rule, Lowest cost entry method, Vogel's Approximation Method(VAM), Optimality Test

VI **Game Theory:** 7
Introduction, Competitive games, Definitions, maximin and minimax criterion of optimality, solution of pure strategy games with saddle-point, game with no saddle point, rule of dominance (principle of dominance)

Text Books:

1." Optimization methods of engineers",N.V.S.Raju,PHO,2014

2."Engineering Optimization: Methods and applications",A.Ravindran,Wiley 2006

References:

1. Laurence A. Wolsey (1998). *Integer programming*. Wiley. ISBN 978-0-471-28366-9.

2. John K. Karlof (2006). *Integer programming: theory and practice*.CRC Press. ISBN978-0-8493- 1914-3.

3. Dimitris Bertsimas; Robert Weismantel, *Optimization over integers. Dynamic Ideas*.ISBN 978-0 9759146 2-5, 2005.

4. Der-San Chen; Robert G. Batson; Yu Dang, *Applied Integer Programming: Modelingand Solution*, John Wiley and Sons. ISBN 978-0 470 37306-4, 2010.

AMT1703:Deep Learning							
Ver. 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Knowledge in Linear Algebra and Probability, Machine learning

Course Description: This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. Deep learning algorithms extract layered high- level representations of data in a way that maximizes performance on a given task.

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

CO1 **Understand**[2] the algorithmic topics of deep learning
CO2 **Build**[6] application using Convolutional Neural Networks & Sequence modeling
CO3 **Apply**[3] the Auto Encoders in practical applications
CO4 **Use**[6] deep learning architectures for developing applications

Syllabus (Theory)

Units	Description	Hours
I	**Fundamentals Concepts of Machine Learning:** Historical Trends in Deep Learning-Machine Learning Basics: Learning Algorithms-Supervised and Unsupervised Training, Testing, Cross-Validation, Over/Under-fitting, Hyper parameters and validation sets, Estimators, Bias, Variance, Regularization-Introduction to a simple DNN, Platform for deep learning, Deep learning software libraries.	7
II	**Deep Feed Forward Networks:** Deep feed forward networks-Introduction-Learning XOR- Gradient-Based Learning-Various Activation Functions, error functions- Architecture Design-differentiation algorithms- Regularization for Deep learning- Early Stopping, Drop out	7
III	**Convolutional Neural Networks and Recurrent Neural Networks:** Convolutional layers, Object Detection, Kernel, Cross-correlation and convolution operation, Padding, Stride, Pooling, Image augmentation, SGD for CNNs, 3D CNNs, Sequence Modeling, RNN Models, LSTM	7
IV	**Auto Encoders:** Auto encoders - Auto encoders: under complete, regularized, stochastic, demising, contractive, applications– dimensionality reduction, classification, recommendation, Optimization for Deep Learning: optimizers.	7
V	**Deep Architectures in Vision:** Deep Architectures in Vision: Alex net, ResNet -	7

Image Augmentation, Fine-Tuning, Object Detection and Bounding Boxes, Anchor Boxes, Transfer Learning, Generative adversarial networks

VI	**Applications of Deep Learning**: Introduction to-Large Scale Deep Learning, Computer Vision, Speech Recognition, natural language processing & other applications	7

Textbooks:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016 (available at http://www.deeplearningbook.org)
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

References:

1. Michael N ielsen, Neural Networks and Deep Learning, Online book, 2016 (http://neuralnetworksanddeeplearning.com/)
2. Jason Brownlee , Deep Learning with Python, Ebook, 2016

AMT17041:Computer Vision							
Program Elective, Artificial Intelligence and Machine Learning							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass%
3	-	-	3	Theory (100 Marks)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Computer graphics, Data structures

Course Description: The course is about an introduction to the analysis of images and video in order to recognize, reconstruct and model objects in the three-dimensional world. Course describes application of machine learning and deep learning techniques for image and video processing.

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

CO1 **Apply**[4] low level processing on digital images
CO2 **Discuss**[6] multi-camera views
CO3 **Compare**[4] feature extraction & image segmentation methods
CO4 **Analyze**[4] pattern & motion recognition methods

Syllabus (Theory)

Units	Description	Hours
I.	**Digital Image Formation and low-level processing:** Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing	7
II.	**Depth estimation and Multi-camera views:** Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.	7

III. **Feature Extraction:** Edges - Canny, LOG, DOG; Line detectors (HoughTransform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT 7

IV. **Image Segmentation:** Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection **7**

V. **Pattern Analysis:** Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un- supervised, Semi-supervised; Classifiers: Bayes, KNN, Convolution Neural Networks **7**

VI. **Motion Analysis:** Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation **7**

Textbooks/ References :

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer-VerlagLondon Limited 2011.
2. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, PearsonEducation,2003
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in ComputerVision, Second Edition, Cambridge University Press, March2004.
4. K. Fukunaga, Second Edition, Introduction to Statistical Pattern Recognition,Academic Press, Morgan Kaufmann, 1990.
5. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

AMT17042:Introducation to Robotics							
Program Elective, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Artificial Intelligence

Course Description: The objectives of this course are Identify robots and its peripherals for satisfactory operation and control of robots forindustrial and non-industrial applications

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

CO1 list and explain the basic elements of industrial robots
CO2 analyses robot kinematics and its control methods
CO3 Classify the various sensors used in robots for betterperformance.
CO4 Summarize various industrial and non-industrialapplications of robots

Syllabus (Theory)

Units	Description	Hours
I	**Introduction to Robotics** : to automation & its types, History & evolution of robotics, Definition of robots, Robotic manipulators, Types of robots, Generations of robots, Laws of robotics, Classification of robots & its applications, Specifications of robots.	7
II	**Robot Anatomy :** Anatomy of robots, Drive systems, Actuators and Power Transmission systems, Types of drives & its applications, Hydraulic drives, Pneumatic drives, Electric drives, Hybrid drives, Robot activation & feedback components	7
III	**Sensors in robotics :** Touch Sensors, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Force Sensors, Light sensors, Pressure sensors, Ultrasonic sensors, Infra-red sensors, Pots, Encoders, Position & Velocity Sensors	7
IV	**Articulated Mechanical System:** Materials used for robot design & its properties, Transmission devices in robots & its types, End effectors, Types of end effectors, Tools & Grippers, Classification of tools & grippers, Types of tool & gripper actuations.	7

V	**Robot Controllers & Programming :** Robot brain, Controller & its types, Need for controller in robots, Robot simulation, Robot software, Robot Programming & the Languages, Types of robot programming, Industrial robot programming	7
VI	**Robot Applications** : Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Social, Environmental & economic issues in robot applications, Advantages & Disadvantages of Robotization.	7

Textbooks:

1. Dr. T.C.Manjunath, "Fundamentals of Robotics", Nandu Publishers, 5th Edn., India, 2005.
2. Elaine Rich & Kevin Knight, "Artificial Intelligence", Mac Graw Hill, Singapore, 3rd Edn., 2017.
3. Dr. T.C.Manjunath, "Fast Track to Robotics", Nandu Publishers, 2nd Edn., Mumbai, Maharashtra, India, 2005.
4. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics: Control Sensing Vision & Intelligence", Mac Graw Hill, USA, 5th Edition, 2010.
5. Robin R. Murphy, "Introduction to AI and Robotics", MIT Press, Second Edition, 648 pp., Oct. 2019

References:

1. Industrial Robotics, Technology, Programming & Applications, Grover, Weiss, Nagel, Ordey,Mc Graw Hill.
2. Robotic technology & Flexible Automation, S R Deb. TMH.
3. Robotics for Engineers, Yoram Koren, Mc Graw hill.
4. Fundamentals of Robotics, Larry Health.
5. Robot Analysis & Control, H Asada, JJE Slotine.

AMT1705: Nature Inspired Computing Lab							
Ver. 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
-	-	2	1	Theory (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: Soft Computing

Course Description:

To understand the theoretical foundations of Nature Inspired Computing techniques, how they can be used to solve problems and in which areas are most useful and effective.

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Experiment**[3] Swarm Intelligence system & bat algorithm.

CO2 **Implementation** different optimization algorithms

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	Practical Implementation using Simulation Annealing Algorithm
2	Practical Implementation using Genetic Algorithm
3	Practical Implementation using Fire Fly Algorithm
4	Practical Implementation using Cuckoo Search Algorithm
5	Practical Implementation using Particle Swarm Optimization Algorithm
6	Practical Implementation using Bat Algorithm
7	Practical Implementation using Flower Pollination Algorithm
8	Practical Implementation using Spider Monkey Optimization Algorithm
9	Practical Implementation using Artificial Bee Colony

Textbooks:

3. "Nature-Inspired Optimization Algorithms"-Yang, Xin-She, ElsevierScience,2014

4. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms andApplications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

References:

4. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies",MIT Press, Cambridge, MA, 2008.

5. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.

AMT1706: Optimization Techniques Lab							
Ver. 1.0, Program Core, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: Basic linear algebra, calculus

Course Description:

Introduction to optimization techniques using both linear and non-linear programming. The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Experiment**[3] Swarm Intelligence system & bat algorithm.

CO2 **Implementation** different optimization algorithms

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	Practical Implementation of graphical method to solve LLP
2	Implementation of algorithm to find BFS
3	Implementation of Simple duplex method
4	Implement Vogel's Approximation method
5	Implement algorithm of weighted sum method to multiple objective LLP
6	Implement algorithm of Fibonacci search technique
7	Implement Game thory
8	Implement Pivotal reduction
9	Implement Kuhn Tucker Condition

Text Books:

1." Optimization methods of engineers",N.V.S.Raju,PHO,2014

2."Engineering Optimization: Methods and applications",A.Ravindran,Wiley 2006

References:

1.Laurence A. Wolsey (1998). *Integer programming*. Wiley. ISBN 978-0-471-28366-9.

2.John K. Karlof (2006). *Integer programming: theory and practice*.CRC Press. ISBN 978-0-8493- 1914-3.

3.Dimitris Bertsimas; Robert Weismantel, *Optimization over integers. Dynamic Ideas*.ISBN 978-0 9759146 2-5, 2005.

4.Der-San Chen; Robert G. Batson; Yu Dang, *Applied Integer Programming: Modelingand Solution,* John Wiley and Sons. ISBN 978-0 470 37306-4, 2010.

AMT17081:Computer Vision Lab							
Program Elective, Artificial Intelligence and Machine Learning							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass%
-	-	2	1	Theory (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: Image Processing

Course Description:

This course is a broad introduction to computer vision. Topics include camera models, multi-view geometry, reconstruction, some low-level image processing, and high-level vision tasks like image classification and object detection.

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Experiment** Image Formation·
CO2 **Implementation** of edge & line detection.

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	Program for Reading, Writing and Displaying Images
2	Program for Changing Color Spaces
3	Program to resize Images
4	Program to Rotate Images
5	Programs using Histogram Equalization
6	Programs for Edge detection
7	Programs for Line Detection
8	Programs using Scale Invariant Feature Transform (SIFT)
9	Programs for Motion Detection
10	Programs for Face Detection
11	Programs to differentiate objects

Textbooks/ References :

1. Richard Szeliski, *Computer Vision: Algorithms and Applications,* Springer-VerlagLondon Limited 2011.
2. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach,* Pearson Education,2003
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in ComputerVision, Second Edition, Cambridge University Press, March2004.
4. K. Fukunaga, Second Edition, Introduction to Statistical Pattern Recognition,Academic Press, Morgan Kaufmann, 1990.

