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.

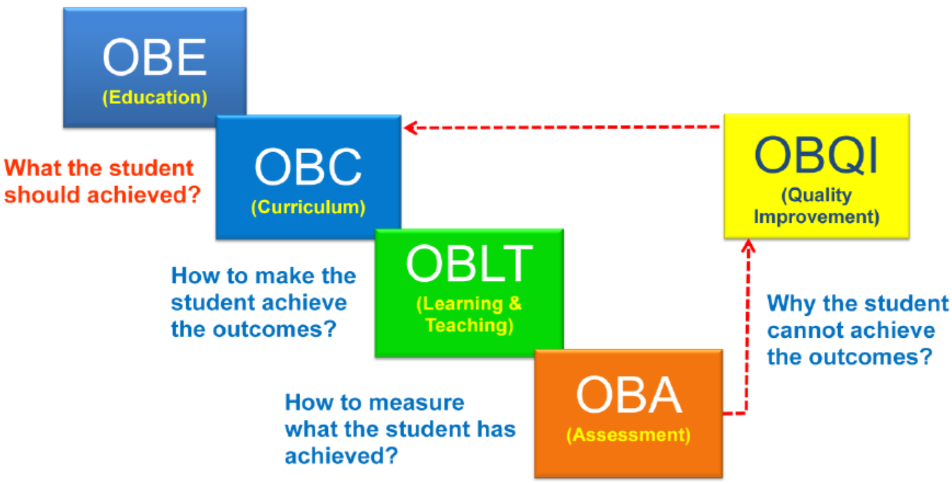
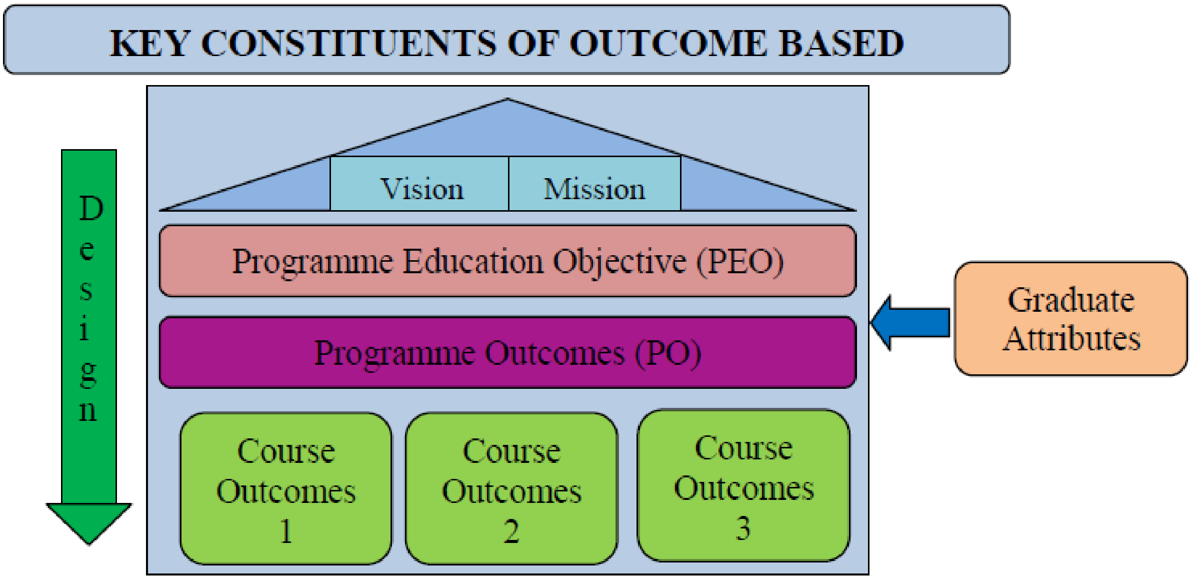


Figure 1: OBE flows and desciption

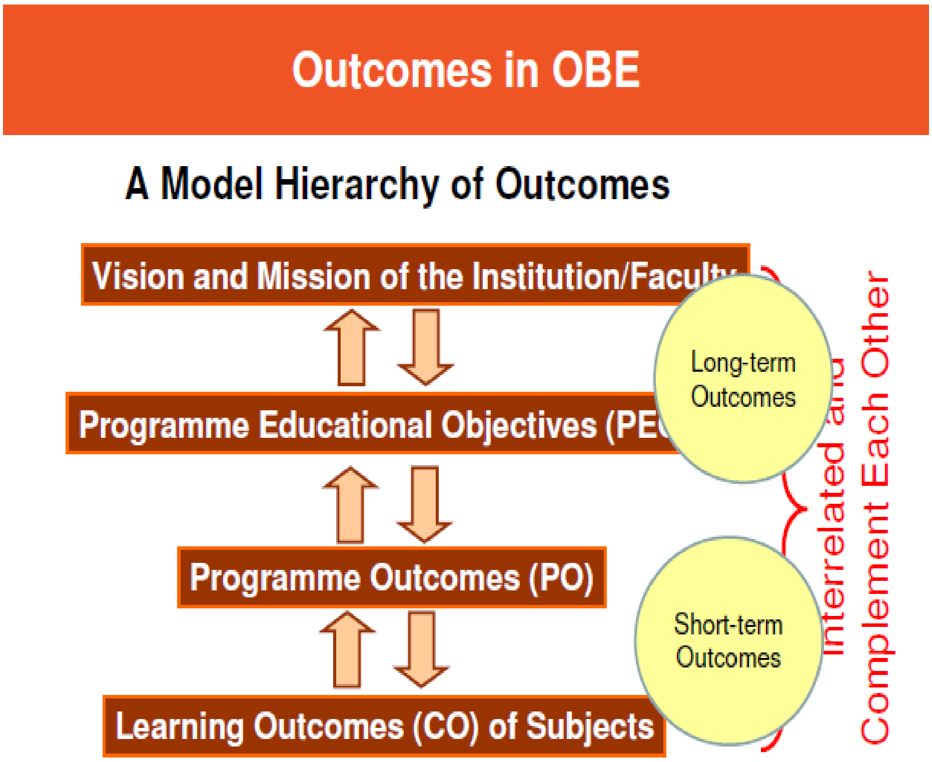


The OBE model measures the progress of the graduate in three parameters, which are

- 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

Approved in the second Academic Council Meeting held on 9th May, 2018 and to be implemented from academic year 2018-19. [Version R0]

Sanjay Ghodawat University Kolhapur

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

(Implemented from Academic year 2018-19)

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.

2.0 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 30^{th} 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.

3.0 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.

3.1 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.

3.2 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

3.3 Audit Course:

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

3.3.2 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.

3.3.3 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.

4.0 Course Registration:

4.1 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.

4.2 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.

4.3 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.

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

4.5 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.

4.6 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.

6.0 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:

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

6.2 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.

6.3 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.

6.4 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:

7.1 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 re-register 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:

8.1 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.

8.2 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.

8.3 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.

8.4 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.

8.5 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.

8.6 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.

8.7 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.

8.8 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.

8.9 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.

8.10 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.

8.11 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.

10. Attendance:

10.1 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.

10.2 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.

10.3 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.

10.4 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 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.

10.5 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:

10.1 Assessment of Theory Courses:

10.1.1 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).

10.1.2 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.

10.1.3 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.

10.1.4 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.

10.1.5 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.

10.1.6 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

10.1.7 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.

10.1.8 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.

10.1.9 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.

10.2 Assessment of Laboratory Courses:

10.2.1 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.

10.2.2 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.

10.2.3 Student failed in ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted alongwith 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.

11.1. Award of Grade (Regular Semester):

11.1.1 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.

11.1.2 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

11.1.3 A student shall pass the course if he/she gets any grade in the range "O" to "P".

11.1.4 “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.

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

12.2 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).

12.3 The performance of a student is less than 40% in FET, CAT1 and CAT2 Combined.

12.4 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.

12.5 Grade "X" may be given to a student if

12.5.1 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.

12.5.2 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).

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

12.6.1 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.

12.6.2 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.

12.6.3 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:

13.1 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

13.2 A student shall apply for re-examination before the last date of such application and shall appear for re-examination.

13.3 50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

13.4 **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:

13.5 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 4th 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.

15.2 Cumulative Grade Point Average (CGPA)

The total cumulative performance of a student at the end of specific semester is indicated 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.

15.3 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)

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

$$\text{FYPI} = \frac{\sum_i C_i g_i}{\sum_i C_i}$$

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.

16.2 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.

16.3 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.

16.4 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 form 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):

19.1 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:

20.1 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).

20.2 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.

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

21 Award of Degree:

Following rules prevail for the award of degree.

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

22 Grace Marks

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

Semester – III

Course Code	Course Title	L	T	P	C	Evaluation Scheme for (L T P) Component	Exam	WT	Pass %
MET 201 R1 (BS6)	Differential Calculus & Transforms	3	1	-	4	L (100)	FET	20	Min 40
							CAT-I	15	
							CAT-II	15	
							ESE	50	Min 40
MET 203 R1 (ES8)	Material Science & Metallurgy	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 205 R1 (PC1)	Manufacturing Processes	2	-	-	2	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 207 R1 (PC2)	Thermodynamics	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 209 (PC3)	Strength of Materials	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 211 (PC4)	Workshop Practice – III	-	-	2	1	P (100)	FEP	100	Min 40
MET 213 (ES9)	Material Science & Metallurgy Lab	-	-	2	1	P (100)	FEP	50	Min 40
							POE	50	Min 40
MET 215 (PC5)	Manufacturing Processes Lab	-	-	2	1	P (100)	FEP	50	Min 40
							POE	50	Min 40
MET 217 (PC6)	Thermodynamics Lab	-	-	2	1	P (100)	FEP	100	Min 40
MET 219 (PC7)	Strength of Materials Lab	-	-	2	1	P (100)	FEP	100	Min 40
MET 221 HS4	Environmental Science	1	-	2	NC	P (100)	FEP	100	Min 40
MET 223 UC 1	Professional Development Skills I	-	-	2	AU	P (100)	FEP	100	Min 40
	Total	**15**	**01**	**14**	**20**	**Total Hrs: 30, Total Credits: 20**			

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight; PC: Program Core, PE: Program Elective, UC: University Core, UE: University Elective; ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts; FET: Faculty Evaluation Lecture, FEP: Faculty Evaluation Practical, ESE: University Evaluation Practical

Semester – IV

Course Code	Course Title	L	T	P	C	Evaluation Scheme			
						Component	Exam	WT	Pass
MET 202 (BS 7)	Numerical Methods and Statistics	3	1	-	4	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 204 (ES 10)	Electrical Technology & Electronics	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 206 (PC8)	Kinematics of Machines	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 208 (PC9)	Fluid Mechanics	3	-	-	3	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 210 (PC10)	Metrology	2	-	-	2	L (100)	FET	20	Min 40
							CAT I	15	
							CAT II	15	
							ESE	50	Min 40
MET 212 (PC11)	Machine Drawing & CAD Lab	-	-	4	2	P (100)	FEP	50	Min 40
MET 214 (PC12)	Workshop Practice – IV (Basic CNC)	-	-	2	1	P (100)	FEP	100	Min 40
MET 216 (PC13)	Computer Programming Lab	-	-	2	1	P (100)	FEP	50	Min 40
							POE	50	Min 40
MET 218 (ES 11)	Electrical Technology & Electronics Lab	-	-	2	1	P (100)	FEP	100	Min 40
MET 220 (PC14)	Kinematics of Machines Lab	-	-	2	1	P (100)	FEP	100	Min 40
MET 222 (PC15)	Fluid Mechanics Lab	-	-	2	1	P (100)	FEP	100	Min 40
MET 224 (PC16)	Metrology & Mechanical Measurement Lab	-	-	4	2	P (100)	FEP	50	Min 40
							POE	50	Min 40
MET 226 UC 2	Professional Development Skills II	-	-	2	AU	P (100)	FEP	100	Min 40
	Total	**14**	**01**	**18**	**24**	**Total Hrs: 33, Total Credits: 24**			

L: Lecture, T: Tutorial, P: Practical, C: Credits, WT: Weight; PC: Program Core, PE: Program Elective, UC: University Core, UE: University Elective; ST: School of Technology, SS: School of Sciences, SC: School of Commerce, SM: School of Management, SA: School of Arts; FET: Faculty Evaluation Lecture, FEP: Faculty Evaluation Practical, ESE: University Evaluation Practical

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	T	C
MET 201 R1	**Differential Calculus & Transforms**	**03**	**01**	**04**

Course Description

This course is basically includes the study of differential equations, applications of ordinary differential equations, Laplace transform & Fourier Series.

