DEPARTMENT OF TECHNOLOGY
SHIVAJI UNIVERSITY, KOLHAPUR

STRUCTURE AND SYLLABUS
OF
THIRD YEAR B. TECH.
(MECHANICAL ENGINEERING)

TO BE EFFECTIVE FROM
ACADEMIC YEAR 2022-23

Four year B. Tech. Course Academic Rules and Regulations

INDEX

Glossary

B. Tech.: Bachelor of Technology, an Under Graduate Degree awarded from the Shivaji University, Kolhapur

Director: Director, Department of Technology, Shivaji University, Kolhapur

DC: Department Committee

DEC: Departmental Examination Coordinator

Semester: The academic year shall be divided into two regular semesters of approximately 20 weeks duration each. Typically the odd semester shall be from the first week of July to last week of November while the even semester shall be from the first week of January to the last week of May.

This shall include the period of academic delivery (14 to 15 weeks), Continuous Internal Evaluation (CIE) i.e. Mid Semester Examination and Assignments, Semester End Examination (SEE) assessment and declaration of results.

Course: Subject

Course Coordinator: Subject teacher

Course Credit: Weighted sum of the number of Lecture hours (L), Tutorial hours (T), and Practical hours (P) associated with the course.

Credits Earned: The sum of course credits for credit courses in which a student has passed.

Grade: Assessment of the student's performance in a course indicated by the letters, “AA”, “AB”, “BB”, “BC”, “CC”, “CD”, “DD”, “FF”, “XX”, “ ABSENT”, “PP”, “NP”.

Grade Point: Number equivalent of the letter grades given by 10, 9, 8, 7, 6, 5, 4 corresponding to grades “AA”, “AB”, “BB”, “BC”, “CC”, “CD”, “DD” respectively. “FF” and “XX” carry zero grade points.

Instructor: Member of faculty who shall be assigned to teach a specific course.

Semester Grade Points: The sum of the products of credits and Grade Points for each course registered by a student in a semester.

SGPA: Semester Grade Point Average

CGPA: Cumulative Grade Point Average

ATKT: Allowed to Keep Terms.

Shivaji University, Kolhapur
DEPARTMENT OF TECHNOLOGY

Four year B. Tech. Course Academic Rules and Regulations

R.B.T. 1 Admission:

Candidates are admitted to this course according to norms and conditions prescribed as per AICTE, DTE, Maharashtra.

R.B.T. 2 Award of Degree:

Following rules prevail for the award of degree:

1. B.Tech Degree shall be awarded to the student, who has registered and earned all the credits of prescribed courses under the general departmental requirements.
2. In addition to the credit requirement prescribed above for the Degree award, each student shall have to complete the requirements of Audit Course (AC) during the programme. All the students shall receive certification as PP *(for Passed)*, and NP *(for not passed)* in AC, in the Grade Card. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this shall not be taken into account for computing the final Cumulative Grade Point Average.
3. A student has obtained CGPA ≥ 4.5.
4. A student has paid all the institute dues and satisfied all the requirements prescribed.
5. A student has no case of indiscipline pending against him/her.
6. University authorities shall recommend the award of B. Tech. Degree to a student who is declared to be eligible and qualified for above norms.

R.B.T. 3 Attendance Rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75% of the classes actually held. A student with less than 75% attendance in a course during the semester, in lectures, tutorials and laboratories taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

The course coordinator will award 'XX' grade to the student who is deficient in attendance taking into account the consolidated attendance record for the whole semester. For the purpose of attendance calculation, every scheduled practical class will count as one unit irrespective of the number of contact hours.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and laboratories together, as applicable).