R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992

AMT17042:Introducation to Robotics Lab							
Program Elective, Artificial Intelligence and Machine Learning							
Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass%
-	-	2	1	Theory (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: AI

Course Description:

laboratory-based introduction to robotics. Focus will be on both hardware (sensors and actuators) and software (sensor processing and behavior development). Topics will include: the basics in kinematics, dynamics, control, and motion planning; and an introduction to Artificial Intelligence (AI) and Machine Learning.

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Use** Fundamental and technical knowledge of robot programming
CO2 **Use** RAPID language and AML

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	Robat programming using Flex Pendant-Lead through programming including coordination system of Robot
2	Wrist Mechanism-Interpolation-interlock commands
3	VAL language commands motion control, Hand Control, program control, pick and place applications
4	Palletizing application using VAL
5	Object detection and sorting
6	Robot welding application using VAL program
7	RAPID language and AML

Textbooks:

1. Dr. T.C.Manjunath, "Fundamentals of Robotics", Nandu Publishers, 5th Edn., India, 2005.
2. Elaine Rich & Kevin Knight, "Artificial Intelligence", Mac Graw Hill, Singapore, 3rd Edn., 2017.
3. Dr. T.C.Manjunath, "Fast Track to Robotics", Nandu Publishers, 2nd Edn., Mumbai, Maharashtra, India, 2005.
4. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics: Control Sensing Vision & Intelligence", Mac Graw Hill, USA, 5th Edition, 2010.
5. Robin R. Murphy, "Introduction to AI and Robotics", MIT Press, Second Edition, 648 pp., Oct. 2019

References:

1. Industrial Robotics, Technology, Programming & Applications, Grover, Weiss, Nagel, Ordey,Mc Graw Hill.
2. Robotic technology & Flexible Automation, S R Deb. TMH.
3. Robotics for Engineers, Yoram Koren, Mc Graw hill.
4. Fundamentals of Robotics, Larry Health.
5. Robot Analysis & Control, H Asada, JJE Slotine.

AMT17083:Fundamental of Tensor Lab							
Program Elective, Artificial Intelligence and Machine Learning							
Lect.	**Tut.**	**Pract.**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass%**
3	-	-	3	Theory (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: Basic Mathematics

Course Description:

laboratory-based introduction to robotics. Focus will be on both hardware (sensors and actuators) and software (sensor processing and behavior development). Topics will include: the basics in kinematics, dynamics, control, and motion planning; and an introduction to Artificial Intelligence (AI) and Machine Learning.

Course Objective: Students will be able to List architectural elements of modern processors and explain their impact on performance.

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

CO1 **Use** Fundamental and technical knowledge of robot programming
CO2 **Use** RAPID language and AML

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	Vector spaces, inner products and norms.
2	Linear operators, matrices and canonical forms.
3	SVD and low rank approximations.
4	Tensors products of spaces and Kronecker products.
5	Rank of tensors.
6	Multilinear maps as tensors. Applications to product of matrices
7	Low rank approximation of tensors
8	The role of algebraic geometry in tensor analysis: Segre varieties.
9	Applications to algebraic statistics: Phylogenic ideals and varieties for general Markov model.

AMT1709: Software Proficiency Program III							
Program Core, Artificial Intelligence and Machine Learning							
Lect	**Tut**	**Pract**	**Credits**	**Evaluation Scheme**			
				Component	**Exam**	**Weightage %**	**Pass %**
-	-	2	1	Practical (100 Marks)	FEP	50	40
					POE	50	40

Pre-requisites: Programming skills

Course Description: Julia is a high-level, high-performance dynamic programming language developed specifically for scientific computing.

Course Objective: To enable the students to program in Julia language.

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

CO1 **Apply**[3] data structures , object oriented programming, networking concepts in Julia

CO2 **Examine**[4] Data Frames ,plots and make use of R and Python libraries in Julia

Practical/Experiments:

Four hours per (week/batch) practical is to be utilized for learning Python. This shall include extra problem statements and there implementations to strengthen the programming logic. It should comprise of minimum of 16-17 experiments. Students of different batches should implement different programs based on following guidelines

	Experiment Title
1	Basics of Julia for Data Analysis-Running your first program
2	Basics of Julia for Data Analysis-Loops, Conditionals, Functions in Julia
3	Programming in Julia- Object Oriented Features, type system
4	The Julia Ecosystem-Packages (common scientific computing packages, and how to use them) - graphics, math packages, graph theory, optimization, etc.
5	Meta-programming in Julia
6	I/O, Networking, parallel computing
7	Exploratory analysis with Julia-Introduction to Data Frames.

8	Exploratory analysis with Julia-Visualization in Julia using Plots.
9	Exploratory analysis with Julia-Bonus – Interactive visualizations using Plotly
10	Visualizing Data with Scatterplots, Histograms, and Box Plots
11	Data Munging in Julia
12	Building a predictive ML model-Logistic Regression
13	Building a predictive ML model- Decision Tree
14	Building a predictive ML model- Random Forest
15	Calling R libraries in Julia-Using pandas with Julia
16	Calling Python libraries in Julia-Using ggplot2 in Julia

Text Books:

1. Ivo Balbaert , Adrian Salceanu, *Julia 1.0 Programming Complete Reference Guide*, Packt Publishing, May 20, 2019

References:

1. Paul D. McNicholas, Peter Tait, *Data Science with Julia*, 1st Edition, CRC Press Publications, January 11, 2019.
2. Ivo Balbaert, *Getting Started with Julia*, Kindle Edition, Packt Publishing, 2015

AMT1710: Mini Project-III							
Program Core, Artificial Intelligence and Machine Learning							
Lect	Tut	Pract	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass %
-	-	2	1	Practical (100 Marks)	FEP	50	40
					POE	50	40

Prerequisite: - Computer Programming Language, Database Concepts, Software Engineering Concepts, Operating System Concepts, Computer Network Concepts.

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

CO1 Apply3 the engineering approach to solve the real time problems.

CO2 Apply3 the skills of team building and team work.

Contents

The Mini Project work should be carried out by using free and Open source softwares. The students should form group of 3 to 4 students each and every group is supposed to choose a specific domain in which they would like to develop their expertise. Further, the group should identify the relevant problem and propose the solution, which can be implemented as a miniproject using suitable technology. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report in the format provided by the department. Periodic internal review shall be conducted which is evaluated by panel of examiners. The mini project work will be evaluated in the mid and end of the semester during which the group should give presentation and demonstration of their work done.
Evaluation of the mini project will be based on the following criteria: Originality and Novelty Project Scope, Objectives and Deliverables Understanding of the Project Concept Output of Results and Proper Documentation Final Reports and Presentations Two hours per week per batch practical is to be utilized for project work.
Students should follow following sequence of activities :

1. Project topic and title finalization.
2. Submission of proposal for project work (Synopsis)

3. First presentation which includes
a. Requirements analysis
b. Architecture
c. Data design
d. Algorithm design
e. Module identification
f. Class properties
g. Method identification. If applicable)
4. Level 0 & Level 1 DFD
5. Object oriented analysis (UML diagrams).
6. Second presentation.
7. End Semester Review in 3rd Presentation (after 100 % implementation of all modules).
8. Project report preparation.

Textbooks:
1. Pankaj Jalote, Software Engineering: A precise Approach, Wiley India, 2010.
2. Yashvant Kanetkar, Let Us C, BPB Publications, 2016.

References:
1. Paul Cobbaut, Linux Fundamentals, CEST, 2015.

B.Tech (Common to all Programs) Semester- VII OPTIONS to Students (TRACKS)

Choices are given to students in terms of tracks to pursue their interest of study. In the B. Tech Semester VII,students are required to undertake the pre-work in respect of chosen tracks and this activity is assigned one credit. The tracks available to students are:

Track	Details of Track	Credit Assigned
Track 1	**Industry Internship Program (IIP II) with project.**	**1**
Track 2	**Capstone project with Vertical and University Open Electives**	**1**

Each student should choose one of the tracks at the beginning of the seventh (VII) Semester and the same track will continue through the B. Tech VIII Semester. Once selected the track in the VII semester, no change in track isallowed as pre-work is assigned to each of the selected track.

As a part of preparation to the selected track, a pre work is designed to prepare the students for effectively completing the track in semester VIII and students are evaluated for their performance in assigned work through designedassessment schemes. This pre-work is assigned one credit.

B Tech (Common to all Programs) Semester – VIII

TRACK – I : Industry Internship Program (IIP-II) with Project

Track	CourseCode	Course Title	L	T	P	C	Evaluation Scheme for Theory and Practical			
							Compone nt	Exam	% WT	Pass
I	AMT1801	Industry Internship II	-	-	-	6	Practical Training (OJT)	FEP	100	Min 50
	AMT1802	Industrial Project	-	-	-	6	Project	FEP	50	Min 50
								POE	50	
	AMT1803	Online Course in Advanced Technology (domain area)	-	-	-	4	--	FET	100	Min 50
	AMT1804	Self-Study Course(Non-Instruc tional)	-	-	-	4	Report & Presenta-tion	FET	100	Min 50
	Total		-	-	-	20	Total Credits: 20			

Note
Students are required to spend entire semester-VIII in industry allotted and complete the project individually in the company where the students are doing his internship.
Course Codes:
II – Industrial Internship Program with Project;
ED – Entrepreneurship Venture Scheme; RE – Undergraduate Research Opportunity Program;CP – Capstone Project; UE – University Open Elective

B Tech (Common to all Programs) Semester – VIII

TRACK – I : Industry Internship Program (IIP-II) with Project Phase – II

Industry Internship Program (IIP-II)

AMT1801: Industrial Internship

Sanjay Ghodawat University place high focus on the interaction with industries to give them adequate exposure to the practicing aspects of theoretical knowledge they learn in classroom. Moving a step ahead, in order to enhance the students experience with world of work, we are introducing industry internship with project after a through consultation with industry persons, academicians as a part of the major curricular reforms in the choice based credit system (CBCS).

Choice Based for students at Semester VIII for full semester (16 weeks) and pre -work at semester VII (Preparation)This track aims at giving students hands on experience with the world of work which imbibes in them the skills and competencies required to make them competent graduates for employment as per the expectation of the industry. It is a semester long (16 Weeks) course where the students are expected to work as interns and carry out the individual project assigned to them by the company. The students learning progress is monitored by both industry person concerned and the institutional l Faculty assigned.

This course aims at giving students hands on experience to the world of work which imbibes in them the skills and competencies required to make them competent graduates for employment as per the expectation of the industry. It is a semester long course where the students are expected to work as interns and carry out the individual project assigned to them by the company. The students learning progress is monitored by both industry person concerned and the institutional Faculty assigned.

IIP track has two components
Internship training in the industry for full semester.
Individual Project Assignment in the same company

CRITERIA FOR SELECTION OF STUDENTS

The students who want to opt for IIP II and project track are required to fulfill the criteria specified below:

CGPI of students up to semester VI should be ≥ 6.75 (with no backlogs)
Ready to move to the place where industry assignment is allotted.
The entire cost of the Internship will be borne by the students (lodging boarding and any other cost). However, any facilities extended by the company like conveyance facility, subsidizedcanteen facility and stipend the students can avail.
They have to go through the selection process of the company if required.
Maximum number of students will be decided based on the policy guidelines prepared by the university/Department and also availability of internships at industries from time to time.
Once the student is allotted the company (after final selection process) cannot be changedand it is binding on the student to complete the assignment in that company.

CRITERIA FOR LISTING OF COMPANIES

It should be a medium or large scale industry having the functional departments and facilities to design develop and manufacture the products or offer services and potential to offer challenging projects.