Pre-requisites

FYT 101Matrices & Multivariable Calculus, FYT 122 Complex Numbers & Calculus

Course Objectives

1 Applications of ordinary differential equations
2 Laplace transforms & applications to solve ordinary differential equations

Course Outcomes

	Students will be able to	Bloom's Level
CO 201R1.1	Solve LDE with constant coefficients.	3
CO 201R1.2	Apply the methods of solution of Linear differential equations with constant coefficients for solving problems in Mechanical Engineering field	3
CO 201R1.3	Find gradient of Scalar, gradient & curl of vector field.	3
CO 201R1.4	Apply the techniques to find Laplace transforms	3
CO 201R1.5	Apply the techniques to find Inverse Laplace Transforms	3
CO 201R1.6	Examine periodic function as a Fourier series	4

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing	40%			40%	--	--
Planned Marks	30	30	20	100	--	--

Mapping of COs with POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 201R1.1	1													1
CO 201R1.2		1											2	
CO 201R1.3	1													1
CO 201R1.4		1												
CO 201R1.5		1												
CO 201R1.6		1											1	
	(1 – Low, 2 – Moderate, 3 – High)													

MET 201 R1	**Differential Calculus & Transforms**

Syllabus (Theory)

Units	**Description**	**Hours**
01	**Linear Differential Equations (LDE)**: Linear Differential Equations with constant coefficients- Definition, Complementary function and Particular integral (without method of variation of Parameters), Homogeneous Linear differential equations.	8
02	**Applications of Linear Differential Equations with Constant Coefficients**: The Whirling of Shafts. Mass – spring Mechanical system. Free oscillations Damped Oscillations. Forced oscillations without damping.	6
03	**Vector Differential Calculus**: Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function, Irrotational and solenoidal vector field.	6
04	**Laplace Transform**: Definition, Transforms of elementary functions, Properties of Laplace transform, Effect of multiplication by t^n and division by t, Transforms of derivatives and Integral.	8
05	**Inverse Laplace transforms formulae**: Inverse Laplace transforms by using standard results, partial fractions and Convolution theorem. Solution of Linear differential equation with constants coefficients by Laplace transforms method.	6
06	**Fourier Series**: Definition, Euler's Formulae, Dirichlet's Condition. Functions having points of discontinuity Change of interval, Expansion of odd and even periodic functions, Half range series.	6

Reference Books

Sr. No.	Title of Book	Author	Publisher/Edition
1	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers, Delhi.
2	A text book of Applied Mathematics, Vol.-I,II,III	P. N. Wartikar& J. N. Wartikar	Pune VidyarthiGrihaPrakashan, Pune.
3	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India Pvt. Ltd.
4	Advanced Engineering Mathematics	H. K. Das	S. Chand Publication
5	Mathematical methods of Science and Engineering	Kanti B. Datta	Cengage Learning
6	Engineering Mathematics	V. Sundaram	Vikas Publication
7	Advance Engineering Mathematics	Merle C. Potter	Oxford University Press

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	T	C
MET 203 R1	**Material Science and Metallurgy**	**03**	**--**	**03**

Course Description

The course familiarizes the students with the fundamental concepts of materials science and metallurgy useful for material selection. Understanding the properties of engineering materials and their metallurgy is essential to developing new and improved products. The course deals with the types of materials, structure, properties, their equilibrium diagrams, characteristics and applications, with special emphasis between their relationships. It includes heat treatment for metals and alloys for particular application. This course also contains study of powder metallurgical technique and manufacturing steps of powder metallurgy products

Pre-requisites

Applied Chemistry FYT 103, Applied Physics FYT102

Course Objectives

1 To impart fundamental knowledge of Ferrous and Non-Ferrous Metals
2 To study applications of different Metals and Alloys
3 To Know Fundamentals of Metallography
4 To develop futuristic insight into Metals.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 203R1.1	**Illustrate**the properties and applications of various engineering materials.	2
CO 203 R1.2	**Interpret** equilibrium diagram and microstructures of various types of steels.	2
CO 203 R1.3	**Select** appropriate heat treatment for metals and alloys for particular applications on the basis of TTT, CCT curves	3
CO 203 R1.4	**Explain** mechanical testing methods for various metallic materials.	2
CO 203 R1.5	**Explain** powder metallurgy technique, manufacturing of typical P/M products.	2

Evaluation Strategy						
Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	15%	15%	20%	50%	--	--
Passing	40%			40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 203 R1.1	3													
CO 203 R1.2	2	2										2		
CO 203 R1.3	2											2		2
CO 203 R1.4	2	2												
CO 203 R1.5	2													1
	(1 – Low, 2 – Moderate, 3 – High)													

MET 203 R1	**Material Science and Metallurgy**	
Unit No.	**Contents**	Hrs.
Unit 01	**Engineering Materials** Overview of Metallic Materials: Ferrous and Non-Ferrous Metals, Ceramics-Traditional and Engineering Ceramics, Polymers: Traditional and Special Polymers, Composites: Ceramic- Metal- Polymer composites, Carbon nano tube composites. **Metals and Alloy Systems** Metals, Metallic bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Nucleation and growth, Cooling curves, Dendritic structure and coring. Solid solutions and intermediate phases, Gibbs phase rule, Construction of equilibrium diagrams from cooling curves.	6
Unit 02	**Plain Carbon and Alloy Steels** Type of equilibrium diagrams in metals and alloys, lever rule. Iron - Carbon equilibrium diagram, critical temperatures. Allotropy, cooling curve and volume changes of pure iron. Microstructures of slowly cooled steels, estimation of carbon from Microstructures, non-equilibrium cooling of steels, Effects of alloying elements and examples of alloy steels. Stainless steels. Tool steels and tool materials. Applications of plain carbon and alloy steels, specifications of commonly used steels for engineering applications (e.g. EN, DIN, IS etc. with examples)	7
Unit 03	**Cast Irons** Classification of Cast irons: Gray cast irons, nodular cast irons, white cast irons, malleable cast irons, chilled. Effect of various parameters on structure and properties of cast irons. Applications of cast irons for different components of machine tools, automobiles, pumps, etc.	7
Unit 04	**Mechanical Testing** Tension test - Engineering and true stress strain curves, Compression test, Hardness Tests: Brinell, Rockwell, Vickers, Hardness conversions, Impact test, Non Destructive Testing: Magnetic Particle test, Dye penetrant, ultrasonic tests, radiography and eddy current testing.	6
Unit 05	**Heat Treatment of Steels** Transformation products of austenite, Time temperature Transformation diagrams, Critical cooling rate, continuous cooling transformation diagrams. Heat treatment of steels, Cooling media. Annealing, normalizing, hardening. Tempering, Carburising, Nitriding, Carbonitriding, Flame and Induction hardening. Commercial heat treatment practice of gears of different sizes, tools, lathe beds, springs, etc.	8
Unit 06	**Powder Metallurgy** Sintered structural components, Advantages and Limitations of powder metallurgy, powder manufacture, testing and characterization, Manufacturing of typical P/M products: cemented carbides, cermets, sintered carbide cutting tools, diamond impregnated tools, sintered metal friction materials and self- lubricating bearings.	6

MET 203 R1	**Material Science and Metallurgy**

Sr. No.	**Reference Books**
01	D. R. Askland& P. P. Phule, “Material Science & Engineering of Materials”, by Cengage Learning Center India Pvt Ltd., 6/e, 2011
02	S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill Publ. Co., 2/e 1997
03	R. Balasubramaniam,Callister's Materials Science and Engineering, Wiley India Pvt. Ltd., 2008.
04	V. Raghvan, “Materials Science & Engineering”, PHI 5th Edition, Prentice-Hall of India (P) Ltd.
05	W. Callister, “Materials Science & Engineering”, John Wiley & sons
06	R. A. Higgins, Engineering Metallurgy Part-I, Applied Physical Metallurgy, ELBS with Edward Arnold, 6/e, 1993.
07	K. Bhargava, Mechanical Behaviour and Testing of Materials by and C. P. Sharma, Publication PHI 2011.

SY B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	T	C
MET 205 R1	**Manufacturing Processes**	**02**	**--**	**02**

Course Description

It consists of primary manufacturing processes such as casting and metal forming includes metal forming process like forging, rolling, drawing and extrusion. Machine tools like lathe drilling milling shaping and planning and operations performed on it along with the cutting parameters is also included. It also includes plastic molding processes and non-conventional machining processes. This course covers application of each of the process included in it.

Pre-requisites

FYT104R1 Elements of Mechanical Engineering; FYT120 Workshop Practice – 1;
FYT126 Workshop Practice – 2

Course Objectives

1. To explain various operations performed on machine tools and selection of cutting parameters for these operations.
2. To explain various primary manufacturing processes its advantages, limitations and applications.
3. To introduce the various plastic molding processes and non conventional machining processes its characteristics and applications.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 205.1	Select cutting parameters for metal cutting processes on lathe, drilling, milling, shaping and planning etc.	2
CO 205.2	Identify a suitable primary manufacturing process for a component/job	2
CO 205.3	Compare various method of metal casting w.r.t. principles, characteristics, advantages, limitations and applications.	2
CO 205.4	Describe the characteristics of different types of non-conventional methods of manufacturing.	2

Evaluation Strategy

Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	15%	15%	20%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 205.1	2		2						2	1				
CO 205.2	2	2												
CO 205.3		2							1	1				
CO 205.4	2	2							1	1				
	(1 – Low, 2 – Moderate, 3 – High)													

MET 205 R1	**Manufacturing Processes**

Unit No.	Contents	Hrs.
01 CO 205.1	**Metal Cutting Processes** a. Centre lathe, lathe operations, taper turning, methods of taper turning, work holding and cutting tool, thread cutting, machining time and power estimation b. Drilling machine, its types, twist drill, drilling time and power estimates, counter boring, spot facing, boring, reaming, tapping, and broaching, broach tool, broaching types and operations, Sawing Machine - Types, Operations c. Milling machine and its types, milling operations, milling cutters, milling time and power estimates, Gear cutting using indexing mechanism, indexing types - simple, compound and differential indexing.	6
02 CO 205.2	**Metal Forming Processes** a. **Rolling** – Introduction, Hot and cold Rolling, Classification of Rolling Mills, Defects in Rolling, b. **Forging-** Introduction, Hand Forging Operations, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer) Open and Closed Die Forging, Defects in Forging c. **Extrusion-** Introduction, Types – Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in Extrusion d. Drawing – Processes of wire, rod and pipe drawing, Defects in Drawing.	6
03 CO 205.3	**Metal Shaping Processes** a. Introduction to **casting processes** : Patterns, Cores, core prints, sand casting procedure, Specialized casting processes such as shell mould casting, die casting, centrifugal casting, investment casting and permanent mould casting b. **Plastics Processing**: Molding – Compression molding, Transfer molding, Blow molding, Injection molding – Process and equipment. Extrusion of Plastic – Type of extruder, extrusion of film, pipe, cable and sheet Thermoforming – Principle, pressure forming and vacuum forming c. **Sheet metal working**: Sheet metal cutting operations, sheet metal noncutting operations.	6
04 CO 205.4	**Non-Conventional Machining Processes** Need Classification, selection of process, Electro Discharge Machining, Electro Chemical Machining, Ultra Sonic Machining, Electron Beam Machining, Laser Beam Machining, Plasma Arc machining, Abrasive Jet Machining, Water Jet Machining, Abrasive water jet machining,	6