R.B.T. 4 Academic Progress Rules (ATKT Rules)

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 not failed in more than three passing heads (SEE, EPE/EOE) shall be considered for deciding the eligibility for ATKT.
2. For the promotion to the Third Year, student should not fail in more than three passing heads (SEE, EPE/EOE) of Second Year and all credits of First Year must be earned.
3. For the promotion to the Final Year, student should not fail in more than three passing heads (SEE, EPE/EOE) of Third Year and all credits of Second Year must be earned.
4. A student who has obtained 'FF' grade in SEE of a regular semester and has obtained 'FF' grade in 2nd attempt of SEE shall be eligible to choose one of the two options below to clear his/her backlog:
   i. Re-registration for the next regular semester course whenever that course is offered.
   ii. Application for Repeated Examination.
5. A student who has detained in a regular semester and obtained 'XX' grade can Re-register for the next regular semester whenever it is offered.
6. The maximum duration for getting B. Tech. degree for students admitted in the first semester of U.G. program shall be 12 semesters (six academic years) while for lateral entry students admitted in the third semester shall be 10 semesters (five academic years) from their date of admission. The maximum duration of the program includes the period of withdrawal, absence and different kinds of leaves permissible to a student but excludes the period of rustication of a student from the Department. If a student is unable to gain all credits of first year in three years from the date of his/her admission, then he/she shall be declared as "Not Fit for Engineering" leading to discontinuation of his/her registration with the Department.
7. If a student is unable to gain all credits of first year in three years from the date of his/her admission, then he/she shall be declared as "Not Fit for Engineering" leading to discontinuation of his/her registration with the Department.
8. Depending upon the academic progress of a student, Department may take a decision regarding continuation or discontinuation of his/her registration with the institute.

R.B.T. 5 Academic Flexibility

1. Flexibility in deciding Structure and Contents of Curriculum with reasonable frequency for changes in the same.
2. Continuous Assessment of Students performance with newly adopted - Credit System based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. They are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All subjects (year-wise) under each course/discipline are unitized

R.B.T. 6 Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

R.B.T. 7 Features of Credit System at Department of Technology, Shivaji University, Kolhapur:

Every subject is allotted credits based on its academic importance/weightage.

1. All subjects may not have same credits.
2. 25 Credits / Semester.
3. Absolute Grading System with 7 Passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Standardization of courses; each course is of 6 units.
5. Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), both having (70:30) weightage in the student's performance in Course Work/Laboratory Work and other activities. A student's performance in a subject shall be judged by

taking into account the results of CIE and SEE together. Students must score 40% marks in SEE irrespective of the CIE marks.

(Note: The CIE shall be conducted as Mid Semester Exam and assignments throughout the semester on dates announced in advance by the department, and its results made known to the students from time to time. However, the dates for the SEE shall be fixed at the University level.)

6. Continuous Internal Evaluation consists of Mid Semester Examination of 20 marks and assignment of 10 marks handled by Department of Technology and setting of question papers should be done by course coordinator. Assignments may be of varied nature for each course based on the need of the course coordinator.
7. Semester-End Examination (SEE), to be conducted by the Department of Technology, Setting of question papers should be done by course coordinator and jointly with an external examiner; this shall include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.
8. Request for Mid Semester Examination for the students representing in co-curricular, extracurricular activities or on medical grounds will be considered only. On receipt of application from the student the DC will take decision for the conduct of the Mid Semester Examination.
9. Care shall be taken to ensure that the total numbers of days for academic work are ≥180 per year.
10. Academic schedule prescribed shall be strictly adhered to all the Branches.

R.B.T. 8 Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weight-age is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course: Concrete Technology: 4 credits (3-0-2)

The credits indicated for this course are computed as follows:

3 hours/week lectures = 3 credits

0 hours/week tutorial = 0 credit

2 hours/week practical = 2 × 0.5 = 1 credit

Also, (3-0-2) **4** credit course = (**3** h Lectures + **0** h Tutorial + **2** h Practical) per week

= **5** contact hours per week

R.B.T. 9 Detailed Evaluation Scheme:

1. Out of total 100% theory weightage, 30% weightage is allotted for Continuous Internal Evaluation (CIE). Appearing for CIE is must and student must submit the assignments to become eligible for Semester End Examination (SEE) of respective course.