Company should provide minimum 2-3 internship assignments along with projects and extend facilities tostudents the on the job training (OJT) as well as access to data & information and guidance to complete theassigned project.

Should be able to keep record of attendance and provide a mentor to monitor the project and help the students to sort out problem/ issues.

Students who are eligible as per criteria and get the internship with their own contacts can also be considered subjected to approval of the company by the University for Internship.

PROJECT ASSIGNMENT

A student doing internship in the company is required to carry out an individual project in the domain specific area with help of company mentor/Guide and faculty guide assigned to qualify for the credits mentioned instructure and also required to undergo self-study or online certification course approved by Department Program Committee of the host department.

The project proposal is to be prepared and get approved by the DPC of the department student is required select the problem for solution which requires a problem definition, data Collection, analysis and implementation of the solution, Design, fabrication and testing as applicable (It is not a just company Internship Report)

INDUSTRY INTERNSHIP AND PROJECT MONITORING

A team of faculty members from the institute assigned will monitor closely the progress of training and project and helps to sort out any issues concerned. The institute faculty accountability includes proper orientation ofstudent in the company, helping in finalizing project assignments, mentoring the student for overall effectiveness of internship program and a liaison between companies, student and the department.

OUTCOME EXPECTED AT THE END OF IIP II

After the successful completion of the IIP-2, the student should be able to
Understand the functioning of the company in the term so fin puts, transformation process and the outputs(products and services)
Develop an attitude to adjust with the company culture, work norms, code of conduct.
Understand and follow the safety norms, Code of conduct.
Demonstrate the ability to observe, analyze and document the details as per the industry practices.
Understand the processes, systems and procedures and to relate to the theoretical concepts that is beingstudied.
Improve the leadership abilities, communication.
Demonstrate project management and finance and cost management skills

OUTCOME EXPECTED FROM PROJECT

After the successful completion of the project, the student should be able to;

Identify the project/problem in the domain of program and relevant to the company.
Collect the information to the pertaining to the problem identified.
Analyze the information using the statistical tools/ techniques.
Suggest the feasible alternative solution and select the best solution.
Present the solution to the company and seek assistance in the implementation.
Measure the impact of the project on the performance of company/department/section.

INTERNSHIP MONITORING

Each student is assigned a faculty mentor by the program department who monitors the progress of both the internship and project and helps the student to sort out any issues/ problems faced by the students. The faculty isscheduled to make five visits during the internship

1	At the beginning of the program for orienting students to the company.	Prior to the program or during First week of program
2	Finalization of project proposal	During 4th week
3	Mid of the program (to review program)	Between 8th and 9th Week
4	Final progress review	During 15th week
5	At the end of the internship for evaluation	During16 the week

Note: Apart from these scheduled visits, the faculty on request of students/company will visit in case of any issue related to the internship /project.

WORK DIARY

Each student is provided with a diary which contains details regarding internship, do's and don'ts and evaluationscheme. Students is required to write the dairy regularly and get it signed by the industry guide periodically duringthe visit the faculty assigned to the student should be able to go through the dairy to access the work done and write the remarks/ instruction. At the end of the internship, the duly completed dairy to be submitted to the department.

EVALUATION OF INTERNSHIP: (6 CREDITS)

The assessment of the internship will be done jointly by the industry and the faculty assigned to the students. The tentative scheme of assessment will be

Punctuality, behavior and following code of conduct (to be assesse d by the companypersonal) 20%
Initiative, observation and interest in learning new things(faculty in charge) 20%
Familiarization with specific Department/shop/function assigned to student (to beassessed by the company personal) 20%
Final evaluation based on presentation of work, internship report 40%
(jointly by the company personnel and examiner appointed by institute & facultyguide.

Minimum 50% is mandatory for successful completion of internship or els e the extension will be given to makethe student to come up to the expectation.

AMT1802: Industrial Project

EVALUATION OF THE PROJECT (6 CREDITS)

Project/Problem identification and preparation of project proposal approved by both the company and faculty 20%
endorsed by the DPC
Mid review of the project as per schedule specified jointly by company and facultyassigned. 30%
Final examination of the project along with detailed project report
(industry person + Faculty guide + External examiner, either at institute/company as per the convenience) 50%

The student is required to complete both internship and project successfully to become eligible for award of the degree along with the credits for the self-study/online /certification courses.

A special certificate will be awarded to student by the university along with B Tech Degree after successful completion of IIP II and Project in industry.

Special Note: The terms of reference are subjected modifications as per the prevailing conditions at the time and academic council decision in this respect is final and binding to all the concerned with this track I

AMT1803: Online Course (MOOCS)

Student should register for the online course of minimum 2 weeks offered by SWAYAM, NPTEL, Course era or any other authorized platforms. The courses which the student registers should be advanced in the domain area and should be able to help students in the project assignment the yare doing in company. The courses are to be approved by the committee appointed by the department. Student should complete the course and after the examination should produce a certificate. Unless student produces the grade certificate to the department, the course will not be complete. Course will be graded based on certificate credentials mentioned on the certificate by the authorized agency.

Evaluation

Certification with grades	**100%**

Note: The students should preferably register for the course in consultation with coordinator, MOOCS, Sanjay Ghodawat University Kolhapur.

AMT1804: Self Study Course

Students who choose Industry Internship Program (IIP II) and Project should undergo a self-study course of one credit. The objectives of this self-study course are to give freedom to choose the course of interest area and promote lifelong learning. It also helps to develop independent learning without the instructors.

The skills and outcomes expected at the end of the course is student will be able to choose the course from variety of courses available, plan and organize the study, Collect the information from relevant sources and prepare a concise report and give presentation about what he has learnt. A guide is allotted to the student to finalize the course title and contents. The courses student opts should not have been the part of curriculum for the program of study.

The following types of courses may be selected by the student:

Advanced technology courses from any domain area of technology.
Course in the area of Music, Drama, Fine arts and Literature. Journalism.
Courses in the area of sports, travel and tourism
Courses in contemporary issues in Management, economics and Social Issues.
Any foreign language or Indian Language (Which you do not know).
Courses on nature, philosophy and Indian history.

The list is not exhaustive and you can choose the courses other than areas listed here.

Evaluation
Student is evaluated based on the report and presentation with assessment rubrics.

FET (In semester Evaluation)	50%	Minimum Passing
ESE (Report and Presentation)	50%	50%

Semester – VIII
B Tech (Common to all Programs) Semester - VIII

TRACK – II : Capstone Project with Program Verticals & University Open Electives

Track	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	Evaluation Scheme for Theory and Practical			
							Compone nt	Exam	WT	Pass
IV	AMT-1801.X	Program Elective – IV(as per Vertical)	03	-	-	03	Theory	FET	20	Min 40
								CAT I	15	
								CAT II	15	
								ESE	50	
	UE-2851.X	University Open Elective I	03	-	-	03	Theory	FET	20	Min 40
								CAT I	15	
								CAT II	15	
								ESE	50	Min 40
	UE-2871.X	University Open Elective II	02	-	-	02	Theory	FET	20	Min 40
								CAT I	15	
								CAT II	15	
								ESE	50	Min 40
	CP-2802	Capstone Project	-	-	12	06	Project	ISE	50	Min 50
								ESE	50	
	CP-2803	Career Planning & Corporate ReadinessProgram	-	-	-	02	Student Portfolio Grading	FET	100	Min 50
	CP-2803	Online Course in Advance Technology(Domain Area)	-	-	-	**04**		**FET**	**100**	Min 50
	Total		**08**	-	**12**	**20**	Total Hrs: **20**, Total Credits: **20**			

Note
Students are required to spend minimum 12 hours on project under the instructions from supervisor as per the timetable.
Course Codes :
II – Industrial Internship Program with Project;
ED – Entrepreneurship Venture Scheme; RE – Undergraduate Research Opportunity Program;CP – Capstone Project; UE – University Open Elective

CST-402.X Programme Elective – IV

Semester – VIII		
Programme Verticals	**Course Code** CST 280_	**Programme Elective – IV Courses** (select as per respective Vertical)
Networking	AMT1801	Cloud Computing
Artificial Intelligence	AMT1802	Data visualization
Applications	AMT1803	Social Networks
Information Security	AMT1804	Cloud Security

UE-402.X : University Open Elective –I

	Course Code UE-2851	**University Open Elective – I (03 Credit Course)**
University Open Elective – I	UE-2852	Engineering Management
	UE-2853	Marketing for Engineers
	UE-2854	Finance for Engineers
	UE-2855	AI and ML Fundamentals
	UE-2856	Project Management
	UE-2857	Electrical Vehicles
	UE-2858	Optimization Techniques

UE-404.X : University Open Elective – II

	Course Code UE-2871	**University Open Elective – II (02 Credit Course)**
University Open Elective – II	UE-2872	Design Thinking
	UE-2873	Creativity and Innovation
	UE-2874	Total Quality Management
	UE-2875	Industry 4.0
	UE-2876	Costing & cost Control
	UE-2877	Autotronics
	UE-2878	Sensor Technology
	UE-2879	Nano Technology
	UE-2880	Leadership
	UE-2881	Entrepreneurship Development
	UE-2882	Human values & professional ethics

AMT1801: Cloud Computing

Ver. 1.0, Program Elective, School of Technology

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass %
3	--	--	3	Theory(100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Basics cloud computing and Information security

Course Description: Course Introduces the concept of cloud computing and describes the IT infrastructure security capabilities it also describes IT infrastructure security capabilities at the network, host, and application levels. Examines the current state of data security and the storage of data in the cloud Explains the identity and access management (IAM) practice and reveals the importance of audit and compliance functions within the cloud.

Course Objective:
To describe the physical and virtual components of and identify the principle technologies ofcloud based systems.
To Evaluate and implement the security controls necessary to ensure confidentiality, integrityand availability in cloud computing
To Conduct risk assessments of existing and proposed cloud-based environments
To explain importance of Identity and Access Management(IAM) and audit and compliancefunctions within the cloud

Course Outcomes: After the end of this course students will be able to
CO1 **Analyze**[4] basic concepts and services of cloud computing.
CO2 **Demonstrate**[2] large scale distributed systems and cloud applications
CO3 **List**[1] the importance of cloud security
CO4 **Explain**[2] Ubiquitous Computing and applications

Syllabus (Theory)

Units	Description	Hours
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.	7
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 virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V Different hypervisors and features.	7
III	Monitoring And Management: Architecture for federated cloud computing, LA management in cloud computing: Service provider's perspective, performance prediction for HPC on	7

	Clouds, Monitoring Tools.	
IV	Security: Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor.	7
V	Cloud Implementation And Applications: Cloud Platforms: Amazon EC2 and S3, Cloud stack, Inter cloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.	7
VI	Ubiquitous Computing: Basics and Vision, Applications and Requirements, Smart Devices and Services, Human Computer Interaction, Tagging, Sensing and controlling, Context-Aware Systems, Ubiquitous Communication, Management of Smart Devices, Ubiquitous System Challenge and outlook	7

Textbooks:

Barrie Sosinsky, *Cloud Computing Bible*, Wiley Publications, 2011
Gautham Shroff, *Enterprise Cloud Computing*, Cambridge University Press, 2010.
Stefan Poslad, *Ubiquitous Computing: Smart Devices, Environments and Interactions*, JohnWiley & Sons Publications, 2011.
References:
Rajkumar Buyya, J.Broberg, A. Goscinski, *Cloud Computing Principles and Paradigms*, FirstEdition, Wiley Publications, 2013.
Ronald Krutz and Russell Dean Vines, *Cloud Security: Comprehensive guide to Secure CloudComputing*, Wiley Publications, 2010.