MET 205 R1	**Manufacturing Processes**

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Manufacturing Technology-Vol. – I	P. N. Rao	Tata McGraw-Hill	
02	Manufacturing Technology-Vol. – II	P. N. Rao	Tata McGraw-Hill	
03	A Textbook of Production Technology (Manufacturing Processes)	P. C. Sharma	S Chand Publishing	
04	Production Technology HMT	HMT	Tata McGraw Hill Education	
05	Principles of metal casting	Haine And Rosenthal	Tata McGraw-Hill Book Company. New Delhi	
06	ASTM Volumes on Welding, casting, forming and material selection		ASTM handbook	
07	Manufacturing Processes And System	E P. Ostwald, J. Munoz	John Wiley & Sons (asia) Pvt.Ltd	2nd Edition
08	Fundamentals of Modern Manufacturing	M.P.Groover	Wiley India Pvt. Ltd.	
09	Westermann Tables for the Metal Trade	Jutz Hermann	New Age International Pvt Ltd	
10	CMTI : Machine Tool Design Handbook	CMTI	Tata McGraw Hill Publication	

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	T	C
MET 207 R1	**Thermodynamics**	**03**	**--**	**03**

Course Description

This course will cover the fundamental concept, principles and laws of thermodynamics and application of these principles & laws to solve problems in the field of combustion & Vapour power cycles.

Pre-requisites

FYT105 Elements of Mechanical Engineering

Course Objectives

1. To study basic concepts of thermodynamics, Laws of thermodynamics and its applications.
2. To study physical significance of entropy term and its application.
3. To study thermodynamics behind combustion.
4. To Study properties of pure substance & Vapour power cycle

Course Outcomes

	Students will be able to	Bloom's Level
CO 207R1.1	Classify types of systems and their relative properties	02
CO 207R1.2	Apply the concept of First law & second law of thermodynamics to design simple systems	02
CO 207R1.3	Explain the significance of Entropy and principles of entropy generation.	02
CO 207R1.4	Solve numerical problems on combustion and stoichiometry.	02
CO 207R1.5	Solve problems on Vapour power cycles.	03

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 207R1.1	1													2
CO 207R1.2	2	2	2										2	2
CO 207R1.3		2												2
CO 207R1.4	2													2
CO 207R1.5	2													2
	(1 – Low, 2 – Moderate, 3 – High)													

MET 207 R1	**Thermodynamics**	03	**--**	03

Unit No.	**Contents**	Hrs.
Unit 01	**Fundamental Concepts and Definitions** Thermodynamic systems; properties, Macroscopic v/s Microscopic viewpoint, processes and cycles. Thermodynamic equilibrium, Quasi-static process, Work and heat Transfer: path function and point function, specific heat and latent heat, Temperature & Zeroth law of thermodynamics, Energy.	05
Unit 02	**First Law of Thermodynamics** First law of thermodynamics for a closed system undergoing a cycle and change of state, Energy, Enthalpy, PMM-I control volume. Application of first law of steady flow processes (nozzle, turbine, compressor, pump, boiler, throttle valve etc.) Numerical on SFEE.	06
Unit 03	**Second Law of Thermodynamics** Limitation of first law of thermodynamics, cycle heat engine, refrigerator and heat pump (Numerical Treatment), Kelvin-Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem.	06
Unit 04	**Entropy** Introduction, Clausius theorem, T-s plot, Clausius inequality, Entropy and Irreversibility, Entropy principle and its application, Entropy change for reversible processes (Numerical Treatment). **Availability**: Available and unavailable energy: availability of a closed and open system, Availability of work and heat reservoirs, Energy, energy and exergy, (No numerical on Availability).	07
Unit 05	**Combustion Thermodynamics** Kinetic theory of gases- introduction, basic assumption, molecular flux, equation of state for an ideal gas, principle of equi-partition of energy, classical theory of specific heat capacity, Theoretical (Stoichiometric) air for combustion of fuels. Excess air, mass balance, Exhaust gas analysis, A/F ratio, Enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency.	08
Unit 06	**Properties of Pure Substances and Vapour Power Cycles** Properties of steam, Use of steam table and Mollier chart, Deviation of real gases from Ideal gases, Equations of state-Vander Waal, Beattie-Bridgemen, Virial and Diterici's equations, P-V-T surfaces and triple point of water, (Descriptive treatment) Carnot cycle using steam, Limitations of Carnot cycle, Rankine cycle, Representation on T-S and h-s planes, Thermal efficiency, Specific steam consumption, Work ratio, Effect of steam supply pressure and temperature, Condenser pressure on the performance. (Numerical Treatment), Reheat and regenerative steam power cycles.	07

MET 207 R1	**Thermodynamics**

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Basic and Applied Thermodynamics	P.K. Nag	Tata McGraw Hill	2/e, 2009
02	Thermodynamics: an engineering approach	Yunus A. Cenegal and Michael A. Boles	Tata McGraw Mill Publ. Co.	6/e, 2008
03	An Introduction to Thermo Dynamics	Y.V.C. Rao	Wiley Eastern Ltd	2003
04	Fundamental of Thermodynamics	G. J. Van Wylen, R.E. Sonntag	John Wiley and Sons	5/e, 1998
05	Thermodynamics	Radhakrishnan	PHI	2/e revised
06	Thermal Engineering	R.K. Rajput	Laxmi Publications	9/e, 2013

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	T	C
MET 209	**Strength of Materials**	**03**	**--**	**03**

Course Description

Strength of materials is the main foundation for Mechanical Engineering in the upcoming design courses. The field of strength of materials deals with forces and deformations that result from their acting on a material.

Pre-requisites

FYT 108 Engineering Mechanics

Course Objective

To familiarize the students with the fundamentals of deformation, stresses & strains in structural elements.

Course Outcomes

Students will be able to

		Bloom's Level
CO 209.1	Solve [2] numerical on simple stresses & strain, principle stresses & strain.	2
CO 209.2	Illustrate [2] shear force and bending moment diagrams for different types of beams by solving numerical.	2
CO 209.3	Solve [3] numerical on bending and shear stresses in beams with different cross sections.	2
CO 209.4	Solve [3] numerical on slope and deflection of beam for different types of load.	2
CO 209.5	Solve [3] numerical on torque in shaft of circular cross section & bucking of columns.	2

Evaluation Strategy

Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	15%	15%	20%	50%	--	--
Passing	40%			40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs:

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 209.1	2	2										2		2
CO 209.2	2	2										2		2
CO 209.3	2	2										2	2	2
CO 209.4	2	3										2	3	2
CO 209.5	2	2										2		2
	(1 – Low, 2 – Moderate, 3 – High)													

MET 209 Strength of Materials

Unit No.	Contents	Hrs.
Unit 01 CO 209.1	**Simple stresses and strains**: Basic Concept of stress and strain (linear, lateral. shear and volumetric), Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, stress strain diagrams for ductile and brittle materials, factor of safety, working stress, Hooke's law, bulk modulus, interrelation between elastic constants**.** Stresses, strains & deformations in determinate and indeterminate problems, homogenous and composite bars under concentrated loads and temperature changes.	06
Unit 02 CO 209.1	**Transformation of Stresses and Strains** Normal and shear stresses on any oblique plane. Concept of principal planes. Derivation of expressions for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear, graphical solution using Mohr's circle of stresses.	06
Unit 03 CO 209.2	**Transversely Loaded Components** Shear Force and Bending Moment in Determinate Beams due to Concentrated Loads, Uniformly Distributed Loads. Relation between SF and BM Diagrams for Cantilevers, Simple and overhang Beams, Defining Critical and Maximum Values and Positions of Points of Contra Flexure	08
Unit 04 CO 209.3	**Bending stresses and Shear stresses:** Theory of simple bending, assumptions, derivation of flexure formula, second moment of area of common cross sections with respect to centroidal and parallel axes, Bending stress of symmetrical and unsymmetrical sections. Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress.	08
Unit 05 CO 209.4	**Slope and deflection of Beams:** Relation between BM and slope, slope and deflection of determinate beams, Double Integration Method (Macaulay's Method). Derivation of Formulae for Slope and Deflection for Standard Cases (point load and uniformly distributed load - UDL).	06
Unit 06 CO 209.5	**Torsion of circular shafts and Buckling of Columns** Basic assumptions, Torsion formula, Hollow and solid circular shafts, Angular deflection of shaft. Concept of buckling of columns. Derivation of Euler's formula for buckling load for column with hinged ends. Concept of equivalent length for various end conditions. Limitations of Euler's formula. Rankine's formula. Johnson's formula, safe load on columns.	06

Sr. No.	Reference Books
01	"Strength of Materials", R.K. Rajput, S. Chad Publication.
02	"Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
03	"Strength of Materials", Timoshenko and Young, CBS Publication.
04	"Strength of Materials", Beer and Johnson, CBS Publication.
05	"Strength of Materials", G.H. Rider,MacMillan India Ltd.
06	"Strength of Materials", Nag and Chanda, Willey India Publication.
07	"Advanced Mechanics of Materials", Boresi, Willey India Publication.
08	"Strength of Materials", Den Hartong, McGraw Hill Publication.
09	"Mechanical analysis and design", H. Burr and John Cheatam, PHI, New Delhi.

	B. Tech. Mechanical Engineering **Second Year (Semester – III)**	P	C
MET 211	**Workshop Practice – III**	**02**	**01**

Course Description

This course contains hands on working on machines like lathe, drilling, shaping and grinding to make simple components. It familiarizes the student with practices in workshop, machines, tools and the measurement of dimensions.

Pre-requisites

Workshop Practice I and II, Elements of Mechanical Engg.

Course Objectives

1. To impart knowledge and skill to use tools, machines, equipment, and measuring instruments.
2. Educate students of Safe handling of machines and tools.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 211.1	**State the** safety precautions taken in Workshop	2
CO 211.2	**Select** appropriate machine tool for given drawing	3
CO 211.3	**Develop** a process sheet for given drawing and selected machine tool	3
CO 211.4	**Make** a job on machine tools using process sheet.	2
CO 211.5	**Inspect** a job using measuring instruments	3

Evaluation Strategy						
Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	--	--	--	--	100%	--
Passing		--		--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 211.1	1									2		2		
CO 211.2	1									2				
CO 211.3	2	2								2		2		
CO 211.4	2									2		2		1
CO 211.5	2									2		2		1
	(1 – Low, 2 – Moderate, 3 – High)													

MET 211	Workshop Practice – III	02	01

Sr. No.	Term Work	
01	Lathe: plain turning, taper turning, external threading and knurling operation along with preparation of its process sheet.	06
02	Drilling machine involving drilling, countersinking, counter boring, reaming and tapping	04
03	Shaper involving various operations on shaping machine.	06
04	Grinding machine – Cylindrical, surface and center less grinding	04

Note: - For above all operations one job will be performed by the students.