   CIE (30% weightage) includes:

   a. Mid Semester Exam of 20 Marks of one Hour
   b. Assignment of 10 Marks during entire semester

2. For the Semester End Examination (SEE), 100 marks paper will be set and finally it will be converted to 70 marks, in which student must secure 40% (28 Marks out of 70) as university examination pass head and must appeared for CIE to become eligible for SEE of respective course.
3. Final theory marks (out of 100) will be the addition of CIE (30 Marks) and SEE (70Marks).
4. Final laboratory letter grade will be awarded (100%) will be the addition of CIE (50%) and SEE (50%).
5. Semester End Examination (SEE) for laboratory consists of External Practical Evaluation (EPE)/External Oral Examination (EOE). Continuous Internal Evaluation (CIE) for laboratory consists of Internal Practical Evaluation (IPE) / Internal oral Evaluation (IOE).
6. There shall be no (SEE) for laboratory courses of First Year. The entire assessment of a student shall be based on CIE (IPE/IOE) 100% weightage and a minimum performance of 40% in CIE shall be required to get the passing grade. CIE of laboratory work consists of (IPE/IOE) shall be 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 oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IPE/IOE of the concerned course. Non submission of IPE/IOE will lead to term not grant (TNG).
7. The assessment of laboratory course from the 3rd semester onwards shall be carried out in two parts.

i. CIE of laboratory consists of IPE/IOE shall be 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 oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IPE/IOE of the concerned course. Non submission of IPE/IOE will lead to term not grant (TNG).

ii. SEE of laboratory shall be based on performing an experiment followed by an oral examination or a written examination.

iii. The relative weightage for CIE and SEE for assessment of laboratory courses shall be 50% and 50% respectively from second year onwards and a minimum performance of 40% in both CIE and SEE separately shall be required to get the passing grade.

iv. SEE for laboratory course shall normally be held one week before the SEE for theory courses and shall be conducted by a panel of examiners consisting of external and internal examiner. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with Coordinator of the respective department.

8. A student failed in SEE of a laboratory course in a regular semester shall be eligible to appear for examination conducted along with SEE of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to EPE/EOE i.e. External Practical/Oral Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He/She shall suffer a grade penalty as per Table 3.

9. Assessment of Seminar, Mini-project, Major Project etc:

i. The Seminar/Project report must be submitted by the prescribed date usually two weeks before the end of academic session of the semester.

ii. It is desirable that the topics for seminar/project be assigned by the end of previous semester.

iii. The seminar report and the presentation of seminar shall be evaluated by panel of three departmental faculty members (decided by Branch Coordinator).

iv. The mini-project shall be evaluated jointly by a panel of three Internal Examiners.

v. The report on field training shall be evaluated by a panel of three Internal Examiners.

vi. The assessment of B. Tech major project work shall be carried out in two phases as shown below:

I-phase CIE (50% weightage) consists of

a) Departmental Committee (Synopsis submission seminar)

b) Project work assessment by Guide

(Departmental Committee consists of following:

Director- Chairman

Branch Coordinator from respective branch – member

Senior faculty from respective branch – member

Guide/Course Coordinator- member)

I-phase SEE (50% weightage) consists of Progress Seminar and presentation evaluated by Panel of Internal Examiners.

II-phase CIE (50% weightage) consists of

a) Project work assessment by Guide

b) Report submission seminar evaluated by Departmental Committee

II-phase SEE (50% weightage) (Final orals and presentations) evaluated by Panel of External and Internal Examiners.

10. *Semester End Examination duration will be 4 hrs.

11. In respect of CIE, and Laboratory work a target date shall be fixed for the completion of each sheet, job, Project, experiment or assignment and the same complete or incomplete shall be collected on the target date and assessed immediately at the respective departments by the concerned teachers and % marks (or grades) shall be submitted to the Co-coordinator. The Co-coordinator of the Department of Technology shall communicate this % of marks (or grades) to the University within a week after the end of each term.

R.B.T. 10 Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (≥40% minimum grade DD), the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

R.B.T. 11 CGPA Improvement Policy for award of degree:

A student getting CGPA ≤ 4.50 with grade 'DD' in any course or grade 'FF' in any course shall have the possibility to repeat one or more 'DD' graded courses along with the failed courses, /are being offered in a semester.

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 4.50, to improve his/her grade by allowing him/her to appear for SEE of maximum two theory courses of seventh and eighth semester.

R.B.T. 12 Evaluation System:

1. **Semester Grade Point Average (SGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})}{\sum(\textbf{Course credits in registered courses})}$$

2. **Cumulative Grade Point Average (CGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})\textbf{of all Semesters}}{\sum(\textbf{Course credits in registered courses})}$$

   i. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. I to Sem. VIII for regular students.

   ii. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. III to Sem. VIII for lateral entry students.