AMT1802: Data Visualization

(Ver. 1.0, Program Elective, School of Technology)

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass %
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: : Basic programming skills

Course Description: This course is designed to provide students with the foundations necessary forunderstanding and extending the current state of the art in data visualization.

Course Objective: An understanding of the key techniques and theory used in visualization, includingdata models, graphical perception and techniques for visual encoding and interaction.
Course Outcomes: After the end of this course students will be able to

CO1 **Explain**[2] the basics of data visualization
CO2 **Select**[2] the techniques of the visualization process

CO3 **Choose**[3] different techniques for data visualization.
CO4 **Apply**[3] appropriate data visualization techniques from visualization systems.
Syllabus (Theory)

Units Description **Hours**

Introduction: 7
Introduction of visual perception, History of visualization, visual representation ofdata, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, and visual analytics.
Visualization Techniques 7
Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and textdocuments

Visualization Techniques for Tree, graph and Networks 7
Visualization of groups, trees, graphs, clusters, networks, software, Metaphoricalvisualization
Visualization of spatial data for field based GIS 7
Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborativevisualizations, Evaluating visualizations
Comparing and evaluating Visualization Techniques 7
User task, User characteristics, Data characteristic, Visualization characteristic,Structure for evaluating visualization, Benchmarking Procedure
Visualization Systems 7
System based on Data Type, System based on Analysis Types, Text analysis andvisualization, Modern integrated visualization system.

Textbooks:
Ben Fry, *Visualizing Data: Exploring and Explaining Data with the Processing Environment*,1st Edition, O'Reilly Media Publications, 2008.
Chun-houh Chen, Wolfgang Härdle, Antony Unwin, *Handbook of Data Visualization*,Springer Publications, 2007.

References :
Thomas Strothotte, *Computer Visualization–Graphics Abstraction and Interactivity*, SpringerPublications, 2011.
Edward R. Tufte, *The Visual Display of Quantitative Information* , Second Edition, GraphicsPress Publications, 2001
Charles D. Hansen and C. R. Johnson, *Visualization Handbook*, Academic Press Publications,2007

AMT1803 : Social Networks
Ver. 1.0, Program Elective, School of Technology

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage %	Pass %
3	-	-	3	Theory 100 Marks	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Social Network Analysis

Course Description: This course is an introduction to the concepts and methods of social network analysis. Students will learn to extract and manage data about network structure and dynamics, and toanalyze, model and visualize such data.

Course Objective: To understand theoretical and empirical issues in current research on social networkanalysis

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

CO1 **Understand**[2] basic concept of social network and evolution.
CO2 **Explain**[2] knowledge Extraction for Social Networks analysis.
CO3 **Compare** [4] Modeling and visualization technique in online social network.
CO4 **Relate** [2] the ontology in social network & semantic web

Syllabus (Theory)

Units **Description** **Hours**

Introduction 7
Introduction to Web, Limitations of current Web, Development of Semantic Web,Emergence of the Social Web, Statistical Properties of Social Networks, Network analysis, Development of Social Network Analysis-Key concepts and measures innetwork analysis, Discussion networks-Blogs and online communities-Web-based networks

Evolution 7
Evolution in Social Networks–Framework, Tracing Smoothly Evolving Communities,Models and Algorithms for Social Influence Analysis, Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing, Link Prediction in Social Networks, Feature based Link Prediction

Mining Communities and Opinion Mining 7
Applications of Community Mining Algorithms, Node Classification in Social Networks Opinion Extraction–Sentiment Classification and Clustering, Temporal

Sentiment Analysis-Irony Detection in Opinion Mining-Wish Analysis–ProductReview Mining–Review Classification

Modeling and Visualization Visualizing 7

Online Social Networks, A Taxonomy of Visualizations, Graph Representation-Centrality-Clustering-Node-Edge Diagrams-Visualizing Social Networks with Matrix-Based Representations-Node-Link Diagrams, Hybrid Representations, Modeling and Aggregating Social Network Data, Random Walks and their Applications, Ontological representation of Social Individuals and Relationships

Ontology Engineering 7

Ontology's and their role in the semantic web, Ontology, Ontology Web Language(OWL), UML, XML/XML Schema, Constructing Ontology, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic,Rule and Inference Engines.

Social Network and semantic web 7

What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis, Electronic Discussion networks, Blogs andOnline Communities, Web Based Networks.

Textbooks:

Charu C. Aggarwal, *Social Network Data Analytics*, Springer Publications, 2011
Peter Mika, *Social Networks and the Semantic Web*, First Edition, Springer Publications, 2007.
BorkoFurht, *Handbook of Social Network Technologies and Applications*, First Edition, SpringerPublications, 2010.

References :

Valente, Thomas W. 2010. *Social Networks & Health: Models, Methods, & Applications*, OxfordUniversity Press Publications, 2010, ISBN 9780195301014
Ajith Abraham, Aboul Ella Hassanien, VáclavSnášel, *Computational Social Network Analysis:Trends, Tools and Research Advances*, Springer Publications, 2012

AMT1804: Cloud Security

Ver. 1.0, Program Elective, School of Technology

Lect.	Tut.	Pract.	Credits	Evaluation Scheme			
				Component	Exam	Weightage	Pass%
3	-	-	3	Theory	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

Prerequisite: Information security basics and computer network basics

Course Description: The course will describe the Cloud security architecture and explore the guidingsecurity design principles, design patterns, industry standards, applied technologies and addressing regulatory compliance requirements critical to design, implement, deliver and manage secure cloud based services.

Course Objective:
To describe the physical and virtual components of and identify the principle technologies ofcloud based systems.
To Evaluate and implement the security controls necessary to ensure confidentiality, integrityand availability in cloud computing
To Conduct risk assessments of existing and proposed cloud-based environments
To explain importance of Identity and Access Management(IAM) and audit and compliancefunctions within the cloud

Course Outcomes: After the end of this course students will be able to
CO1 **Evaluate** [5] the security various layers of cloud infrastructure
CO2 **Analyze** [4] encryption and identity management services in a cloud environment
CO3 **Perform**[3] vulnerability assessments in a cloud environment
CO4 **Develop**[3] a cloud disaster recovery and business continuity plan

Syllabus (Theory)

Units	Description	Hours
	Introduction to Cloud Computing	7
	The Evolution of Cloud Computing, What is Cloud computing? , SPI framework of Cloud Computing, Traditional Software Model, Cloud Service Delivery model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise	
	Fundamentals and Risk Issues in the Cloud	7

Cloud Information Security Objectives, Cloud Security Services, Cloud Security Design Principles, Secure Cloud Software Requirements, Security Policy Implementation and decomposition, Cloud Computing and Business Continuity/Disaster Recovery, CIA triad, Privacy and compliance risk

Infrastructure and data Security 7

Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level 4 15% 4 Data Security and Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security

Identity and Access Management 7

Trust Boundaries and IAM, Why IAM? , IAM Challenges, IAM Definitions, IAM Architecture and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud. Cloud Authorization Management, Cloud Service Provider IAM Practice and use cases for IAM with Amazon EC2 and Amazon S3. IAM access management, policies and permissions.

Security Management in the Cloud 7

Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management

Audit and Compliance 7

Internal Policy Compliance, Governance, Risk, and Compliance (GRC) Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives Additional Key Management Control Objectives, Control Considerations for CSP Users Regulatory/External Compliance, Cloud Security Alliance Auditing the Cloud for Compliance

Textbooks:

Tim Mather, Subra Kumaraswa my and Shahed Latif, *Cloud Security and Privacy*, O'ReillyPublications, 2009.

References :

Raghu Yeluri and Enrique Castro-Leon, *Building the Infrastructure for Cloud Security ASolutions view*, Apress open Publications, 2014.
Ronald L. Krutz and Russell Dean Vines, *Cloud Security A Comprehensive Guide toSecure Cloud Computing*, Wiley Publications, 2010.

UE-2851.X : University Open Elective – I

	Course Code	**University Open Elective – I (03 Credit Course)**
	UE-2851	
University Open Elective – I	UE-2852	Engineering Management
	UE-2853	Marketing for Engineers
	UE-2854	Finance for Engineers
	UE-2855	AI and ML Fundamentals
	UE-2856	Project Management
	UE-2857	Electric Vehicles
	UE-2858	Optimization Techniques

BTech(Common to all Programs) Semester –VIII
Course work with Capston Project

University Open Elective I

UE-2851 Engineering Management

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description:
Engineering management gives overview of business environment the factors affecting the business environment. The effect of global environment on different business activities. It also focuses Business development framework and world class business practices. In its second part it highlights business functions and its integration to make the business profitable. In addition, it gives the guidelines about engineering economics and the different accounting principle used in industry to evaluate business performance

Course Learning Outcomes:
After successful completion of this course, students will be able to
Identify the factors that influence business environment.
Discus different business growth strategies
Justify importance of business excellence models on world class business development
Appraise the scope and objectives of functional areas of business and the integration
Apply engineering economics for evaluation of business

Course Content

Overview of Business Environment (6)

Definition of Engineering Management, Engineering Managers

Business Environment- Nature, scope and objectives of business, National & Global Perspective, Environmental Analysis and Forecasting. Factors Affecting the Business Economic Environment, Political and government Environment, natural and Techno logical Environment, Business and Society, Industrial Policies and Regulations, Economic planning and Development,

Global Environment- GATT/WTO and Global Liberalization, international Investments, Multinational Corporations, Globalization

Business Development Framework (6)

Vision, Mission, Objectives, Goals, Strategic Planning. SWOT Analysis, Policy formation, Procedure, Steps in Development Framework, Roles of Engineering Managers, Decision Making. Organizing. Leading. Engineer as a leader, Engineer as a manager, leadership skills for 21 centuries, Controlling setting performance sta nda rd, benchmarking

World Class Business Development **(6)**

Understanding Business Excellence, Core Values and Concepts, Business Excellence Introduction to Baldrige Modeland EFQM Model, Detailed Study and Case Studies on EXIM Bank relationship between Business Excellence Models and Core Values and Business Excellence Assessment, Criterion, Competitiveness) Growth Collaboration, Acquisition, Merger, Joint Ventures

Integration of Business Functions (6)

Product Production and Sales Planning. Materials Management Purchasing. Marketing Management, Finance Resource Management, Supply Chain Management, Human Resource Management, Customer Relationship Management, Manufacturing Planning, Inter-relationship of all Business Functions (ERP Modules) Case Studies

Engineering Economics (6)

Engineering Economics - Introduction, Cost Analysis, Time value of money and compound interest Cash flows, Annuity, Depreciation, Methods of Computing Depreciation (Sinking Fund Method, Declining Balance Method, Sum of Years Digit Method). Investment decision for capital assets, Evaluation Criterion for Investment Decisions- Payback Period, Average Rate of Return, Net Present Benefit Cost Internal Rate of Return(IRR)

Financial Accounting, Analysis & Management (6)

Introduction, Accounting Principles, Types of Accounts, Key Financial Statements, Fundamentals of Financial Analysis, Balance Sheet, Elements of Market Economy, Capital Sources of finance, Financial Institutions, Financial statements, Balance sheet and P&L accounts

Reference Books

Dr M. T. Telsang, Industrial Engineering and Production Management, S. Chand &Co.
C. M. Chang, Engineering Management, Pearson Education Inc, 2012.
J.P. Bose, S. Talukdar, Business Management -, New Central agencies (P) Ltd.
Francis Cherunilam, Business Environment, Himalaya Publishing House, 1997.
K. Shridhara Bhat, World Class Manufacturing. Himalaya Publishing House, 1"
edition, 2013.
James A. F. Stoner, R. Edward Freeman, Management, Prentice Hall of India New Delhi, 6 edition, 2009.
4 Gene Burton and Manab Thakur, Management, Today Principles and Practice, Tata McGraw HillPublishing Company, New Delhi, 1995.
Koontz & O'Donnell, Essentials of Management, McGraw-Hill, 10 edition, 2015.
Philip Kotler, Marketing Management, Prentice Hall of India New Delhi, 155 edition, 2016.ProgramElective-IV
MEE2110: Logistics and Supply Chain Management

BTech(Common to all Programs) Semester - VIII Course work with Capston Project
University Open Elective I

UE 2852 Marketing for Engineers

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description
To familiarize the students with the marketing function & concept of marketing mix & study the marketing mix of some start-ups, companies operating in India. This course will give overall understanding of marketing management which will help them in developing their own marketing decisions & in understanding the importance of market survey techniques. It will also help them in conducting suitable market survey for their own selected products

Course Learning Outcomes :
After successful completion of the course, students will be able to
Apply basic principles of marketing for various products,
Prepare market survey.
Select proper product mix & pricing decision.
Select proper digital marketing technique for selected business

Prerequisite:
General knowledge of market, sales, distribution & advertising & clear concept about own business model.