Sr. No.	Reference Books
01	S. K.Hajra Choudhury, Elements of Workshop Technology – Vol. II, Media Promoters & Publishers, Mumbai
02	Production Technology-HMT, Tata McGraw-Hill Publishing Co. Ltd.

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		P	C
MET 213	**Material Science and Metallurgy Lab**	**02**	**01**

Course Description

This course gives students an opportunity to perform practical on Universal tensile test machine, hardness test machine, impact test machine. It also provides to conduct non-destructive testing. This course contains study and applications of different heat treatment for steels.

Pre-requisites

Applied Chemistry FYT 103, Applied Physics FYT102

Course Objectives

1. To impart practical knowledge on the evaluation of material properties through various destructive testing procedures
2. To impart practical exposure on the microstructures of various materials and their hardness evaluation.

Course Outcomes

	Students will be able to	Bloom's Level
CO 213.1	**Interpret** the findings of destructive and non-destructive testing.	02
CO 213.2	**Interpret** the microstructures observed and drawn from plain carbon steel and cast-iron samples.	02
CO 213.3	**Compare** types of heat treatments on steel samples prepared in laboratory.	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	50%	50%
Passing		--		--	40%	40%
Planned Marks	--	--	--	--	50	50

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 213.1	2	2										2		
CO 213.2	2	3												2
CO 213.3	2		2											
	(1 – Low, 2 – Moderate, 3 – High)													

MET 213	Material Science and Metallurgy Lab	02	01

Course Content (Laboratory, Assignments, Mini Project, Seminar)

	Activity	Hrs
Lab 01	Tensile testing of M.S. and C.I.	02
Lab 02	Hardness testing (Rockwell and Brinell)	02
Lab 03	Impact testing (Izod and Charpy) of M.S, Brass and Al Alloy.	02
Lab 04	Demonstration of N.D.T. (Minimum two of different NDT tests)	02
Lab 05	Macroscopic Examinations Spark Test.	02
Lab 06	Examination of microstructure of steels and Cast Irons.	02
Lab 07	Examination of microstructure of Nonferrous alloys (Brass, Duralimin, Babbit)	02
Lab 08	Heat treatment of steels (Annealing, Normalizing, Hardening on medium/ high carbon steels)	02
Lab 09	Jominy end -quench test for hardenability	02
Lab 10	Observation of various industrial heat treatments processes during industrial visits.	02

Reference Books /Handbooks /Catalogues /Other

Sr. No.	Name of Book /Handbooks /Catalogues	Author (s)	Publisher /Organization	Edition, Year of Publication, ISBN
01	Material science and metallurgy for engineers	V.D.Kodgire	Everest Publishers Pune	12thEdition.
02	Heat Treatments Principles and Practices	T.V. Rajan and C.P. Sharma,	Prentice Hall of India Pvt Ltd	
03	Heat Treatment of Metals	J L Smith and SC Bhatia	CBS Publisheres and distibutors, New delhi	1st edition, 2008
04	Material science and engineering	W.D Callister	Wiley India Pvt.Ltd.	5thEdition

SY B. Tech. Mechanical Engineering
Second Year (Semester – III)

		P	C
MET 215	**Manufacturing Processes Lab**	**02**	**01**

Course Description

This course contains study and demonstration of machines like grinding machines, gear manufacturing machines and mold making processes. It also includes design of dies simple sheet metal parts; and visits to industries for understanding the processes better.

Pre-requisites

FYT 104 R1 Elements of Mechanical Engineering; FYT 120 Workshop Practice – 1,
FYT 126 Workshop Practice – 2, MET 205 Manufacturing Processes

Course Objectives

1. To refer handbook /data book for preparation of process sheets for various operation on lathe, drilling and milling processes and its applications.
2. To prepare sand mold and test various properties of sand and study effect of its constituents on properties of molding sand.

Course Outcomes

	Students will be able to	Bloom's Level
CO 215.1	**Prepare** process sheets for various operations on lathe, drilling and milling and **calculate** machining time.	3
CO 215.2	**Test** properties of molding sand.	3
CO 215.3	**Select** an appropriate grinding wheel for suitable application.	2
CO 215.4	**Summarize** the rolling process, forging process.	2

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	50%	50%
Passing	---			--	40%	40%
Planned Marks	---	--	--	--	50	50

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 215.1			2			2								
CO 215.2				3										
CO 215.3		2												
CO 215.4				3								2		
CO 215.5	1											3		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 215 Manufacturing Processes Lab

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.	
01	Preparation of process planning sheet for a job including processes such as turning, milling and drilling.	02
02	Study of Shaping machine and planning machine and its various mechanisms.	04
03	Demonstration of Grinding Machine, grinding wheel, its types, materials, Standard nomenclature.	04
04	Study of various Gear Manufacturing Processes and its applications.	03
05	Demonstration of Mold Making process.	04
06	Industrial Visit to Rolling mill, Forging and press work.	03

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Principles of metal casting	Haine And Rosenthal	Tata McGraw-Hill Book Company. New Delhi	
02	ASTM Volumes on Welding, casting, forming and material selection		ASTM handbook	
03	Manufacturing Processes And System	E P. Ostwald, J. Munoz	John Wiley & Sons (asia) Pvt.Ltd	2nd Edition
04	Fundamentals Of Modern Manufacturing	M.P.Groover	Wiley India Pvt. Ltd.	

	B. Tech. Mechanical Engineering **Second Year (Semester – III)**	L	T	C
MET 217	**Thermodynamics Lab**	**03**	**--**	**03**

Course Description

This Lab course will cover testing of lubricant properties, Exhaust gas analysis and study of jet propulsion engines & steam power plant.

Pre-requisites

FYT105 Elements of Mechanical Engineering

Course Objectives

1 To test the lubricant for various properties
2 To conduct test on emission analyzer
3 To study Jet propulsion engines & steam power plant

	Course Outcomes *Students will be able to*	Bloom's Level
CO 217.1	Interpret the various properties of lubricants by conducting the tests in laboratory.	03
CO 217.2	Examine engine exhaust gas for pollutant measurement by exhaust gas analyzer.	03
CO 217.3	Demonstrate the working of Jet propulsion Engine & steam power plant.	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 217.1	2													2
CO 217.2	2					2								2
CO 217.3	1													2
	(1 – Low, 2 – Moderate, 3 – High)													

MET 217 Thermodynamics Lab

	Activity	Hrs.
Lab 01 CO 217.1	Test on Grease penetrometer and dropping point apparatus	02
Lab 02 CO 217.1	Test on Carbon residue, Cloud and Pour point apparatus.	02
Lab 03 CO 217.1	Test on Redwood viscometer and Aniline point apparatus.	02
Lab 04 CO 217.1	Determination of flash and fire point of a lubricating oil.	02
Lab 05 CO 217.2	Trial on Exhaust gas analyzer.	02
Lab 06 CO 217.3	Study of Jet propulsion Engines.	02
Lab 07 CO 217.3	Demonstration on steam power plant.	02
Lab 08 CO 217.3	Industrial visit to a steam power plant.	06

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Basic and Applied Thermodynamics	P.K. Nag	Tata McGraw Hill	2/e, 2009
02	Thermodynamics: an engineering approach	Yunus A. Cenegal and Michael A. Boles	Tata McGraw Mill Publ. Co.	6/e, 2008
03	An Introduction to Thermo Dynamics	Y.V.C. Rao	Wiley Eastern Ltd	2003
04	Fundamental of Thermodynamics	G. J. Van Wylen, R.E. Sonntag	John Wiley and Sons	5/e, 1998
05	Thermodynamics	Radhakrishnan	PHI	2/e revised
06	Thermal Engineering	R.K. Rajput	Laxmi Publications	9/e , 2013

	B. Tech. Mechanical Engineering **Second Year (Semester – III)**	P	C
MET 219	**Strength of Materials Lab**	**02**	**01**

Course Description

Strength of materials is the main foundation for Mechanical Engineering in the upcoming design courses. The field of strength of materials deals with forces and deformations that result from their acting on a material.

Pre-requisites

FYT 108 Engineering Mechanics

Course Objectives

1 To familiarize the students with the fundamentals of deformation, stresses & strains in structural elements. & Solve numerical assignment based on the same.

Course Outcomes

	Students will be able to	Bloom's Level
CO 219.1	Solve [3] numerical on simple stresses & strains and principal stresses & strains.	02
CO 219.2	Solve [3] numerical on beams with different cross section and different loading to draw shear force and bending moment diagrams.	02
CO 219.3	Solve [3] numerical on beams with different cross section and different loading to evaluate shear stresses, bending stresses and deflection of beam.	02
CO 219.4	Solve [3] numerical on circular shaft for torsional loading, buckling of columns for different loading.	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 219.1	3	2										2		2
CO 219.2	3	2										2		2
CO 219.3	3	2										3	3	2
CO 219.4	3	3										2	2	2
	(1 – Low, 2 – Moderate, 3 – High)													

MET 219 Strength of Materials Lab

Sr. No.	Numerical assignments to be carried out on following topics, and report to be submitted in prescribed format.
01	Simple stresses and strains
02	Transformation of stresses and strains (principal stresses)
03	Transversely Loaded Components (Shear Force Diagram & Bending Moment Diagram)
04	Bending stresses and shear stresses
05	Torsion of circular shafts
06	Buckling of columns
07	Theories of elastic failure
08	Strain energy and impact loading

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		L	P	C
MET 221	**Environmental Science**	**01**	**02**	**NC**

Course Description

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

Pre-requisites

Basic knowledge of Environmental science

Course Objectives

1 To introduce the students to the concept of Environmental studies
2 To acquaint the students with various ongoing problems and issues in the Environment
3 To introduce the concepts of Ecosystem, Biodiversity, Pollution and Environment protection act.

Course Outcomes

	Students will be able to	Bloom's Level
CO 221.1	Describe multidisciplinary nature and importance of Environmental Studies	2
CO 221.2	Explain concept of ecosystem	2
CO 221.3	Explain concept of natural recourses and associated problems	3
CO 221.4	Recognize importance of biodiversity, threats and conservation practices	2
CO 221.5	Explain concept of environmental pollution, causes, effects and controls	2
CO 221.6	Describe global environmental issues and laws.	2
CO 221.7	Describe Environmental protection policies and practices	2

Evaluation Strategy

Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	--	--	--	70%	30%	--
Passing		--		40%	40%	--
Planned Marks	--	--	--	100	50	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 221.1				3		1								
CO 221.2	1			2		1		3	2				1	
CO 221.3	1		2	1	3	1		2	1					
CO 221.4	1	2		1	3			1	1					
CO 221.5								3		2				
CO 221.6						1				3	1			
CO 221.7						1				3				
	(1 – Low, 2 – Moderate, 3 – High)													

MET 221	**Environmental Science**	**01**	**02**	**NC**

	Course Content	Hrs.
Unit 01 CO 221.1	**Nature of Environmental Studies :** Definition, scope and importance. Multidisciplinary nature of environmental studies, Need for public awareness. Concept of sustainability, sustainable development and its goals with Indian context.	03
Unit 02 CO 221.2	**Ecosystems :** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem : a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Degradation of the ecosystems and it's impacts	09
Unit 03 CO 221.3	**Natural Resources and Associated Problems :** a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy , Biomass energy, Nuclear energy, e) Land resources: Land as a resource, land degradation, man induced Landslides, soil erosion and desertification. Consumerism, ecological foot prints, carbon foot prints, carbon credits. Role of an individuals in conservation of natural resources, Equitable use of resources for sustainable lifestyles	08
Unit 04 CO 221.4	**Biodiversity and its conservation :** Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega- diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, convention on biological diversity.	08