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below :

   Ist Division with distinction : CGPA ≥ 7.5 and above

   Ist Division : CGPA ≥ 6.0 and < 7.5

   IInd Division : CGPA ≥ 5.5 and < 6.0

New gradation suggested as follows.

Table 1

Grade Points	Equivalent Range
5.5	55%
6.0	60%

6.5	65%
7.0	70%
7.5	75%

Conversion of CGPA to percentage marks for CGPA **≥ 4.5** can be obtained using equation.

Percentage marks = (CGPA x 10)

An example of these calculations is given below:

Typical academic performance calculations - I semester

Table 2

Course no.	**Course credits**	**Grade awarded**	**Earned credits**	**Grade points**	**Points secured**
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Total Points earned for this semester = 124

$$\textbf{Semester Grade Point Average (SGPA)} = \frac{124}{21} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

   Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this semester)

   = 248

   Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\textbf{Cumulative Grade Point Average (CGPA)} = \frac{\Sigma(124 + 124)}{\Sigma(23 + 21)} = 5.63$$

Table 3

System of Evaluation

Grade	Grade Points	Marks obtained (%)			Description of Performance
		Regular Semester	Re-examination	Repeated Examination	
AA	10	90-100	--	--	Outstanding
AB	09	80-89	90-100	--	Excellent
BB	08	70-79	80-89	90-100	Very Good
BC	07	60-69	70-79	80-89	Good
CC	06	50-59	60-69	70-79	Fair
CD	05	45-49	50-59	60-69	Average
DD	04	40-44	40-49	40-59	Poor
DD$	04	Below 40	Below 40	Below 40	Poor (Subject to Application of Ordinance 96)
FF	00	Below 40	Below 40	Below 40	Fail
XX	--	--	--	--	Detained
ABSENT	--	--	--	--	Absent
PP	--	--	--	--	Passed (Audit Course)
NP	--	--	--	--	Not Passed (Audit Course)

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on his/her demand after remitting prescribed fees by Shivaji University.

R.B.T. 13 Entry of Students from Regular Pattern to Credit Pattern

A student of Department of Technology, Shivaji University, Kolhapur admitted before academic year 2020-21, and such student shall clear back log subjects of regular pattern if any, by appearing for respective examination conducted by Department of Technology. Further they shall undergo additional academic requirements (bridge course) if required as suggested by Department committee, so as to have turning with credit pattern.

R.B.T. 14 Audit Courses:

Additional courses shall be included as audit courses from the third semester onwards. While the performance of the student in audited courses shall be included in the Grade Card. These grades are not contributed to SGPA or CGPA of the concerned student.

R.B.T. 15 Awards of Grades for Re-Examination:

- A student who has obtained grade ‘FF’ in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester.
- In such cases Continuous Internal Evaluation performance of a student shall not be wiped out.

- A student shall apply for re-examination before the last date of such application and shall appear for re-examination.
- 70% weightage similar to SEE shall be given to re-examination.
- A student who is eligible for re-examination, but remains absent for reexamination shall be given grade 'Absent'.
- A student shall be awarded a grade between 'AB' to 'DD', or 'FF' or 'XX' as given in Table 3 depending upon the cumulative marks obtained by him/her in CIE and Re-examination of SEE. Here a student has to suffer a grade penalty by accepting one grade lower as compared with the regular grades.

R.B.T. 16 Showing Evaluated Semester End Examination Answer Paper, Re-Evaluation, and applying for revaluation:

The evaluated answer book will be shown to the student as per the timetable prepared by the exam cell of DOT after the declaration of result. The grievances regarding the incorrect total and assessment of the not assed questions will be done by the respective faculty on submission of grievance form. A student having doubt regarding the grade declared in a course can apply for the photocopy of the answer book by remitting the prescribed fee as specified; a student can also apply for rechecking of his/her SEE answer book as per Shivaji University norms. There is no provision for showing of evaluated answer book, photocopy and rechecking for revaluation of the reexamination.