Course Content
Introduction to marketing (6)
Evolution; core marketing concept, selling concept, marketing concept, Holistic marketing concept, portfolio approach- BCG matrix; Marketing Environment: Demographic, economic, political, legal, socio cultural, technological environment (Indian context); environmental scanning to discover marketing opportunities

Market segmentation & marketing Research (6) Targeting and Positioning. difference between segmentation, targeting and positioning, customer value proposition. Marketing Research- Concept & practice, Steps in Marketing Research, Assessment of demand & supply, Preparation of survey questionnaire
Product Decisions(6)
Concept of PLC, product classification, product line decision, product mix decision, new product development, branding decisions, packaging & labeling, Service as a part of Product

Pricing Decisions (6)
Determinants of price, pricing methods (non-ma the metical treatment). Adapting Price (Geographical pricing, promotional pricing and differential pricing), pricing strategies for startups

Promotion & Place Decisions (6)
Factors determining promotion mix, promotional l tools basics of advertisement, sales promotion, public relations &publicity and personal selling.
Distribution Channel functions, channel levels, types of intermediaries (types of retailers, types of wholesalers)
Digital Marketing (6)
Digital Marketing Overview, Seven "C" of Digital Marketing. Digital Marketing vs e-marketing, Search Engine Optimization (SEO), Social Media Optimization (SMO). Pay per Click (PPC), Email Marketing

Reference Books

I For B2C , Kotler, P., Keller, KL, Koshy, A and Jha, M.: Marketing Management, Pearson
For B2B , Sarin, S.: Strategic Brand Management for B2B Markets, Sage References:
Kotler P. & Armstrong, G., Principles of Marketing. Pearson
Amico, Z.D., Marketing, Cengage
Boone, L.E and Kurtz, D.L Principles of Marketing. Thomson South-Western
Hoffman, K.D. and Bateson, J.E.G., Marketing of Services, Cengage
EDP Resourse material by EDI. Ahmedabad

BTech(Common to all Programs) Semester –VIII Course work with Capston Project
University Open Elective I

UE 2854 Finance for Engineers

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course description -
To familiarize students with accounting, mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.

The objectives of the course are to build the skills, frameworks and knowledge in finance. Students will study the financing of small and medium sized businesses from the perspective of both the entrepreneur and investors. They will learn how the financing decisions of small and medium sized private companies differ from those of public firms. They will also see how the use of real options and milestones relate to the strategy and the value on an opportunity

Course Learning Outcomes :
After successful completion of the course, students will be able to,
Understand basic Financial Terminologies.
Prepare & analyze financial statements.
Prepare financial Plan for venture.
Make & analyze investment decisions.
Calculate working capital requirement

Prerequisite: General knowledge of economics & clear concept about own business model.

Course Content
Accounting Terminologies (6)
Meaning, nature, function, types of accounting, basics of financial statements, generally accepted accounting concepts, principles and conventions: double entry system. Accounting Records, Fundamentals of record keeping, the accounting process, transactional analysis, the Adjusting and Closing process. Accounting systems. Computer based accounting systems. Accounting cycle.
Financial Statements (6)
Balance sheet: assets, liabilities. Income statement: concept of income, concept of expenses, concept of gain and losses Components of the income statement. Other concepts of income Cash Now statements: purpose, components, and categories. Preparation of cash flow statements concept activities Accounting and pricing.
Financial Statement Analysis **(6)**
Business objectives, measures Ratios: Price Earnings, Profit margin, invest Ent, capital asset intensity, workingcapital measures, liquidity and solvency. Analysis of cash flow statements Break-even analysis, CVP analysis, Total Cost: cost concepts, direct and indirect costs, product costing systems, non-manufacturing costs, cost analysis, product pricing.

The concept of Financial Management **(6)**
Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan its objectives, essential features, consideration in formulating financial plan, Capitalization over, under and fair capitalization. Concept of risk and returns, Time value of money.

Investment Decisions (6)
Capital budgeting technique.
Financing Decision Cost of Capital - Meaning, definition classification and computation of specific weight and marginal cost of capital. Capital structure - Definition, factors determining the financial structure, Leverage Analysis
- Financial operating and combined leverage.
Dividend decision: Dividend policy, Dividend Theories. Factors affecting dividend decisions. Long term financing. Sources of long term financing

Working Capital Management **(6)**
Concept of working capital - Classification, importance, factors determining adequate value of working capital. Estimation of working capital requirements. Financing of working capital - Long- medium-short term. Trends in Financing of working capital by banks, Inventory management. Cash Management and Receivable Management

Reference Books

Maheshwari, S.N. and Maheshwari, S.K, Financial Accounting, Vikas Publishing House
Leach, CJ. and Melicher, R. W: Entrepreneurial Finance. Thomson.
Ghosh, T.P.. Financial Accounting for Managers, Taxmann Allied Services
Balwani, N., Accounting and Finance for Managers, Excel Books
Gupta, A., Financial Accounting for Management, Prentice Hall
4 Bhattacharyya, A.K., Financial Accounting for Business Managers, PHI Publishing
Jain, S.P. and Narang. K.L, Advanced Accountancy, Kalyani Publishers,
Stanton, J.M., Entrepreneurial Finance - For New and Emerging Businesses, Thomson
Smith, J.L. Smith, R.L. and Bliss, R.T. Entrepreneurial Finance, Stanford University

B. Tech. (All Programs) Semester VIIICourse work with Capstone Project
University Open Elective I

UE2855 Artificial Intelligence & Machine Learning Fundamentals

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description:
This course gives a basic introduction to machine learning (ML) and artificial intelligence (AI). Through an algorithmic approach, the students are given a practical understanding of the methods being taught, in particular through making their own implementations of several of the methods. The course covers supervised classification based on e.g., artificial neural networks (deep learning), as well as unsupervised learning (clustering), regression, optimization (evolutionary algorithms and other search methods). Course gives overview of neural network and deep learning techniques. Number of case studies are expected to be covered to have better understanding of applications of AI and ML.
Course Objectives
The Open elective aims to equip students as follows:
Understand different ways of modeling data and real-world scenarios computationally;
Be able to model a real-world problem into the appropriate form (such as optimization, classification, regression, clustering, or association);
Be able to apply the appropriate artificial intelligence or machine learning techniques to solve the problem;
Understand common pitfalls and limitations of existing techniques
Course Learning Outcomes:
After successful completion of the course, students will be able to
Discuss[2] the pros and cons for choosing ML & AI methods for different applications
Develop[3] problem solving methodology for selected ML & AI methods
Use[3] popular AI & ML tools like Python, Tensor flow and Ker as to develop applications
Prerequisite:
Probability Distributions, Python Basics

Course Content
UNIT 1: Machine Learning: Introduction
Overview of Machine learning concepts – Types of Machine learning, Supervise d learning, Unsupervised learning,Reinforced learning, Data preprocessing techniques

UNIT 2: Machine Learning: Prediction Techniques
Linear Regression, Naive Bayes classifier, K-Nearest Neighbors, Decision trees, Random forest, Clustering - k-means

UNIT 3: Artificial Intelligence: Introduction
Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, agents, environments, Problem solving as state space search, production system, control strategies and problem characteristics; Searchtechniques: Breadth First and Depth-first, Hill-climbing, Heuristics and Meta-heuristics, Best-First Search

UNIT 4: Artificial Intelligence: Genetic Algorithms and Fuzzy Logic
Genetic algorithms - Encoding, Crossover, Selection, Mutation, etc., Solving single -objective optimization problems using GAs, Fuzzy logic – introduction, operations, Membership functions, interfere nce in fuzzy logic, fuzzy if-then rules, Fuzzifications & Defuzzifications, Fuzzy Controller

UNIT 5: Artificial Neural Networks and Model Evaluation
Introduction to ANN, Perceptron, Deep Learning – Introduction, convolution neural networks, Deep learning framework – Tensor flow, Model evaluation techniques

UNIT 6: Applications of AI and ML
Use of AI in banking and finance, Fraud detection, AI in manufacturing industry: Dee p learning for smart manufacturing, Machine learning for quality control in manufacturing, IoT: Prevention first Predictive analytics, Machine learning in government administration: Type of government problems appropriate for AI applications, AI for Answering questions, Routing requests, Chat bots for communication between citizen and government, Introduction to Smart grid, Machine learning applications in smart grid.

Reference Books

www.coursera.com - online course on Machine Learning by Andre NG
Artificial Intelligence: A Modern Approach, 3rd edition,Stuart J. Russell and PeterNorvig, Publisher: Pearson
Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press http://www.deeplearningbook.org
Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media

BTech(Common to all Programs) Semester - VIII Course work with Capston Project
University Open Elective I

UE2856 Project Management

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description

The course covers key components of project management including project integration, project scope management, project time and cost management, quality management, human resource considerations, communications, risk management, and procurement management.

Student Learning Outcomes : Upon satisfactory completion of the course, the learner should be able to
Recognize issues in a realistic project scenario.
Employ work breakdown structures (WBS) in a project application.
Demonstrate the use of appropriate network scheduling techniques.
Produce a project proposal
Discuss the implementation of a proposed plan

Course Contents

Basics of Project Management (6)
Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles

Project Identification, Selection and planning (6) Introduction, Project Identification Process, Project Initiation, Pre - Feasibility Study, Feasibility Studies,Project Brea k-eve n point, Project Planning, Nee d of Project Planning, Project t Life Cycle, Roles,Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)

PERT and CPM (6)
Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, Measures of variability, CPM Model, Network Cost System, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

Project Risk Management (6)
Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks, Project Management Information System (PMIS), Planning of PMIS, Design of PMIS

Project Performance Measurement and Evaluation (6) Introduction, Purchase Cycle, Contract Management, Procurement Process, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement andEvaluation, Controlling the Projects

Project Execution and Control (6)
Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up.