Unit 05 CO 221.5	**Environmental Pollution :** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Solid waste Management control rules. Role of an individual in prevention of pollution.	08
Unit 06 CO 221.6	**Social Issues and the Environment :** Human Population Growth, impact on environment. Human health and welfare. **Environment ethics:** role of Indian religious traditions and culture in conservation of the environment. **Environmental Movements** : Chipko movement, Appiko movement, silent valley, Resettlement and rehabilitation of people; its problems and concerns. Water conservation, rain water harvesting, watershed management, water conservation by Dr. Rajendra Singh, Anna Hazare etc. **Disaster Management :** floods, earthquake, cyclone, tsunami and landslides. Wasteland reclamation. Environmental communication and public awareness, case studies.	09
Unit 07 CO 221.7	**Environmental Protection – Policies and Practices :** From Unsustainable to Sustainable development Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act Wildlife Protection Act Forest Conservation Act Population Growth and Human Health, Human Rights.	05
Unit 08	**Field work:** Visit to a local area to document environmental assets • River/ forest/ grassland/ hill/ mountain. Or • Visit to a local polluted site – Urban/ Rural/ Industrial/ Agricultural Or • Study of common plants, insects, birds. Or • Study of simple ecosystems – ponds, river, hill slopes, etc. (Field work is equal to 10 lecture hours)	10

Reference Books

Sr. No.	Name of Book	Author(s)	Publisher	Edition, Year of Publication, ISBN
01	Environmental Studies	Dr. P. D. Raut	Shivaji University, Kolhapur	
02	Perspective in Environmental studies	Anubha Kaushik	New Age International Publications	
03	Introduction to Environmental Sciences	R S Khoiyangbam	TERI Press	ISBN: 978-81-7993-455-5
04	Introduction to Environmental Science: 2nd Edition	Caralyn Zehnder	University press of Georgia	ISBN: 97-81-2343-478

B. Tech. Mechanical Engineering
Second Year (Semester – III)

		C
MET 223 UC 2	**Professional Development Skills I**	**AU**

Course Description

Professional skill Development empowers students in their soft skill and communication. Professionalism and employability skills are enhanced with the help of this subject.

Pre-requisites

Ability of Reading and Writing

Course Objectives

01 Development of professional skills and abilities
02 Enhancement of communication skills and public speaking

Course Outcomes

	Students will be able to	Bloom's Level
CO 223.1	Apply[3] self-analysis techniques	2
CO 223.2	Plan[4] and execute SMART goals	2
CO 223.3	Demonstrate[3] team building skills	3
CO 223.4	Exhibit[3] presentation and public speaking skills	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing		--		--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 223.1			3											
CO 223.2							3							
CO 223.3	1													
CO 223.4				1										
	(1 – Low, 2 – Moderate, 3 – High)													

MET 223 UC 2 Professional Development Skills I

Contents

Units	**Description**	Hrs
01	**Soft Skills:** What are soft skills? Importance of soft skills, selling your soft skills, identifying and improving your soft skills **Self Analysis:** Importance of knowing yourself, SWOT Analysis, Importance of Self Confidence, Self Esteem	04
02	**Goal Setting:** SMART Goals, Short Term goals, Moderate term goals, Long Term, Life Time Goals	04
03	**Team Building and Teamwork:** Introduction-meaning–aspects of team building, team Vs group, Stages of team building, Characteristics of effective team, role of a team leader, role of team members	04
04	**Time Management:** Value of time, Diagnosing Time Management, Preparing to do list, Prioritizing work	04
05	**Presentation skills and Public Speaking:** Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation. Extempore and Prepared speeches	04

Note: During the practical sessions, it is expected that the contents of all modules should be delivered to the students of different batches and assignments be given based on the activities discussed as per the modules. Students must demonstrate the acquired skills by means of giving presentations, delivering public speeches, group discussions etc.

Reference Books

1. Wallace & Masters, Personal development for Life & work, Thomson Learning.
2. Barun K. Mitra, Personality Development and Soft- Skills, Oxford University Press.
3. Fred Luthans, Organizational behavior, McGraw Hill.
4. Asa Don Brown, Interpersonal skills in the Workplace, Tate publishing and Enterprises.

	B. Tech. Mechanical Engineering **Second Year (Semester – IV)**	L	T	C
MET 202	**Numerical Methods & Statistics**	**03**	**01**	**04**

Course Description

This course includes various numerical techniques to find differentiation, integration & to solve Engineering problems

Pre-requisites

FYT 101Matrices & Multivariable Calculus, FYT 122 Complex Numbers & Calculus, MET201 Differential Numerical techniques, Probability, Interpolation, Basics of Matrices, Polynomial & System of equations.

Course Objectives

1 To develop Numerical techniques to solve Engineering Problems.

Course Outcomes

	Students will be able to	Bloom's Level
CO 202R1.1	Solve Algebraic and Transcendental Equations	3
CO 202R1.2	Apply the methods of solution of Simultaneous linear equations	3
CO 202R1.3	Solve Ordinary Differential Equation	3
CO 202R1.4	Express numerical data as polynomial.	2
CO 202R1.5	Evaluate derivative and integration	5
CO 202R1.6	Apply the probability distributions	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	20	100	--	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 202.1	1	1												
CO 202.2	1												1	
CO 202.3	1													
CO 202.4	1													
CO 202.5	1												2	
CO 202.6		1											1	
	(1 – Low, 2 – Moderate, 3 – High)													

MET 202	**Numerical Methods and Statistics**

Content (Theory)

Units	Description	Hours
01	**Algebraic and Transcendental Equations**: Introduction, Types of errors, Rules for estimate errors, Roots of Equation by Bisection Method, False position method, Secant method, Newton- Raphson method.	8
02	**Simultaneous Linear Equations**: Gauss elimination method, Gauss-Jordan method, Factorization method, Gauss- Seidel iterative method, Jacobi iterative method.	6
03	**Ordinary Differential Equation**: Taylor series method, Picard Method, Euler Method, Euler modified method, fourth order Runge-Kutta method.	6
04	**Interpolation**: Introduction, Interpolation on equal intervals -Newton forward and backward difference formulae, Sterling Interpolation formula (tabular values), Interpolation on unequal intervals- Newton divided difference formula, Lagrange Interpolation.	8
05	**Numerical Differentiation and Integration**: Newton forward and backward difference formulae for equally spaced data, Derivative using sterling formula (tabular values), Newton's divided difference formula for unequally spaced data, Derivative using Lagrange's Interpolation, Numerical Integration by Trapezoidal rule and Simpson rule.	8
06	**Statistics**: Random variable, Probability mass function and probability density function, Binomial, Poisson and Normal distributions.	6

Reference Books

Sr. No.	Title of Book	Author	Publisher/Edition
1	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publishers, Delhi. 7/e,2005
2	Numerical Methods	E. Balguruswamy	Tata McgrawHill Publication Company Ltd.,8/e,2002.
3	Numerical Methods	S. Arumugam, A. Thangapandi Isaac and A.Somasundaram,	Scitech Publications India Pvt.Ltd.,Chennai, 2/e,2007.
4	Numerical Methods	Dr. V.N.Vedamurthy	Vikas Publication
5	Numerical Methods	G.Haribaskaran	Laxmi Publications Pvt.Ltd, New Delhi, 1/e,2006.
6	Numerical Analysis Theory and Applications	R.L.Burden and J.D.Faires	Cengage Learning India Pvt.Ltd.,New Delhi,1/e,2005.
7	Numerical Mathematics and Computing	Ward Cheney	Cengage Learning India Pvt.Ltd.,New Delhi,7/e

	B. Tech. Mechanical Engineering **Second Year (Semester – IV)**	L	T	C
MET 204	**Electrical Technology & Electronics**	**03**	**--**	**03**

Course Description

This course gives brief idea on DC motors and three phase induction motors. Also it consists of application of electrical drives. This course describes the combinational and sequential logic circuits and different types of sensors and transducers. This course gives introduction to computer networks and its applications.

Pre-requisites

FYT107- Elements of Electrical Engineering, FYT 106- Elements of Electronics Engineering.

Course Objectives

1. This course intends to provide basic concept of DC motor & AC motor.
2. It intends to develop skills to evaluate ratings of DC machines and AC machines for various applications
3. This course provides the knowledge of electrical drive system and their selection criteria's for different applications.
4. This course gives the knowledge about the sensors and transducers used to sense different parameters.
5. This course intends to provide basic theory of computer network connections.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 204.1	Explain working and characteristics of DC motors	2
CO 204.2	Explain working and speed control methods for induction motors	2
CO 204.3	Classify different types of drives used in industry.	2
CO 204.4	Explain various sensors and transducers with their application	2
CO 204.5	Illustrate the operation of digital combinational and sequential circuits.	2
CO 204.6	Classify different computer networks with their types.	2

Evaluation Strategy

Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	15%	15%	50%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	100	50		

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 204.1	2													
CO 204.2	2		1											
CO 204.3	1		3											
CO 204.4	1													
CO 204.5			2											
	(1 – Low, 2 – Moderate, 3 – High)													

MET 204 Electrical Technology & Electronics

Unit No.	Contents	Hrs
Unit 01	**DC motors** Construction, Working, Types, Back emf, Speed equation, Torque equation, Speed torque characteristics, Applications, Power losses in d.c. Motors. Need of starter, 3 point starter, Speed control of D.C. Shunt and series motor (numerical treatment), Reversal of rotation, Electric braking of shunt and series motor. DC servo motor, Stepper motor (VR type and PM type).	6
Unit 02	**Three Phase Induction Motor** Construction, Types, Working, Speed equation, Torque equation, Starting torque, Concept of full load torque, Torque speed characteristics, Power stages in motor (Numerical treatment), Need of starter, Star delta starter, DOL starter, Rotor resistance starter, Variable Frequency Drive speed control method, Block diagram of electronic VFD control, Rotor resistance speed control. Reversal of rotation. AC servo motor, Introduction to BLDC motor and linear induction motor.	10
Unit 03	**Electrical Drives** Advantages of electrical drives, Types – Individual, group, Multi-motor drive. 2 quadrant and 4 quadrant operation of electric machines. Criteria for selection of motors for applications - machine tools,. Determination of power rating of electric motors for continuous duty – Constant load.	4
Unit 04	**Sensors and Transducers** Definition, Various Types of Transducers, Classification of Transducers, Selection Factors and General Applications of Transducers, Detailed Study of Transducers: (i) Motion, (ii) Flow, (iii) Pressure, (iv) Temperature, (v) Force and Torque, (vi) Sound Transducer, Hall Effect Transducers, Digital Transducers, Proximity Devices, optical Sensors, Smart Sensors, Piezo – electric sensors	8
Unit 05	**Combinational & Sequential Logic Circuits** Adder, Subtractor, Multiplexer and Demultiplexer, encoder, decoder, 4 bit Magnitude Comparator, Sequential circuits - SR Latch, One bit memory cell, JK flip-flop	6
Unit 06	**Introduction to Computer Networks:** Networks definition &requirements, Networks topologies, LAN,MAN and WAN network, Introduction to OSI,TCP/IP reference model, Modem- block schematic and working, network devices: network connectors, Hubs, Switches, Routers, Bridges, NIC; Introduction to Internet of Things	6

Sr. No.	Reference Books
01	Electronic Instrumentation. H. S. Kalsi, TMH Publication
02	Digital Design - M. Morris Mano - Pearson Education, 3/e, (Unit 1,2,3,4)
03	Computer networks Andrew S. Tanenbaum, Pearson Education, 5/e.
04	A. Anand Kumar, “Fundamentals of digital circuits” 1/e, PHI publication, 2001
05	A course in Electrical, Electronics Measurement and Instrumentation, A.K.Sawhney

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		T	T	C
MET 206	**Kinematics of Machines**	**03**	**--**	**03**

Course Description

This course will deal with kinematic analysis of mechanisms and machines. It will include motion analysis of linkage mechanisms. This will cover inversion of kinematics chain, velocity and acceleration analysis. The course will demonstrate various concepts by working out problems relevant to real life applications of mechanisms. The course is expected to help students in their basic understanding and use of kinematic analysis.