R.B.T. 17 Change of Branch:

Students shall be eligible to apply for Change of Branch after completing the first two semesters. The change of branch shall be permitted strictly on merit basis subject to the rules and regulations prescribed by Directorate of Technical Education, Maharashtra State/Admission Regulatory authority, Maharashtra State time to time.

R.B.T. 18 Disciplines and Conduct:

i. 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 Department.

ii. Any act of indiscipline of a student reported to the Department, shall be referred as per Shivaji University norms.

iii. If a student while studying in the institute 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 Department without any notice.

iv. If a student is involved in any kind of ragging, the student shall be liable for strict action as per Maharashtra anti-ragging act 1999, which is in effect from 15th May 1999.

v. 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 institute and fees paid shall be forfeited.

vi. Student once admitted in the Department of Technology shall follow instructions issued from time to time.

vii. If a student is found guilty of malpractice in examinations then he/she shall be punished as per the recommendations of the Shivaji University, Kolhapur.

viii. Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Department of Technology. The student must have valid ID card with him/her while in the Department of Technology.

ix. 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.

x. 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.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

B. Tech. Programme in Mechanical Engineering

1. Vision To be a premier centre of engineering education and industrial research that provides excellent academic ambience and nurtures innate talents of students to become technically sound, application oriented, innovative and successful mechanical engineers

2. Mission To empower students with the fundamentals of Mechanical Engineering through innovative curriculum and effective teaching thereby enabling them for successful career by imparting knowledge, skills and right attitude and a spirit to serve the society with professional ethics.

3. Programme Educational Objectives (PEO's)

Graduate should:

1. Demonstrate successful professional careers with strong fundamental knowledge in Science, Mathematics, English and Engineering Sciences so as to enable them to analyze the Mechanical Engineering related problems leading to leadership, entrepreneurship or pursuing higher education
2. Acquire technical knowledge in specialized areas of Mechanical Engineering such as Materials, Design, Manufacturing and Thermal Engineering with a focus on research, innovation and gaining the technical skills in advanced software packages.
3. Work with multidisciplinary field of engineering and technology to enlarge the ability among the students to understand the different industrial environments.
4. Continuously learn, research and develop with strong professional, moral and ethical values and with a zeal for life-long learning.

4. Programme Outcomes (PEO's)

An engineering graduate of Mechanical Engineering Programme at Department of Technology by the time of graduation will achieve and demonstrate:

a) An ability to apply basic knowledge of science, mathematics and engineering fundamentals in the field of Mechanical Engineering.

b) An ability to identify, formulates, review research literature and analyze mechanical engineering problems using basics principles of science, mathematics and engineering.

c) An ability to design for complex mechanical engineering problems using basic design concepts, analyze and process to meet the desired needs with in realistic constraints such as manufacturability , durability, sustainability and economy with appropriate consideration for the public health, safety, cultural, societal, and environmental considerations.

d) An ability to design and conduct experiments using research-based knowledge and methods including design of experiments, analyze, interpret the data and results with valid conclusion.

e) An ability to apply the modern tools and apply appropriate techniques to synthesize, model, design, analyze, verify and optimize to solve complex mechanical engineering problems within defined specification by using suitable modern tools to satisfy the needs of the society within realistic constraints such as social, economical, political, ethical, health, safety and manufacturing.

f) An ability to understand the impact of mechanical engineering solutions globally, in terms economic, societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) An ability to understand the principles, commitment and practice to improve product sustainable development globally in mechanical engineering with minimal environmental effect.

h) An ability to understand and apply ethical principles and commitment to address professional ethical responsibilities of an engineer.

i) An ability to function efficiently as an individual and as a group member in a team in multidisciplinary activities

j) An ability to communicate, comprehend and present effectively with engineering community and the society at large on complex engineering activities by receiving clear instructions for preparing effective reports and design documentation.

k) An ability to acquire and demonstrate the knowledge of contemporary issues related to finance and managerial skills to bring up entrepreneurs and entrepreneurship.

l) An ability to recognize and adapt to emerging field of application in engineering and technology by developing self-confidence for continuing education and lifelong learning process.