Reference Books

Cleland, David I. and William R. King, Systems Analysis and Project Management, McGraw-Hill BookCompany, New York,
Moder, Joseph J. and Cecil R. Phillips,Project Management With CPM and PERT, Van Nostrand-ReinholdCompany, New York, (2nd. ed.)
Martino, R. L., Project Management and Control in three volumes: "Finding the Critical Path," "AppliedOperational Planning," and "Allocating and Scheduling Resources," American Management Association, New York
Archibald, Russell D. and Richard L. Villoria, Network Based Management Systems (PERT/CPM), Wiley, New York,
Wiest, J. D. and F. K. Levy, A Management Guide to PERT/ CPM, Prentice Hall, Inc., New York,
Woodgate, H. S.,Planning by Network, Project Planning andControl Using Techniques, Brandon Systems Press, New York,
Graham, Robert J., and Randall L. Englund. Creating an Environment for Successful Projects. SanFrancisco: Jossey-Bass
Lewis, James. Team-Based Project Management. Beard Books
Lewis, James. Mastering Project Management. New York: McGraw-Hill
Lewis, James. The Project Manager's Desk Reference, Third edition. New York:McGraw-Hill

BTech(Common to all Programs) Semester - VIII Course work with Capston Project
University Open Elective I

UE2857 Electric Vehicles

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description
This course shall equip the students to avail emerging opportunities in the area of HEV & EV technology in automotive industry. This course goes deeper into the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc.

Pre-requisites
FYT107 Elements of Electrical Engineering

Course Objectives
To introduce the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
To study various energy sources and motor drives for Electric & Hybrid vehicle

	Course Outcomes	Bloom's
	Students will be able to	Level
CO 409.4.1	Identify need of Electric & Hybrid vehicle	1
CO 409.4.2	Design Electric vehicle for given requirement	3
CO 409.4.3	Design Hybrid Electric vehicle for given requirement	3
CO 409.4.4	Elaborate different Energy sources for Electric & Hybrid vehicle	2
CO 409.4.5	Choose suitable motor drive for Electric & Hybrid vehicle	3

Hybrid Vehicles Technology
Hybrid electric drive-train, Classification, operating modes, Various architectures of HEVs, Parallel hybrid drive-train with torque coupling & speed coupling 07

Design of HEVs
Control strategies, Design principle for series hybrid electric drive train, Sizing of elements of series & parallel hybrid electric drive trains 06

Energy Sources and Propulsion
Batteries for E Vs & HEVs, Battery Management, Ultra Capacitors, Mechanical flywheel, Electronic devices for EVs & HEVs, Fuel cell concept & characteristics, Fuel cell technology for E Vs & HE Vs, Hydrogen storage & reforming. 06

Electric Vehicle Motors
Types of Motors, DC Motors, Induction Motor, BL DC Motor, Permanent Magnet Motors – Principle, Construction, Selection & 07sizing of motors, RPM and Torque calculation of motor, Motor Controller, Motor ratings

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Modern Electric, Hybrid Electric & Fuelcell Vehicles- Fundamentals, Theory & Design	Mehrdad Ehsani, Yimin Gao, Ali Emadi	CRC press, New York,	2010
02	Electric & Hybrid Vehicles- Design Fundamentals	Iqbal Hussain	CRC press, New York	2003 ISBN 0-8493-1466-6
03	Electric &Hybrid Vehicles	Robin Hardy, Iqbal Hussain	CRC press	
04	Electric Vehicle Technology Explained	James Larminie,John Lowry,	John Wiley & Sons Ltd. England	2003
05	ElectricVehicle Battery Systems	Sandeep Dhameja	Newness, Massachusetts	2002
06	The electric car:Development & Futureof Battery, Hybrid & Fuel- Cell Cars,	Dr Mike Westbrook,M H Westbrook	British library cataloguing in publication Data,UK,	ISBN0852960131

BTech(Common to all Programs) Semester - VIII Course work with Capstone Project
University Open Elective I

UE 2858 Optimization Techniques

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
3	-	-	3	Theory (100)	FET	20	40
					CAT 1	15	
					CAT 2	15	
					ESE	50	40

Course Description**:**
This course deals with Fundamental optimization methods, operations research, heuristic optimization techniques, evolutionary or population-based hyper metaheuristics, parallel optimization techniques. Application of these methods to complex science engineering domains

Course Learning Outcomes
After successful completion of the course, students will be able to
Optimize performance of given problem under a set of resource constraints
Identify suitable mathematical programming techniques to optimize performance of given problem
Apply suitable mathematical programming techniques to optimize performance of given problem under a set of resource constraints where either objective function or set of constraints may be linear or non-linear.
Apply artificial intelligence (AI) techniques (meta-heuristics) to improve the efficiency of manufacturingsystems.
5.
Prerequisite:
Students with knowledge of basic mathematics and statistics can opt this course.

Course Content

Linear Optimization (6)
Simplex Method Revised Simplex Method. Sensitivity Analysis. Duality, and Queuing Theory

Nonlinear Optimization (6)
Introduction, Lagrange Method, Kuhn-Tucker conditions, Quadratic programming, separable programming, chance constrained programming or stochastic programming

Introduction to Integer programming and decision theory (6)
Introduction to Integer Programming; Cutting Plane Method; Branch and Bound method. Decision theory, Decision under certainty, Decision under risk, Decision under uncertainty, Decision Tree

Introduction to Dynamic Programming (6)
Concept of Sub optimization and the principle of optimality: Linear and Continuous Dynamic Programming with Applications in capital budgeting, reliability improvement, cargo loading and minimizing total tardiness in single machine scheduling problem etc.

Advanced Optimization Methods-I **(6)**
Multi-criteria Decision Making, AHP, Meta-heuristic algorithms: Genetic algorithms

Advanced Optimization Methods-II (6)
Neural networks, Particle Swarm Theory & Ant colony optimization.

Reference Books

Rao S.S. Engineering Optimization Theory and Practice, New Age Int. Pub., 3rd Ed., 1996.
2.Haug, E. J. and Arora, J.S., Applied optimal design Wiley Inter Science Publication, NY, 1979
Douglas J. Wilde, Globally optimal design John Wiley & Sons, New York, 1978
Johnson Ray C., Optimum design of mechanical elements, John Wiley & Sons, 1981.
S.D. Sharma, "Operations Research", Khanna Publications, 2001.
David Goldberg, Genetic Algorithms, pearson publications, 2006.
Gen, M. and R. Cheng, Genetic Algorithms and Engineering Optimization, Wiley Interscience, 1999

UE-404.X : University Open Elective – II

	Course Code	**University Open Elective – II (02 Credit Course)**
	UE-2871	
University Open Elective – II	UE-2872	Design Thinking
	UE-2873	Total Quality Management
	UE-2874	Industry 4.0
	UE-2875	Costing & cost Control
	UE-2876	Autotronics
	UE-2877	Sensor Technology
	UE-2878	Nano Technology
	UE-2879	Leadership
	UE-2880	Entrepreneurship Development
	UE-2881	Human values and Professional Ethics

BTech(Common to all Programs) Semester - VIII Course work with Capstone Project
University Open Elective II

UE2871 Design Thinking

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description
It includes identification of opportunity for development of new product based on requirement of customer. Starting from the generation of concepts and its evaluation, preparation of prototype, Product design and testing all aspects of product design are covered. Emphasis is given of aesthetic and ergonomic consideration in design

Pre-requisites
Engineering Graphics Lab

Course Outcomes
Students will be able to
List challenges/ problems of customer and specify customer needs

Compare different ways for Concept selection & testing
Apply different tools and techniques of product design
Review aesthetic and ergonomic consideration for design of Product

Course Contents

Discovery- Opportunity identification for new products **(6)** Product life cycle, need for new products, strategic planning and new product opportunity, sources of newproduct ideas,. Steps in NPD Product idea generation, creativity and innovation.
Identifying Customer Needs, Voice of the customer, gathering customer needs, organizing and prioritizingneeds, Product mission statement, Benchmarking and establishing product specifications

Product Concept Generation, Selection and Testing **(6)** Concept generation process and methods, Concept selection mechanism and techniques, Concept Testing- Purpose, process and methods. Product Architecture-types, establishing architecture, Modular design.Prototyping

Product Design Process and Tools and Techniques (6) Product Design process steps, Stage gate model, Product teardown and experimentation, Concurrent engineering, Quality function Deployment (QFD), Value engineering.

Design Considerations (6)
Product dimensions, Design for manufacturing and assembly (DFMA), Design for Sustainability, Aestheticaspects-Symmetry, balance, contrast, continuity, rhythm, Form and styling, Color in product design, Ergonomic considerations, Anthropometry

Reference Books

Dr Martand Telsang, Industrial Engineering and Production Management, S. Chand & Co. NewDelhi,2006
Ulrich, Eppinger, Anita Goel, Product Design and Development, McGraw Hill Publishing
Otto & Wood, Product Design, Pearson Education
Seider, Lewin,Widagdo, Product and Process Design Principles: Synthesis, Analysis and Evaluation, Wiley Publication
Don Norman, The Design of Everyday Things, Basic Books
Michael G. Luchs, Scott Swan, Design Thinking: New Product Development Essentials from the PDMA, WileyPublication
Richard Morris, The Fundamentals of Product Design, Bloomsbury Publishing
Cooper, Robert G, Winning at New Products, Basic Books

B.Tech. Semester VIII (All Programs)Course work with Capston Project University Open Elective II

UE-2872 Total Quality Management

Teaching Scheme				Evaluation Scheme			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

It gives the students an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby. General barriers in implementing TQM.

Course Outcomes
After successful completion of the course, students will be able to
State importance of assuring quality in the service or manufacturing sector and explain Quality assurance system
Identify and solve the quality related problems in manufacturing or service sector at various stages by usingvarious TQM tools and techniques,
Calculate reliability of system
Interpret various quality attributes and discuss the various quality approaches. 6. Comment on quality usingTaguchi Philosophy.
Course Contents

UNIT I **INTRODUCTION** (6)
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework – Contributions of Deming, Juran and Crosby- Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II **TQM PRINCIPLES** (6)
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment,Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III **TQMTOOLSANDTECHNIQUESI** (6)
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types., Control Charts - Process Capability - Concepts of Six Sigma

UNIT IV **QUALITY SYSTEMS** (6)
Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures. Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, QualityAuditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sector

Reference Books

Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education (First Indian Reprints 2004).
Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.
Implementing Juran's Road Map for Quality Leadership: Benchmarks and ResultsBy Al Endres, Wiley,2000
Understanding, Managing and Implementing Quality: Frameworks, Techniques and CasesBy Jiju Antony;David Preece, Routledge, 2002
Organizing for High Performance: Employee Involvement, TQM, Reengineering, and Knowle dge Management in the Fortune1000:The CEO ReportBy Edward E. Lawler; Susan Albers Mohrman; GeorgeBensonJossey-Bass, 2001
Total Quality Control Feigenban - McGraw Hill Book Company, New York 2
" Fundamentals of Quality Control and Improvement", Amitava Mitra, Pearson Education.
Six Sigma Black Belt Handbook – Thomas McCarty, Michael Bramer & Praveen Gupta, Tata McGraw Hill
Six Sigma Performance Hardware by Praveen Gupta, Tata McGraw Hill Pub.

B.Tech. Semester VIII (All Programs)Course work with Capston Project University Open Elective II

UE-2875 Industry 4.0

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

This course provides a comprehensive overview of the role of digitization, big data, cyber-physical manufacturing systems, robots, human robot collaboration, artificial intelligence and all relevant Industry 4.0 technologies. In particular, we focus on applications and case studies in order to make the audience understand the new technologies and demonstrate the benefits of Industry 4.0. We also include contributions from researchers and industry to theopportunities and challenges of Industry 4.0. One of the greatest challenges in upgrading to Industry 4.0 is education, without young academics the transition to Industry 4.0 won't be sustainable.