Pre-requisites

FYT 108 Engineering Mechanics

Course Objectives

1. To represent kinematic behavior of different machine elements and mechanisms.
2. To select various Power transmitting devices.
3. To explain types of Cam with followers and select according to their applications.
4. To compare types of Governing mechanisms.
5. To analyze effect of friction in Mechanisms and machines

Course Outcomes

	Students will be able to	Bloom's Level
CO 206.1	Understand different types of mechanisms and their applications	02
CO 206.2	Analyze velocity and acceleration of mechanisms by graphical methods.	03
CO 206.3	Select different power transmitting elements according to application	02
CO 206.4	Design the cam with follower for different applications	03
CO 206.5	Select different governing mechanisms according to application.	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 206.1	1	1												
CO 206.2		3												
CO 206.3	1													
CO 206.4		1										2	2	
CO 206.5		2										1		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 206 Kinematics of Machines

Unit No.	Contents	Hrs
Unit 01 CO 206.1	**Basic Concept of Mechanisms** Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubbler‟s criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Analysis of Hooke's joint.	05
Unit 02 CO 206.2	**Velocity and Acceleration in Mechanisms** Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Coriolis‟ component of acceleration, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.	10
Unit 03 CO 206.3	**Friction** Introduction of friction, Friction in pivot bearings, Inclined plane theory, Friction in screws.	05
Unit 04 CO 206.4	**Cams** Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.	08
Unit 05 CO 206.5	**Belts and Dynamometers** Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt, Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer.	06
Unit 06 CO 206.5	**Governors** Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.	06

Sr. No. **Reference Books**

01 Theory of Machines, Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
02 Theory of Machines, P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition
03 Theory of Machines, V.P. Singh, DhanpatRai and Sons
04 Theory of Machines, H.G.Phakatkar, Nirali Publication. Pune
05 Theory of Machines, Dr. R.K.Bansal, Laxmi Publication.
06 Theory of Machines, Thomas Bevan, CBS Publishers, New Delhi.
07 Theory of Machines & Mechanism, G.S. Rao & R.V. Dukipatti, NewAge Int.PubLtd., New Delhi.
08 Theory of Machines, Shah and Jadhawani, DhanpatRaiand Sons
09 Theory of Machines and Mechanism, Shigley, McGraw Hill, New York
10 Theory of Machines, Abdullah Shariff, McGraw Hill, New Delhi.

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		L	T	C
MET 208	**Fluid Mechanics**	**03**		**03**

Course Description

This course imparts the basic knowledge of incompressible and compressible fluids, required for designing machinery like pumps, turbines, compressors, lubrication systems, propulsion engines etc. and analysis using techniques like computational fluid dynamics. It includes basic concepts of properties of fluid and different phases of fluid as statics, kinematics and dynamics, types of flows and the effect of flow through a pipe and flow over bodies.

Pre-requisites

FYT102 Applied Physics, FYT105 Elements of Mechanical Engineering.

Course Objectives

1 Understanding basic laws, principles and phenomena in the area of fluid mechanics.
2 Solve simplified examples of fluid mechanics**.**
3 theoretical and practical preparation enabling students to apply the acquired knowledge and skills in professional and specialist courses

Course Outcomes

	Students will be able to	Bloom's Level
CO 208.1	**Explain** properties of fluids and concept of buoyancy.	02
CO 208.2	**Solve** the numerical assignments on kinematics and dynamics of fluid flow and momentum equation.	03
CO 208.3	**Solve** the numerical assignments on laminar flow of fluids.	03
CO 208.4	**Apply** Dimensional Analysis to a model for flow analysis for various applications.	03
CO 208.5	**Apply** the concept of boundary layer to workout exercises	03

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing		40%		40%	--	--
Planned Marks	30	30	100	100	--	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 208.1	3		1											
CO 208.2	2	2												
CO 208.3	2	2												
CO 208.4	2		2											
CO 208.5	2	2	2											
	(1 – Low, 2 – Moderate, 3 – High)													

MET 208	**Fluid Mechanics**	
Unit No.	**Contents**	Hrs
Unit 01	**Basics:** Introduction, Properties of fluids, Concept of continuum, types of fluids, pressure at a point in the static mass of fluid, variation of pressure, Pascal's law, types of pressure and pressure measuring devices. **Fluid Statics:** Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane, surface submerged in static fluid. Buoyancy, center of buoyancy, meta center and meta centric height, its application in shipping, stability of floating bodies.	07
Unit 02	**Fluid Kinematics**: Types of Flow, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential and stream function, continuity equation in Cartesian co-ordinates. Rotation, vorticity and circulation, Problems. **Fluid Dynamics:** Momentum equation, Impacts of jets- force on fixed and moving vanes, flat and curved. Numerical. Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, venturi meter, orifice meter, pitot tube,Rectangular and triangular notch, orifices etc., related numerical.	09
Unit 03	**Laminar and Turbulent Flow**: Reynolds Number, Entrance flow and Developed flow, Navier-Stokes Equation (without derivation), Laminar flow between parallel plates, Poiseuille equation – velocity profile, Couette flow, Fully developed laminar flow in circular pipes, Hagen - Poiseuille equation, related numerical. Loss of Pressure Head due to Fluid Friction, Darcy-Weishach formula, major and minor losses in pipes, Commercial pipe, Colebrook equation, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numerical.	08
Unit 04	**Flow Over Bodies:** Development of boundary layer, Prandtl's boundary layer equations, Blasius solution, laminar layer over a flat plate, boundary layer separation and its control. Basic concept of Lift and Drag, Types of drag, Co-efficient of drag and lift, streamline body and bluff body, flow around circular bodies and airfoils, Lift and drag on airfoil, Numerical.	05
Unit 05	**Dimensional Analysis:** Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Rayleigh's method, Buckingham Pi theorem, Similitude and Model studies. Numerical.	06
Unit 06	**Compressible Flows:** Introduction, thermodynamic relations of perfect gases, speed of sound, pressure field due to a moving source, basic equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.	05

Sr. No.	**Reference Books**
01	Fluid Mechanics (SI Units), Yunus A. Cengel John M. Cimbala, 3/e., Tata McGraw Hill, 2014.
02	Fluid Mechanics, F M White, McGraw Hill Publications, 8/e. 2016.
03	Fluid Mechanics, John F. Douglas, Janul and M. Gasiosek and John A. Swaffield, Pearson Education
04	Fluid Mechanics and Hydraulic Machines, Dr. R.K. Bansal, Laxmi Publications, 2016.
05	Fluid Mechanics and Hydraulic Machines, Dr. R.K. Rajput, S. Chand Publications, 2015.
06	Fluid Mechanics and Hydraulic Machines, Dr. D. S. Kumar, S.K Kataria and Sons Publications

	B. Tech. Mechanical Engineering **Second Year (Semester – IV)**	L	T	P	C
MET 210	**Metrology**	**2**	**-**	**-**	**2**

Course Description

Quality assurance of the parts manufactured is essential for customer satisfaction and company survival. In this context, this course deals with the basic principles of dimensional measuring instruments and precision measurement techniques. It consists of measurement of linear and angular dimensions, surface characteristics and geometrical relationships between features of components. It also contains analysis of the measured inspection data for the purpose of maintaining quality.

Pre-requisites Applied Physics FYT 102, Machine Drawing & CAD Lab(MET12)

Course Objectives

1 To understand use of standard measurement, limits, fits and tolerances.

2 To understand the principles, construction, working and used of comparators and angle measuring instruments, surface roughness.

3 To study the methods used for measurement of screw threads and gears.

4 To study of the digital measurement like CMM, machine vision, etc. and understand the concept of quality and verify SQC techniques.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 210.1	Design the tolerance for go gauges and no-go gauges using the concept of limits, fits and tolerances used in components and assemblies.	3
CO 210.2	Suggest the use of suitable measuring instruments for different parameters of job.	2
CO 210.3	Interpret geometrical deviations and parameters of thread, gears and surface roughness.	3
CO 210.4	Construct control charts using measured inspection data for drawing inferences.	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	15%	15%	20%	50%	--	--
Passing	40%			40%	--	--
Planned Marks	30		30	100		100

Mapping of COs with POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 210.1	1	2										1		1
CO 210.2	1													
CO 210.3	1	1							1			1		
CO 210.4	1	2										1		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 210	**Metrology**	
Unit No.	Contents	Hrs
Unit 01	**Measurements, Tolerances and Gauging :** Introduction, Need of measurement, Types of measurement, errors in measurement, Limits, fits and tolerances, IS specifications of limits, unilateral and bilateral tolerances, Types of Fits, Slip gauges, Design of plug and ring gauges.	06
Unit 02	**Comparators, Angle Measurement and Advances in measurement:** A) Comparators: Principle and characteristics of Mechanical, Optical, Electrical, Pneumatic comparators B) Angle Measurement: Bevel Protractor, Angle gauges, Sine bar, Angle Dekker. C) In-process gauging, Machine vision, CMM- construction, types, operation, Type of inspection probes	07
Unit 03	**Measurement of Screw Threads, Gears and Surface Roughness** A) Errors in screw threads, Pitch measurement, Measurement of thread diameters with standard wire, screw thread micrometer. B) Errors in gears, Measurement of Spur Gears for Run out checking, Pitch measurement, Profile checking and Backlash checking, Checking of composite errors. C) Concept of straightness and flatness, Measurement of Straightness, Surface Roughness terminology, symbols, CLA, Ra, RMS, Rz & Rt values and their interpretation.	07
Unit 04	**Statistical Quality Control** Need of Quality control in industry, Statistical methods in quality control, Plotting of Normal distribution curve, Six sigma quality concepts. Different types of control charts (X bar, R bar, p, np and c charts) their interpretations and applications.	07

Sr. No.	**Reference Books**
01	"Engineering Metrology",I.C. Gupta, DhanpatRai Publications.
02	"Engineering Metrology", R.K.Jain, Khanna Publisher
03	"Mechanical Measurement", Beckwith and Buck, Pearson Education Asia,5th Edition,2001.
04	"Mechanical Measurement and Control" D.S. Kumar, Metropolitan Book Co.Pvt.Ltd.,New Delhi,4th Edition,2007.
05	"Practical Engineering Metrology",Sharp K.W.B. Pitman, London
06	"Mechanical Measurement and Control", A.K. Sawhney and P. Sawhney, DhanpatRai and Company Pvt.Ltd.,New Delhi, 12th Edition,2010

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 212	**Machine Drawing and CAD Lab**	**04**	**02**

Course Description

This course provides the knowledge and skills of preparing engineering drawings of different machine parts, sub-assemblies and assemblies required for process planning, manufacturing, tool design, designing special purpose machines etc. It includes application of tolerances and fits for assembled products. This is achieved through development of surfaces, Representation of elements of machine drawing, Component Drawings and Assembly drawings. Both manual exercises and drawing using solid modeling CAD software

Pre-requisites

Applied Physics FYT 102; Machine Drawing MET12

Course Objectives

1 To provide basic understanding and drawing practice of various simple mechanical parts, Selection of Views, additional views for various machine elements and parts with every drawing proportions.
2 To demonstrate an ability to design, analyze, interpret data and assembly & disassembly.
3 Modeling in CAD/CAM software by applying the basic knowledge of machine drawing.