5. Programme Specific Outcomes (PEO's)

m) The Mechanical Engineering Graduates will be able to function in various domains of manufacturing industry in the areas of foundry, jigs fixtures, forming processes, quality control, production management and industrial engineering.

n) The Mechanical Engineering Graduates will be able apply the skills of advanced software tools.

o) The Mechanical Engineering Graduates will be able to work in automobile industry, power plants, energy technology in the sphere of operation and maintenance.

DEPARTMENT OF TECHNOLOGY
THIRD YEAR B.TECH
Scheme of Teaching and Examination
Semester – V (Mechanical Engineering)
To be implemented from Academic Year 2022 – 23

Subject Code	Sr. No	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
							Theory			Practical		
			L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
ME501	1.	Machine Design I	04		-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME502	2.	Theory of Machines- II	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME503	3.	Energy Engineering	03	-	-	03	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME504	4.	Tool Engineering	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME505	5.	Heat and Mass Transfer	03	-	-	03	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME502L	6.	**Laboratory** Theory of Machines II	-	-	02	01	-	-	-	EOE	50	20
ME505L	7.	**Laboratory** Heat and Mass Transfer	-	-	02	01	-	-	-	EPE	50	20
ME504L	8.	**Laboratory** Tool Engineering	-	-	02	01	-	-	-	IOE	50	20
ME506L	9.	**Laboratory** Computer Aided Drafting	-	-	02	01	-	-	-	EPE	50	20
ME507L	10.	Workshop Practice III	-	-	02	01	-	-	-	EPE	50	20
ME508L	11.	Internship I and Seminar			01 01	02	-	-	-	IOE	50	20
		Total	18	-	12	25	-	**500**	-	-	**300**	-
	Audit Course											
ME501A	12.	Research Methodology	01	-	02	-	-	-	-	-	-	-

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE.

Total Credits=25

Note:

1. Students are expected to do self-study for two hours as per the guide hence contact hours to be taken as two for the calculation of contact hours
2. Theory of Machine – II: The duration of this paper shall be of 4 Hours.
3. Tool Engineering: The duration of this paper shall be of 4 Hours and shall include drawing of jigs and fixture / press tools problem on separate drawing sheet.
4. **Internship – I and Mini Project** shall include
   - **a.** Internship of minimum four (4) weeks should be done after SY (Semester IV) in summer vacation and it's assessment will be done in TY (Semester V) based on report submitted. – Credit 01
   - **b.** Executing a mini project and delivering a presentation with mini project report. - Credit 01

Work load of the assessment both (a) and (b) shall be assigned to the mini project seminar guide.

5. Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students.

CIE:	Continuous Internal Evaluation	SEE:	Semester End Examination
IPE:	Internal Practical Evaluation	EPE:	External Practical Examination
IOE:	Internal Oral Evaluation	EOE:	External Oral Examination

DEPARTMENT OF TECHNOLOGY
THIRD YEAR B.TECH
Scheme of Teaching and Examination
Semester – VI (Mechanical Engineering)
To be implemented from Academic Year 2022 - 23

Subject Code	Sr. No	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
							Theory			Practical		
			L	T	P	Credits	Scheme	Max. marks	Min. Passing $	Scheme	Max. marks	Min. Passing
ME601	1.	Machine Design II	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME602	2.	Control Engineering	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME603	3.	Internal Combustion Engines	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME604	4.	Metrology and Quality Control	04	-	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME605	5.	Engineering Economics	03	01	-	04	CIE	30	40	-	-	-
							SEE	70		-	-	-
ME601L	6.	**Laboratory** Machine Design II	-	-	02	01	-	-	-	EOE	50	20
ME604L	7.	**Laboratory** Metrology and Quality Control	-	-	02	01	-	-	-	EOE	50	20
ME603L	8.	**Laboratory** Internal Combustion Engines	-	-	02	01	-	-	-	EPE	50	20
ME606L	9.	**Laboratory** Computer Aided Manufacturing	-	-	02	01	-	-	-	IOE	50	20
ME607L	10.	Mini Project	-	-	02	01	-	-	-	IOE	50	20
							-	-	-	EOE	50	20
		Total	**19**	**01**	**10**	**25**	-	**500**	-	-	**300**	-
Audit Course												
ME601A	11.	Introduction to Foreign Language	01	-	02	-	-	-	-	-	-	-