Course Outcomes

After successful completion of the course, students will be able to
State basics, drivers and enablers of Industry 4.0 2
Explain modern methods and techniques of planning, dimensioning, design and optimization of Industry 4.0 production systems
Identify value chains in Industry 4.0
Develop skills in dealing with methods and techniques for various production system

Course Content

Introduction to Industry 4.0 & Basic principles and technologies of a Smart Factory (6) Definition of Industry 4., Developments in India, Germany. USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and today's Factory, Difference between conventional automation and Industry 4.0, Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Big Data, Cyber-Physical Systems, Value chains in manufacturing companies, Customization of products,Digital Twins, Cloud Computing / Cloud Manufacturing, Security issues within Industry 4.0 networks

Cyber-Physical Systems (CPS) and Cyber-Physical Production Systems (CPPS) (6) Definitions, demarcation to embedded systems, ubiquitous computing, etc., Core elements of Cyber-Physical Systems and Cyber-Physical Production Systems, Control theory and real-time requirements, Self-organizationprinciples, Communication in cyber-physical systems, Design Methods for Cyber-physical Systems (Modelling, Programming, Model-Integra ted Development), Applications for cyber-physical systems

Assistance systems for production **(6)**
The connected worker within the Industry 4.0 scenario, Diversity-driven workplaces (barrier free workplaces, accessibility in production), Human-and task-centered assistance systems, Technical tools, Mobile information technologies, Shop floor information systems, Production line support systems (pick by light, assembly displaysystems, assembly control by vision), Manipulator systems and intelligent chairs, Human work support by using exoskeletons, Applications assistance systems in production

Human-Robot Collaboration, Safety and Security (6) Human-Robot Collaboration in Industry, Collaborative Robots, examples Yumi, IIWA, UR, Panda, Types of Human- Robot Collaboration, Applications with Collaborative Robots, Safety with Industry 4.0, Safety for connectedMachines and Systems, Safety in Human Robot cooperation, Security & Security Risks with Industry 4.0, Security and privacy risks in AI, Approach to Cyber-Physica l Security in Industry 4.0

"Industry 4.0: The Industrial Internet of Things" by Alasdair Gilchrist
"Dynamic Factory Automation: Creating Flexible Systems for Competitive Manufacturing (Ibm Mcgraw-Hill Series)" by Alastair Ross
Quick Start Guide to Industry 4.0: One-stop reference guide for Industry 4.0 by Mr Kiran KumarPabbathi
Industry 4.0 for SMEs:Challenges, Opportunities and RequirementsDominik T. Matt,Vladimír Modrák, Helmut Zsifkovits, Springer Nature, 2020

BTech(Common to all Programs) Semester - VIII Course work with Capstone Project
University Open Elective II

UE2876 Costing & Cost Control

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

To provide an in depth study of the Cost Accounting Principles and Techniques for identification, analysis andclassification of cost components to facilitate managerial decision making. Learning aims
Course Learning Outcomes:
After successful completion of the course, students will be able to
Understand and explain the conceptual framework of Cost Accounting
Explain the basic concepts and processes in determination of cost of products and services
Understand the Cost Accounting Standards (CAS)
Apply marginal costing in decision making
Apply the concept of Standard Costing for variance analysis

Course Content

Introduction to Cost Accounting (6)
Definition, Scope, objectives and significance of cost accounting, its relationship with financial accounting and management accounting, Cost Objects, Cost centers and Cost Units, Elements of cost, Classification of costs

Cost Ascertainment – Elements of Cost (6)
Material Costs - Inventory Accounting & Valuation, Physical Verification, treatment of losses Scrap,spoilage, defectives and wastage.
Labor Costs - Principles and methods of remuneration and incentive schemes, Employee cost reportingand measurement of efficiency.
Direct Expenses & Overheads - Collection, classification and apportionment and allocation of overheads,Absorption and treatment of over or under absorption of overheads, Reporting of overhead costs

Methods of Costing **(6)**
Job Costing, Batch Costing, Contract Costing, Process Costing – Normal and abnormal losses, equivalentproduction, Joint and By Products, Operating Costing or Service Costing

Cost Accounting Techniques **(6)**
Marginal Costing, Standard Costing & Variance Budget and Budgetary Control (simple problems only) (i)Concepts, Types of Budgets (ii) Budgetary Control Vs Standard Costing (iii) Advantages and limitations

(iv) Preparation of Budgets (simple problems only), Cost control, Cost Reduction, Introduction to activitybased costing.

References

Principles & Practice of Cost Accounting – N. K. Prasad (Book Syndicate Pvt. Ltd.)
Costing Simplified: Wheldom Series – Brown &Owier (ELBS)
Cost Accounting: B. Jawaharlal (TMH)
Cost Accounting: R.R. Gupta.
Cost Accounting, 13/e - B. K. Bhar, (Academic Publishers, Kolkata)
Cost Accounting: Jain, Narang (Kalyani Publishers)
A Text Book of Estimating and Costing Mechanical – J.S. Charaya & G. S. Narang, (Satya Prakashan)

B.Tech. Semester VIII (All Programs)Course work with Capston Project University Open Elective II

UE-2877 Autotropic

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description
This course introduces the students about fundamentals of electronic engine & chassis management system & their components, various types of sensors, Methods & controls of electronic fuel injection & ignition system, various automotive Electrical l, Comfort & Safety systems and the system approach to control & instrumental & Electromagnetic Interference Suppression.
Course Outcomes
After successful completion of the course, students will be able to
Identify different areas of Autotropic, Sensors & Actuators
Differentiate various electronic fuel injection & control methods
Explain Automotive Electrical, Comfort & Safety system
Explain system approach control & instrumentation

Fundamentals of Automotive Electronics, Sensors & Actuators **(6)**
Microprocessor and micro Computer applications in automobiles, components for engine management System, electronic management of chassis system, vehicle motion control, and electronic panel meters. Basic sensor arrangement; Types of Sensors such as oxygen sensors, Crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, altitude sensors, flow Sensors, throttle position sensors, solenoids, stepper motors, relays.
Electronic Fuel Injection & Ignition System & Digital Engine Control **(6)**
Introduction; feedback carburetor system; throttle body injection and multi point fuel injection System; injection system controls; advantage of electronic ignition systems; types of solid state system and their principle of operation; electronic spark timing. Ope n loop and c lose d loop control system; engine cooling and warm -up control; acceleration, deceleration and idle speed control; integrated engine control system; exhaust emission control engineering; on-board diagnostics
Automotive Electrical, Comfort &Safety **(6)**
Batteries, starter motor & drive mechanism; D.C. generator and alternator; regulation for charging; lighting design; dashboard instruments; horn, warning system and safety devices. Seats, mirrors and sun roofs; central locking and electronic Windows; cruise control; in-car multimedia; security; airbag and belt tensioners; other safety and comfort systems; new developments.

The system approach to control & instrumentation & Electromagnetic Interference Suppression **(6)**
Fundamentals, electronic components and circuits, digital electronics, microcomputer instrumentation and control, sensors and actuators, digital engine control systems, vehicle motion control, automotive instrumentation and telematics, new developments.
Electromagnetic compatibility Electronic dash board instruments - Onboard diagnosis system, Security and warning system.

Reference Books

Automotive Electronics Handbook, Ronald K. Jurgen, McGraw Hill Publishing Co.,

Automotive Electricity and Electronics, Al Santini, Delmar Publishers,

Automobile Electrical & Electronic Equipments, Young, Griffitns, Butterworth Publication, London.

Understanding Automotive Electronics, Bechfold, SAE 1998

B.Tech. Semester VIII (All Programs)Course work with Capston Project University Open Elective II

UE-2878 Sensor Technology

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description
This course introduces the various types of sensors, technology, and their applications The lectures cover the principles and operation of a variety of sensor architectures and modalities, including sensors used for mechanical quantities such as pressure, strain, displacement, proximity, and thermal, electric and magnetic field, optical, acoustic. Simple sensor signal processing algorithms and wired are also discussed. Additionally, the lecture also introduces the methods of interfacing sensors to electronic systems.

Course Outcomes
After successful completion of the course, students will be able to
Explain the principles of operation of the main types of sensors
Utilize the merits of various types of sensors for a wide range of applications
Analyze the specifications of various types of sensors
Select appropriate sensors for a given application and design simple electronic sensor interface systems

Course Contents
UNIT I : **Measurements, instrumentation and sensors** (6) Review of Static characteristics of Instrument systems, dynamic characteristics of Instrument systems, Sensors, Signals and Systems; Sensor Classification; Units of Measurements; Sensor Characteristics Physical Principles of Sensing, Dynamic Models of Sensor Elements

UNIT II : **Thermal Sensors** (6)
Definition of Temperature: Thermal Energy, absolute and relative Temperature, • Metal resistance versus temperature devices: Resistance versus Temperature Approximations, • Resistance-Temperature Detectors (RT D)Thermistors: Semiconductor Resistance versus Temperature, Thermistor Characteristics, • THERMOCOUPLES: Thermoelectric Effects, Thermocouple Characteristics, Thermocouple Sensors • Other thermal sensor: Bimetal Strips, Gas Thermometers, Vapor Pressure Thermometers, Liquid-Expansion Thermometers • Solid- State Temperature Sensors • Design considerations
UNIT III : **Mechanical Sensors** (6)
Displacement, Location, or Position Sensors: Resistive-, Capacitive-, and Inductive Sensors • Variable-Reluctance Sensors, LVDT • Level Sensors • Metal Strain Gauges and Semiconductor Strain Gauges (SGs) • Load Cells Motionsensors: Types of Motion, Accelerometer Principles, Types of Accelerometers • Pressure sensors: Pressure Principles, • Pressure Sensors ($p > 1$ atmosphere), • Pressure Sensors ($p < 1$ atmosphere) • Flow sensors: Solid-Flow

– and Liquid Flow Measurement • Pipe Flow Principles, Restriction Flow Sensors, Obstruction Flow Sensor • Magnetic Flow Meter

UNIT IV : **Optical Sensors** (6)
Fundamentals of EM radiation • Nature of EM Radiation, Characteristics of Light, • Photometry • Photodetectors: Characteristics, Photoconductive Detectors, Photovolta ic Detectors, • Photodiode Detectors •PhotoemissiveDetectors • PYROMETRY: Thermal Radiation, Broadband Pyrometers, Narrowband Pyrometers

Reference books:

"Process Control Instrumentation Technology, 6th Edition", Author: Curtis D. Johnson, Publisher: Prentice HallInternational Edition, ISBN: 0-13-978-200-3
"Measurement, Instrumentation, and Sensors Handbook", John G. Webster., Publisher: CRC – Press – Taylor andFrancis Group,
"Introduction to Instrumentation and Measurement, 3rd Edition", Authors: Robert B. Northrop, Publisher: CRC –Press – Taylor and Francis Group, ISBN: 13: 978-1-4665-9679
Handbook of Modern Sensors:Physical, Designs, and Applications, J. Fraden, AIP Press, SpringerSensors and Transducers, D. Patranabis, PHI Publication, New Delhi
Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication PrivateLimited)

B.Tech. Semester VIII (All Programs)Course work with Capston Project University Open Elective II

UE-2879 Nanotechnology

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

Nanotechnology is the emerging technology and has touched almost all engineering areas like spintronic, sensors and actuators, small materials for building constructions, enhancing the capacity of memory devices, fabrication of nano devices for medical fields etc. So this course is designed to provide the basic knowledge of nanoscience totechnology students so that they can find proper application of nanoscience in their technical filed.