Course Outcomes

Students will be able to — Bloom's Level

		Bloom's Level
CO 212.1	**Explain** [3] the different symbols and nomenclature used in machine drawings.	3
CO 212.2	**Apply** [3] the drawing techniques for development of surfaces of sheet metal components manually and using CAD software.	3
CO 212.3	**Apply** [3] the drawing techniques to draw the different machine elements, single and joined, manually and using CAD software.	3
CO 212.4	**Illustrate** [3] an assembly drawing drawn using part drawings of machine components, along with representation of tolerances and surface roughness manually and using CAD software.	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	--	--
Planned Marks	--	--	--	--	100	--

(***Note****: Technical Graphics is used to communicate the necessary technical information required for manufacture and assembly of machine components. These drawings follow rules laid down in national and International Organizations for Standards (ISO).Hence the knowledge of the different standards is very essential. Students have to be familiar with industrial drafting practices and thorough understanding of production drawings to make them fit for industries.)*

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 212.1	2													
CO 212.2		2												
CO 212.3			3		3									
CO 212.4			3		3									
	(1 – Low, 2 – Moderate, 3 – High)													

MET 212	**Machine Drawing and CAD Lab**

Sr. No.	Practical Contents	Hrs.
01	**Introduction** Need of Graphical Language, Importance Machine Drawing, Tools (use of traditional and advanced Instruments to latest Software) **Projections** Designation, Relative position of views, Examples **Classification of Machine Drawings** Assembly Drawing, Part Drawing, Detailed Drawing, Catalogues Drawing, Drawing for Instruction Manuals, Schematic Representation, Patent Drawing **Principles of Drawings** Scales as per ISO standards, eg. A3 x 3 (420 x891), Importance of Title Block and Part list, Lines types (Lines used in Machine Drawings) **Reproduction of Drawings** Blue printing, Ammonia Printing, Xeroxing, Printing, Plotting, *[Lectures]*	02
02	**Sectioning** Cutting Planes and Section, Hatching Lines, Half Sections, Aligned Sections, Offset Sections, Revolved, Removed Sections, Local Sections, Successive Sections, Thin Sections **Dimensions** Principle of Dimensioning, Counter Sink, Counter Bores, Spot Faces, Chamfers, Screw Threads, Tapered Features, **Limits, Fits and Tolerance** Definitions, Classifications of Fits, System of Fits, Computations, Selection of Fits, Method of Indicating Fits on Drawings, Tolerance Grade, Computations of Tolerance, Positions of Tolerance, Fundamental of Deviations, Shaft and Hole Terminology, Method of Placing Limit Dimensions, Need of Geometrical Tolerance, Geometrical Characteristics of Symbols, Indication of MMC, Interpretation of Indication of Geometrical Tolerance **Conventional Representations** Common features, Springs, Gear Assemblies, Materials, Interrupted views and Braking of Shaft, Pipe, Bar, Surface finishing & Machining Symbols, Abbreviations and Symbols *[Lectures & Drawing Sheet 01* *(Types of Lines, Sections, Dimensioning, Shaft-Hole System for Limits & Fits, Conventional Representations)]*	04
03	**Screwed Fastenings** Screwed Fastenings, Screw Thread Nomenclature, Threads Form, Form of V Threads, Form of Square Threads, Conventional representations, Types of Bolts, Designation, Types of Nuts, Types of Screw, Designation of Bolted Joints, Stud Joints, Types of Nut Locking Arrangements, Special Types of Bolts and Nuts. *[Lectures & Drawing Sheet 02 (Free Hand Sketching of Fasteners)]*	02
04	**Symbols and its conventions** **Key Joints** Types of Key joints, Type of Cotter Joints, Types of Pin Joints and knuckle Joints	02

Sr. No.	Practical Contents	Hrs.
	Riveted Joints Introduction Rivet and Riveting, Classification of Rivet, Terminology of Riveted Joint Types of Joints **Welded Joints** Introduction of Welding Process, Types of Welded Joints, Representation of Welds **Pipes and Pipe Joints** General discussions, Types of Pipe Joints, Piping Layout and Conventions **Pulleys** Applications of Pulleys, Types of Pulleys **Couplings** Applications of Couplings, Types of Couplings, Working Principles *[Lectures & Drawing Sheet 03 (Free Hand Sketching of Keys, Riveted, Welded, Pipe Joints, Pulleys & Coupling)]*	
05	**Assembly Drawings** Introduction, Types of Assembly, Importance of BOM, Assembly procedures, Assembly of Engine Parts, Assembly of Machine Tools Parts *[Lectures & Drawing Sheet 04 (Assembly Drawing)]*	04
06	**Production Drawings** Definitions, Difference with Normal Drawings, Method of amendment of Corrections, representing conventional representations and symbols for machining, dimensioning, etc. *[Lectures & Drawing Sheet 05 (Detailed Drawing)]*	02
07	**Computer Aided Modeling & Drafting** Part Modeling, Assembly Modeling, and Drafting using any advanced CAD Software *[CAD Model & Drawing Sheet through CAD]* Part Modeling of minimum 08 components. The part modeling should be representing conventional representations and symbols for machining, dimensioning, etc. *[Print 01 : Drafting of Part Models in standard views, Print 02 : Solid view of Parts]*	08
	Assembly Modeling comprised of minimum 8 components. The assembly modeling should be representing conventional representations and symbols for machining, dimensioning, etc. Drafting of Part Models in standard view & Solid view. *[Print 03 : Drafting of Assembly Model in standard views, Print 04 : Solid view of Assembly]*	08

Sr. No.	Reference Books
01	P.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi, 7th Edition,2008
02	N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay, 42th Edition , 2007
03	CAD/CAM- Principals and Applications, P.N. Rao, McGraw Hill
04	N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
05	S. K HajraChoudhury, Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai
06	R.K. Dhavan, Machine Drawing, S. Chand and Company, 1st Edition, 1996.
07	"Production Drawing", Narayana, Kannaiah and VenkataReddv,New Age International.2nd Ed.
08	"Machine Drawing", N.D.Junnarkar,Print Pearson Education, 1st Edition.

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 214	**Workshop Practice – IV**	**02**	**01**

Course Description

This course contains hands on working on machines like CNC lathe simple components. It familiarizes the student with CNC machine accessories, manual part programming for CNC machines.

Pre-requisites

Workshop Practice I, II and III

Course Objectives

1. To understand fundamentals of the CNC technology.
2. To understand the programming methods in CNC machines

Course Outcomes

	Students will be able to	Bloom's Level
CO 214.1	**Label** different parts and accessories used on CNC Machine	1
CO 214.2	**Select s**uitable cutting parameter using catalog of tool manufacturers.	2
CO 214.3	**Develop** part program for manufacturing a component on CNC machine	3
CO 214.4	**Make use of part** programing to perform operations on job.	3
CO 214.5	**Inspect** a job using suitable measuring instruments	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 214.1	2													
CO 214.2	2	2										2		
CO 214.3	1								2	2		2		
CO 214.4	2			1	3				2			2		
CO 214.5	2											1		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 214 Workshop Practice IV

Sr.No.	Term Work	
01	Study of construction and working of CNC lathe and machining centers (VMC/HMC), Turn-Mill Centers	02
02	Study of CNC axes & drives, Automatic Tool Changer (ATC) and Automatic pallet changer (APC), Applications	04
03	Study and Demonstration of tools used in CNC machines, Tool Presetting, Use of Catalogue.	02
04	Manual part programming exercise using G and M codes And Address words.	04
05	One job on CNC Machine: group of maximum four students, Plain turning, Step turning, Taper turning, Threading, drilling.	06
06	Industrial visit to study operations of Vertical Machining center, Horizontal Machining center and Turn-mill Centers	02

Sr. No.	Reference Books
01	Chennakesava R. Alavala – CAD/CAM – Concepts and Applications – PHI
02	Fundamentals of Tool Design-ASTME Publication.
03	CAD/CAM- Principals and Applications, P.N. Rao, McGraw Hill
04	S. K HajraChoudhury, Elements of workshop technology – Vol. II,, Media Promoters And Publishers, Mumbai

	B. Tech. Mechanical Engineering **Second Year (Semester – IV)**	P	C
MET 216	**Computer Programming Lab**	**2**	**1**

Course Description

With computerization of every system in engineering, basic programming abilities are essential for engineers. This course imparts the skills in programming using C++ and introductory programming using MATLAB. It deals with the features of these programming languages and their application for handling different computational tasks.

Pre-requisites

Computer Programming FYT 119

Course Objectives

1 To understand the programming language writing skills.
2 To prepare the programs by using C++ and Mat lab software.

	Course Outcomes *Students will be able to*	Bloom's Level
CO216.1	Create and solve programs of operators, loop control statements.	3
CO216.2	Apply their knowledge and programming skills to solve various programs of Array, Array with pointer.	3
CO216.3	Practice the programs of Structure, Class and Objects.	3
CO216.4	Practice the programs of operator, overloading and polymorphism	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	50%	50%
Passing	--			--	40%	40%
Planned Marks	--	--	--	--	50	50

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO216.1	1	2			1									
CO216.2	1	2			1							2		
CO216.3	1													
CO216.4	1	2			2							2		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 216	**Computer Programming Lab**

Unit No.	Lab Work	Hrs
01	Introduction to object oriented programming.	02
02	Programs on Assignment on programs of operators , loop control statements	04
03	Programs on Assignment on programs of Array, types of Array.	04
04	Programs on Assignment on programs of Use of Pointers with Array and Function, Friend function.	04
05	Programs on Class and Objects.	04
06	Programs on Inheritance and its types.	02
07	Programs on Overloading, Polymorphism	02

Sr. No.	**Reference Books**
01	“The C++ Programming Language” by Bjarne Stroustrup
02	Object Oriented Programming by E. Balguruswami
03	Object-Oriented Programming in C++ by Rajesh K Shukla
04	MATLAB and its application in Engineering by Rajkumar Bhansal
05	“The C++ Standard Library: A Tutorial and Reference” by Nicolai M Josuttis
06	A Guide to MATLAB: For Beginners and Experienced Users by Brian R. Hunt

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 218	**Electrical Technology & Electronics Lab**	**02**	**01**

Course Description

This course provides with hands-on working on electrical motors, drives and control. It also familiarizes the student with the basic sensors, multiplexers and LAN technology used in electronic control of machines and devices.

Pre-requisites

FYT 118 Elements of Electrical Engineering Lab, FYT 117 Elements of Electronics Engineering Lab

Course Objectives

1. This course intends to develop the skills to demonstrate performance operation of DC motors using different tests.
2. It intends to develop skills to analyze the working and operation of DC machines & AC machines
3. Students will learn the processing of LAN and WAN set up.