$ In theory student should appear for the CIE (Mid Semester Exam), submit the assignment and must secure 40% marks in SEE. **Total Credits=25**

Note:

1 .Students are expected to do self-study for two hours as per the guidance given by the project guide hence contact hours to be taken as two for the calculation of contact hours

2. Tutorials and Practical to be conducted in batches with batch strength not exceeding 15 students.

CIE: Continuous Internal Evaluation SEE: Semester End Examination
IPE: Internal Practical Evaluation EPE: External Practical Examination
IOE: Internal Oral Evaluation EOE: External Oral Examination

Equivalence of Pre Revised and Revised Structure
Third Year B. Tech. (Mechanical Engineering) Semester V and VI

The above detailed syllabus is a revised version of the Third Year B. Tech (Mechanical Engineering) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2022, (Academic year 2022-23). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Mechanical Engineering at Third Year B. Tech. Semester V and VI pre-revised and Revised Program under the faculty of Engineering and Technology is as follows.

Third Year B. Tech. Semester V (Mechanical Engineering)

Sr. No	Third Year B. Tech. (Mechanical Engineering) Semester V Pre-revised syllabus	Third Year B. Tech. (Mechanical Engineering) Semester V Revised syllabus	Remark
	Credits = 25	Credits = 25	No change in credits
1.	Machine Design I	Machine Design I	Slight modification in the content
2.	Theory of Machine II	Theory of Machines II	Slight modification in the content
3.	Energy Engineering	Energy Engineering	Slight modification in the content
4.	Manufacturing Engineering II	Tool Engineering	Course Name Changed Slight modification in the content
5.	Heat and Mass Transfer	Heat and Mass Transfer	Slight modification in the content
6.	**Laboratory** Theory of Machine II	**Laboratory** Theory of Machines II	Slight modification in the content
7.	**Laboratory** Manufacturing Engineering II	**Laboratory** Tool Engineering	Course Name Changed Slight modification in the content
8.	**Laboratory** Heat and Mass Transfer	**Laboratory** Heat and Mass Transfer	Slight modification in the content
9.	**Laboratory** Computer Aided Drafting	**Laboratory** Computer Aided Drafting	Slight modification in the content
10.	Workshop Practice III	Workshop Practice III	Slight modification in the content
11.	Internship I and Mini Project	Internship I and Seminar	Course Name Changed Seminar Shifted to Semester V and Minor Project Shifted to Semester VI

12.	**Audit Course** Research Methodology	**Audit Course** Research Methodology	Slight modification in the content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

* **Course work:** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement programme outcomes. The practical work and its journal is not part of course work.

Third Year B. Tech. Semester VI (Mechanical Engineering)

Sr. No	Third Year B. Tech. (Mechanical Engineering) Semester VI Pre-revised syllabus	Third Year B. Tech. (Mechanical Engineering) Semester VI Revised syllabus	Remark
	Credits = 25	Credits = 25	No change in credits
1	Machine Design II	Machine Design II	Slight modification in the content
2	Control Engineering	Control Engineering	Slight modification in the content
3	Internal Combustion Engine	Internal Combustion Engines	Slight modification in the content
4	Metrology and Quality Control	Metrology and Quality Control	Slight modification in the content
5	Industrial Engineering and Management	Engineering Economics	Course Name Changed Slight modification in the content
6	**Laboratory** Machine Design II	**Laboratory** Machine Design II	Slight modification in the content
7	**Laboratory** Internal Combustion Engine	**Laboratory** Internal Combustion Engines	Slight modification in the content
8	**Laboratory** Metrology and Quality Control	**Laboratory** Metrology and Quality Control	Slight modification in the content
9	**Laboratory** Computer Aided Manufacturing	**Laboratory** Computer Aided Manufacturing	Slight modification in the content
10	Seminar	Mini Project	Seminar Shifted to Semester V and Minor Project Shifted to Semester VI
11	**Audit Course**	**Audit Course**	Slight modification in the content

	Introduction to Foreign Language	Introduction to Foreign Language	

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out of 50. (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.

* **Course work:** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement programme outcomes. The practical work and its journal is not part of course work.