Course Outcomes

After successful completion of the course, students will be able to

Explain basic science of nanomaterials.
Identify different methods of synthesis of nanomaterials.
Compare properties of materials in bulk form with the nanomaterials.
Discuss the role of nanomaterials in various applications.

Units	Description	Hours
I	Introduction to Nanoscience Introduction, why nano science: particle size versus surface area, scientific revolutions, basic science behind nanotechnology, nanometer, materials at nanoscale, surface chemistry of materials: surface energy, concept of density of states, quantum confinement in nanomaterials.	06
	Synthesis of Nanomaterials Introduction to approaches of synthesizing nanomaterials. **Top-down approach:** Examples of methods like Ball milling method, laser ablation method **Bottom-up approach:** Examples of methods like spray pyrolysis, chemical vapor deposition Introduction to lithography.	06
	Properties of Nanomaterials **Physical Properties:** Melting point, Elasticity, Young's modulus of nanomaterials withexamples, effect of size on physical properties of nanomaterial **Electronic and optical properties:** band structure of nanomaterials, effect of size on band structure, effect of band structure on optical properties. **Magnetic Properties:** GMR effect, particle size and coercivityrelation, superparamagnetic of nanomaterials	06
	Rising Nanomaterials and applications of nanomaterials Introduction, carbon: graphite, diamond, fullerenes, graphene, band structure of graphene in brief (no derivation)	06

Carbon Nanotubes
Structure and types of carbon nanotubes, properties of CNTs.

Applications of Nanomaterials
Nano electronics, MEMS/NE MS, nano sensors, nano catalysts, food and agricultural industry,cosmetics and consumer goods, structure and engineering, automobile, water treatment and environment, medical field, textile, paint, energy, defense and space applications, structural applications, Applications of CNTs and graphene.

Reference Books

M. A. Shah and K. A. Shah, Nanotechnology, The Science of Small, Wiley Publishers, Edition 1, 2013.
M. S. Rao and Sgubra Singh, Nanoscience and Nanotechnology: Fundamentals to Frontiers, WileyPublishers, Edition 1, 2013.
Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay, A.N Banerjee, PHIPublications
Edward L. Wolf, Nanophysics and Nanotechnology: An Introduction to Modern Concepts inNanoscience, Wiley-VCH (2006).

B Tech (Common to all Programs) Semester VIIICourse work with Capston Project
University Open Elective II

UE2880 Leadership

Teaching Scheme				Evaluation Scheme			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description
Engineers wanting to advance their careers must be able to lead teams effectively. This Specialization is designed for professional engineers who are interested in advancing into leadership and management roles.
Course Outcomes
After successful completion of the course, students will be able to
Develop awareness of their own strengths and weaknesses as a leader, and learn to leverage theirstrengths and overcome their weaknesses when they are placed in charge of a team or project.
Learn to manage relationships with team members and colleagues through proven coaching, mentoring,and conflict resolution techniques.
Establish goals and planning methods designed for success.
Learn learn how to set up a creative environment for their team, and motivate each team member to reachhis or her potential.
Course Contents

Introduction to Leadership: (6)
Significance and components of leadership, Personal characteristics that support effective leadership. Types of leadership Styles, Trait approach in theories of leadership. Leader and values. The significance of self- knowledge for the role of leader (identity and integrity of leader). Emotions and self-management, emotional intelligence and its significance in the role of leader.

Leadership of workgroups and teams: (6)
Group structure and dynamics. Formation of teams and team work. Group problem-solving. Team excellence.Participative leadership. Leadership development. Skills for leaders and performance management: Goal setting, support for employee development and communication of feedback; delegation; resolving conflict situations and negotiation, Coaching and mentoring.

Creative leadership: (6)
Influence on the creative potential of work groups and teams; formation of innovative climate in organizations,Developing Leader-Follower trusting relationships.

Leading change in organizations:
Trust, Integrity and Ethics, Transactional and transformational leadership. Models of well balanced and authentic leadership, Organizational Culture (What makes great places to work), Effective Workplace Communication,Personal Code of Ethics, Valuing Diversity.

Reference Books

Art and Science of Leadership. Afsaneh Nahavandi. Prentice-Hall, 7th Edition. ISBN-10:0133546764ISBN-13: 9780133546767

Leadership for Engineers: The Magic of Mindset (Basic Engineering Series and Tools). Ronald Bennett,Elaine Millam. McGraw-Hill Education – Europe. ISBN10 007338593X, ISBN13 9780073385938

Dubran A,J. Principles of leadership [Mason] Southwestern/Ce nga ge Learning 2013

Achua C.F – Lussier R N. Effective leadership [Mason] Southwestern/Cengage Learning 2010

Kouzes J.M., Posner B. Z. Learning Leadership. The Five Fundamentals of Becoming an Exemplary Leader. Wiley. 2016

Yuki G. Leadership in Organizations. Eighth Edition. Pearson Education. 2013. ISBN978-0132771863

BTech(Common to all Programs) Semester - VIII Course work with Capston Project
University Open Elective II

UE2881 Entrepreneurship Development

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

To familiarize students with fundamentals of Entrepreneurship and to encourage them to become successfulentrepreneurs.

Course Outcomes:
The students shall demonstrate the knowledge of Entrepreneurship and shall be motivated to become successful entrepreneurs.

Entrepreneurship & SSI (6)
Definition of Entrepreneur and entrepreneurship, entrepreneurial process, Entrepreneurshipand economic development, job creation, Indian scene
Entrepreneurial Motivation : Self-disclosure, personality effectiveness, risk taking,entrepreneurial competencies, case studies.
Small Scale Units: Concept and definition, role of S.S.I. in Indian economy, governmentpolicies and facilities.
Planning Small Scale Business: Business opportunity identification, idea generation, ideas frommarketplace, market assessment, demand estimation.
Small Business Management: Techniques of marketing, materials, production, manpower and financial management, crisis management, working capital management, fixed capital assessment, cash flow analysis, ROI, techniques of decision making.

Managerial Economics & Business Accounting (6) Introduction to Economics, Kinds of Economic Decisions, Significance and applicability of Managerial Economics in decision making, Role and responsibilities of Managerial Economics, Economic principles relevant to managerial decision making, Opportunity cost, Production possibility curve, Concept of increments and Margin, Discounting principle
Business Accounting: Study of Balance sheets, Profit and Loss statements. Need, format of Trading and Profit and Loss A/c., Items to berecorde don the Debitand Credit Side of Trading and Profit and Loss A/c, Preparation of Trading and Profit and Loss A/c. Need, format of Balance Sheet, identification of Accounts to be written on liabilities and Assets side, Preparation of Balance sheet. (Analytical Problems)

Government Support Organizations (6)
The detailed study of the government support system for the entrepreneurship development
Central Government
State government

Financial support organizations
Government schemes and procedures

Business plan preparation & Statutory Requirements **(6)**Meaning of business plan, project parameters, information sources of economic and technical knowhow, Preparation of project report
Factories Act 1948, Industrial disputes Act 1947, Indian Contract Act, Indian sales and Goods Act, Indian Partnership Act, Central Excise, Sales tax, Income Tax Act, Value Added Tax (VAT). Business ethics, exportenvironment, procedure and documentation, venture capital financing, intellectual property act, patents

References

Developing New Entrepreneurs - Entrepreneurship Development Institute of India, Ahmedabad.
Handbook of New Entrepreneurs
Management of Small Scale Industry - Vasant Desai (Himalaya Publication)
Entrepreneurship Playing to Win- Gordon Betty (Taraporwala & Co.)

BTech(Common to all Programs) Semester - VIII Course work with Capston Project
University Open Elective II

UE2882 Human Values and Professional Ethics

Teaching Scheme				**Evaluation Scheme**			
Lect.	**Tut.**	**Pract.**	**Credits**	**Component**	**Exam**	**WT %**	**Pass %**
2	-	-	2	Theory	FET	20	40
					CAT	30	
					ESE	50	40

Course Description

The objective of the course is an exploration of human values which go into making a good human being, a good human society and a good life. The context is the work life and the personal life of modern Indian professionals. The movement to identify and promote the values shared by societies around the world is relatively new. It is only in recent years as globalization extended its reach to even remote corners of the earth that he needs to refocus and build upon what we as a human society have in common, has become apparent. Increased contact between peoples and nations enhances awareness of our kinship and the shared code of ethics and conduct that underlies all civilization. It's the Human values that we must now promote to create a common vision and means for moving forward toward a more peaceful and sustainable world.

The course also aims to have students appreciate the vastness of the Universe and the wonder of its parts, and the philosophical significance of this for improving the quality of human life through value clarification.

Course Outcomes:
After successful completion of the course, students will be able to
Understand the role of cognitive and moral values in world views, by discussing and writing about theethical implications of modern scientific and technological results
Recognize the difference between matters of fact and matters of value, while understanding the importantways in which facts influence value assessments and how value judgments shape our vision of "the facts"
Understand ethical methodologies and competency in ethical deliberation on rationally applying thesemethodologies to contemporary ethical questions related to scientific progress and technological power
Understand why ethics plays an important role in science and technology

Course Content
Human Values (6)
The value-crisis in the contemporary Indian Society-The Indian system of values-Values in the India n constitution- Aesthetic values: perception and enjoyment of beauty-Relative and absolute values-Morals- Values and Ethics – Integrity-Service – Work Ethic –Service Learning – Civic Virtue – Respect for Others –Respect for the Environment- Quest for Living Peacefully and happily– Attitude of Nonviolence-Innate dignity for human life – Bring out the best in oneself-caring – Sharing– Honesty– Courage– Valuing Time – Co-operation – Commitment – Empathy– Self-Confidence – Character – Spirituality

Engineering Ethics **(6)**
Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy -Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of
Professional Roles - theories about right action- Self-interest - customs and religion - uses of ethical theories.

Engineering asSocial Experimentation **(6)**
Engineering as experimentation - engineers as responsible experimenters - Research Ethics - codes of ethics - a balanced outlook on law - the challenger case study, Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - The Government Regulator's Approach to Risk- the three mile island, Chernobyl and Bhopal case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime

Responsibilities, Rights and Global Issues (6) Multinational corporations - Business Ethics -Environmental ethics –Role in Technological Development- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -Honesty-moral leadership-sample codes of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE) , India,etc.

Reference Books

"Professional Ethics and Human Values", M.P. Raghavan,Scitech Publications (India) Pvt Ltd.
"Human Values and Professional Ethics", Jayashri and Suresh B S ,S Chand .
"Ethics in Engineering", Mike Martin and Roland Schinzinger, , Tata McGraw-Hill, New York, (1996).
"Engineering Ethics(Including Human Values)",Govindarajan M, Natarajan S, Senthil Kumar V. S,Prentice Hall of India, New Delhi.
"A Textbook on Professional Ethics and Human Values", Naagarazan, R.S. ,New Age Publishers .
"Professional Ethics and Human Values",A Alavudeen,R Kalil Rahman M Jayakumaran ,LaxmiPublisher .
"Understanding Human Values :Individua l and Societal",Milton Rokeach ,Free Press Publication .
"Human Values" A N Tripathy, New Age International .
"A Foundation Course in Value Education",R R Gaur,R Sangal,(2009).
"Science and humanism", P L Dhar and R R Gaur, Commonwealth Publishers.
"Wisdom for The New Millennium",H.H .Sri Sri Ravishankarji, founder ,Art of Living, Vyakti Vikas Kendra, Bangalore.
"The Monk Who Sold his Ferrari",Robin Sharma, Jaico Publishing House .
"Mega Living",Robin Sharma, Jaico Publishing House .