Course Outcomes

	Students will be able to	Bloom's Level
CO 218.1	Explain speed control methods of DC motor.	02
CO 218.2	Make use of testing setups to carry out load tests on DC shunt motor and three phase induction motor.	02
CO 218.3	Illustrate DC/AC motor starters	02
CO 218.4	Identify various displacement and temperature transducers.	02
CO 218.5	Demonstrate operation of encoders, decoders, multiplexers, multiplexers and flip flops using digital ICs.	03
CO 218.6	Relate the applications to Internet of Things domain.	03
CO 218.7	Explain the process of LAN set up.	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	40%	
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 218.1	1						2							
CO 218.2				3										
CO 218.3		2												
CO 218.4	2													
CO 218.5	1				3									
CO 218.6			2				1							
CO 218.7	2													
	(1 – Low, 2 – Moderate, 3 – High)													

MET 218 Electrical Technology & Electronics Lab

Sr. No.	Minimum four experiments from sr. no. 1. To 5.and five experiments from sr. no. 6 to 11, from the following list should be performed, and report to be submitted in prescribed format
01	Speed control of D.C. shunt motor by flux control method.
02	Speed control of D.C. shunt motor by armature voltage control.
03	Load test on D.C. shunt motor.
04	Load test on 3 phase induction motor.
05	Study of DC/AC motor starters
06	Study of Displacement and Temperature Transducers
07	Study of Encoders and decoders
08	Study of multiplexers and demultiplexers
09	Study of flip-flops
10	Practical exercises on Basics of Internet of Things
11	Study of LAN set up

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 220	**Kinematics of Machines Lab**	**02**	**01**

Course Description

Kinematics of Machines Lab deals with the study of relative motion between the various parts of machine. This is a fundamental course for Mechanical engineers to understand the working principals of any machine. The knowledge of this lab is very essential for an engineer in designing the various parts of a machine. It combines theory, graphical and analytical skills to understand the Engineering Design.

Pre-requisites

FYT 108 Engineering Mechanics, MET 206 Kinematics of Machines

Course Objectives

1. To represent kinematic behavior of different machine elements and mechanisms.
2. To select various Power transmitting devices and analyze effect of friction in Mechanisms and machines
3. To compare types of Governing mechanisms.

Course Outcomes

	Students will be able to	Bloom's Level
CO 220.1	**Construct** [3] velocity, acceleration diagrams and cam profiles for given applications.	03
CO 220.2	**Experiment with [3]** Porter or Hartnell governor to find out their characteristics.	03
CO 220.3	**Experiment with [3]** belt and dynamometers to find out their characteristics.	03

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing		--		--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 220.1		2												
CO 220.2				2										
CO 220.3				2										
	(1 – Low, 2 – Moderate, 3 – High)													

MET 220	Kinematics of Machines Lab

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.
01	Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
02	One A3 size drawing sheet of Velocity problems by relative velocity method. (Minimum 4 problems)
03	One A3 size drawing sheet of Velocity problems by Kliens construction and Instantaneous center method. (Minimum 4 problems)
04	One A3 size drawing sheet of Acceleration problems by relative acceleration method. (Minimum 4 problems)
05	Verification of ratio of angular velocities of shafts connected by Hooks joint.
06	One A3 size drawing sheet of Problems on cam profile. (Minimum 4 problems)
07	Experiment on Governor characteristics for Porter or Hartnell governor.
08	Experiment on Cam Profile
09	Experiment on belt drives.
10	Experiment on Dynamometer

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 222	**Fluid Mechanics Lab**	**02**	**01**

Course Description

It contains the different flow measurement equipment's and their procedures and flow phenomena and friction in pipes.

Pre-requisites

Applied Physics FYT 102, Elements of Electrical Engg. FYT 107

Course Objectives

Students should be able to verify the principles of fluid mechanics studied in theory by performing the experiments in laboratory

Course Outcomes

	Students will be able to	Bloom's Level
CO 222.1	Explain Properties of fluids and the use of various instruments for fluid flow measurement.	02
CO 222.2	Elaborate the losses of fluid through pipe	02

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing		--		--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 222.1	2	3												
CO 222.2	2		2											
	(1 – Low, 2 – Moderate, 3 – High)													

Sr. No.	Experiments to be performed and report to be submitted in prescribed format.
01	Study of manometers and the demonstration of the same.
02	Determination of metacentric height of a floating body.
03	Flow pattern development using Heleshaw's apparatus.
04	Calibration of venture-meter and orifice meter.
05	Verification of Bernoulli's Theorem.
06	Calibration of V-notch or rectangular notch.
07	Study of minor losses in the flow system.
08	Determination of co efficient of friction in pipes for different materials.
09	Determination of loss of friction in series/parallel pipes.
10	Reynolds experiment.

Reference Books

01 Fluid Mechanics (SI Units), Yunus A. Cengel John M. Cimbala, 3/e., Tata McGraw Hill, 2014.
02 Fluid Mechanics, F M White, McGraw Hill Publications, 8/e. 2016.
03 Fluid Mechanics, John F. Douglas, Janul and M. Gasiosek and John A. Swaffield, Pearson Education Asia
04 Fluid Mechanics and Hydraulic Machines, Dr. R.K. Bansal, Laxmi Publications, 2016.
05 Fluid Mechanics and Hydraulic Machines, Dr. R.K. Rajput, S. Chand Publications, 2015.
06 Fluid Mechanics and Hydraulic Machines, Dr. D. S. Kumar, S.K Kataria and Sons Publications, 2015.

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		P	C
MET 224	**Metrology & Mechanical Measurements Lab**	**4**	**2**

Course Description

This course deals with use of different measuring instruments for linear, angular geometrical dimensions, both absolute and comparative. Further it includes measurement of screw threads and gears and surface characteristics. The measurement lab includes measurement of mechanical quantities such as, speed, temperature, pressure, flow, vacuum, displacement, force, torque, vibrations with the help of mechanical measuring instruments.

Pre-requisites

Applied Physics FYT 102, Elements of Electrical Engg. FYT 107

Course Co-requisites

Metrology MET 10

Course Objectives

1 To understand the inspection methods, use of inspecting equipments for various applications.
2 To analyze the measurement data by using control charts.

	Course Outcomes *Students will be able to*	Bloom's Level
CO 224.1	**Apply** conventional and digital instruments for measurement of different parameters of given samples of components.	2
CO 224.2	**Design and drawing** of Plug and snap gauge.	4
CO 224.3	**Analyze** collected measurement data using control charts.	4
CO 224.4	**Make use of** instruments for measurement of various mechanical quantities.	3
CO 224.5	**Interpret** the measured values of mechanical quantities.	2

Evaluation Strategy

Component	**CAT-01**	**CAT-02**	**FET**	**ESE**	**FEP**	**POE**
Contribution	--	--	--	--	50%	50%
Passing	--			--	40%	40%
Planned Marks	--	--	--	--	50	50

Mapping of COs with POs :

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 224.1	1											2		
CO 224.2	1													1
CO 224.3	1											2		1
CO 224.4	1						1							
CO 224.5	2											2		
	(1 – Low, 2 – Moderate, 3 – High)													

MET 224 Metrology & Mechanical Measurements Lab

Sr. No.	**Lab 1- Metrology**: (2 Hrs/week) Experiments to be performed and report to be submitted in prescribed format.	
01	Measurement of part dimensions using Vernier caliper, Height vernier, Depth vernier and report preparation	02
02	Measurement of part dimensions using outside micrometers, Depth micrometer, Flange type micrometer and report preparation	02
03	Design of plug and snap gauge for given tolerance dimensions.	02
04	Use of Comparators, bore dial gauge for dimensional measurement.	02
05	Study and Use of Angle Measuring Instruments for angle measurement; and report preparation.	02
06	Study of Interferometry. Measurement of Component dimensions by using Optical Flat.	02
07	Measurement of Screw Threads and Gear Measurement and report preparation.	02
08	Measurement of Surface roughness.	02
09	Plotting of normal distribution curve by calculating average and standard deviation for a given set of dimensions. Plotting of Control Chart (at least one of each type) and their interpretation.	04

Sr. No.	**Lab 2- Mechanical Measurements**: (2 Hrs/week) Experiments to be performed and report to be submitted in prescribed format. (Basic theory for each experiment shall be discussed before performing the experiment.)	
01	Introduction to Measurement (Need of measurement, Types of measurement, errors in measurement, Standards used in measurement)	02
02	Angular speed measurement using Stroboscope, Photo-electric pick up and magnetic pick up.	02
03	i) Formation of Thermocouple tip and Calibration of Thermocouple ii)Measurement of temperature using Thermocouple, RTD and Thermistors.	02
04	i)Testing of Mechanical pressure gauge using Dead weight pressure gauge tester. ii)Vacuum measurement using Mc-Lead gauge and Pirani gauge.	02
05	Measurement of displacement using LVDT.	02
06	Flow measurement using Rotameter, Turbine meter, Anemometer and Target meters	02
07	Force and torque measurement using strain gauges and load cell	02
08	Vibration testing using contact and non-contact type instruments Introduction to FFT Analyzer	02
09	Industrial Visit for study of coordinate measuring machine (CMM) and advanced measuring instruments.	04

MET 224	Metrology & Mechanical Measurements Lab

Sr. No.	Reference Books
01	"Engineering Metrology",I.C. Gupta, DhanpatRai Publications.
02	"Engineering Metrology", R.K.Jain, Khanna Publisher
03	"Mechanical Measurement", Beckwith and Buck, Pearson Education Asia,5th Edition,2001.
04	"Mechanical Measurement and Control" D.S. Kumar, Metropolitan Book Co.Pvt.Ltd.,New Delhi,4th Edition,2007.
05	"Practical Engineering Metrology",Sharp K.W.B. Pitman, London
06	"Mechanical Measurement and Control", A.K. Sawhney and P. Sawhney, DhanpatRai and Company Pvt.Ltd.,New Delhi, 12th Edition,2010

B. Tech. Mechanical Engineering
Second Year (Semester – IV)

		C
MET 226 UC 2	**Professional Development Skills II**	**AU**

Course Description

Professional skill Development empowers students in their soft skill and communication. Professionalism and employability skills are enhanced with the help of this subject.

Pre-requisites

Ability of Reading and Writing

Course Objectives

01 Development of professional skills and abilities
02 Enhancement of communication skills and public speaking

Course Outcomes

	Students will be able to	Bloom's Level
CO 226.1	Apply[3] self-analysis techniques	2
CO 226.2	Plan[4] and execute SMART goals	2
CO 226.3	Demonstrate[3] team building skills	3
CO 226.4	Exhibit[3] presentation and public speaking skills	3

Evaluation Strategy

Component	CAT-01	CAT-02	FET	ESE	FEP	POE
Contribution	--	--	--	--	100%	--
Passing	--			--	40%	--
Planned Marks	--	--	--	--	100	--

Mapping of COs with POs :

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
COs	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO 226.1			3											
CO 226.2							3							
CO 226.3	1													
CO 226.4				1										
	(1 – Low, 2 – Moderate, 3 – High)													

MET 226 UC 2 **Professional Development Skills II**

Syllabus

Units	Description	Hrs.
1	**Leadership:** Skills for a good Leader, Assessment of Leadership Skills **Creativity:** Lateral thinking, vertical thinking, Out of box thinking	4
2	**Decision Making:** Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives.	4
3	**Stress Management**: Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters. **Emotional Intelligence**: What is Emotional Intelligence, dealing with feelings, emotional quotient, why Emotional Intelligence matters, Emotion Scales. Managing Emotions.	4
4	**Adapting to corporate life**: Corporate Grooming and dressing, Business Etiquette Business Ethics, Dinning Etiquette, Ethics policy	4
5	**Group Discussion:** Group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language. **Interview:** Process, techniques, Pre-In-After the interview preparation.	4

References

1. Wallace & Masters, Personal development for Life & work, Thomson Learning.
2. Barun K. Mitra, Personality Development and Soft- Skills, Oxford University Press.
3. Fred Luthans, Organizational behavior, McGraw Hill.
4. Asa Don Brown, Interpersonal skills in the Workplace, Tate publishing and Enterprises.