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester V**					
Course Title	**:**	**Machine Design I**			**Course Code:**	**:**	**ME 501**
Teaching Scheme (Hours)	**:**	**Lecture :-**	**4 Hrs/week**		**Total Credits**	**:**	**04**
		Tutorial :-	**Hrs/week**				
Evaluation Scheme (Marks)	**:**	**CIE=30**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
		(20+10)					
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Strength of Materials and Material Science					
Course Domain	**:**	Professional Core course					

Course Rationale:

The purpose of learning this course is to understand the design procedures of different mechanical components and solve problems on it.

Course Objectives:

1. To understand fundamental aspects of design.
2. To study design procedures of different mechanical components.
3. To understand stresses and strain induced in the component.
4. Study of component behavior and failure criteria's of different mechanical components subjected to loads.

Course Outcomes:

1. Formulate the problem by identifying customer need and convert into design specification.
2. Design of components like shaft, key, coupling, spring, power screw, Knuckle joint, Cotter joint and turn buckle etc.
3. Analyze the stresses and strain induced in the component.
4. Understand component behavior subjected to loads and identify failure criteria.

Curriculum Content **Hours**

Unit I: Fundamental aspects of design

The meaning of design, Engineering design, Phases of design, stress and strain consideration, factor of safety and its selection, standardization, preferred series, material selection- weighted point method. Concurrent Engineering. **04**

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit II: Design against static load

Commonly used engineering materials and their important mechanical properties – Cast Iron, Mild Steel, Non-ferrous materials like Copper and Brass, Stress-strain relationship, stresses due to bending and torsional load, design of Cotter joint, Knuckle joint, and Turn-buckle. **10**

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit III: Design of shafts, keys and coupling **10**

Shaft design on strength basis, Shaft design on Torsional rigidity basis, A.S.M.E. code for shaft Design, Types of keys, Design of Flat key and Square key, Design of Muff coupling, Clamp coupling and Flexible coupling.

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit IV: Design of Power Screws **10**

Forms of Threads, Terminology of Power screw, Torque requirement for lifting and lowering load, efficiency of square threaded screw and self-locking screw, design of power screws, introduction to re-circulating ball screw**.**

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit V: Design of mechanical springs **09**

Springs, Types of Spring, Terminology of Helical Spring, Styles of End, Spring Material, Design of Helical springs, Concept Helical Torsion Spring, Multi Leaf Spring and Equalized Stress in Spring Leaves (Nipping)

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit VI: Design of welded joints **09**

Types of welded joints, eccentrically loaded joints, and welded joints subjected to bending moment, Strength of welded joints. Introduction to design of riveted joints.

(Note: The unit includes numerical treatment on the appropriate topics.)

Text Books

1. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ.Co. Ltd.
2. Bhandari V.B. – "Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd.

Reference Books

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International.
2. Black P.H. and O. Eugene Adams – "Machine Design" - McGraw Hill Book Co. Ltd.
3. William C. Orthwein – "Machine Component Design" – West- publishing Co. and Jaico Publ. House.
4. "Design Data" – P.S.G. College of Technology, Coimbatore.
5. Juvinal R.C. – "Fundamentals of Machine Components Design" – John Wiley and Sons.
6. Hall A.S.; Holowenko A.R. and Laughlin H.G. – "Theory and Problems of Machine Design" – Schaum's outline series.

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester V**					
Course Title	**:**	**Theory of Machines - II**			**Course Code:**	**:**	**ME 502**
Teaching Scheme (Hours)	**:**	**Lecture :**	**4 Hrs/week**		**Total Credits**	**:**	**4**
		Tutorial :	**Hrs/week**				
Evaluation Scheme (Marks)	**:**	**CIE=30 (20 + 10)**	**SEE = 70**	**Total =100**	**Duration of SEE**	**:**	**4 hrs**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Knowledge of Theory of Machine I, Strength of Material					
Course Domain	**:**	Core					

Course Objectives: The Course teacher will

1. Introduce various types of clutches and brakes.
2. Introduce to the various types of dynamometers.
3. Introduce to the various types of governor and its working mechanisms.
4. Explain the phenomenon of gyroscope couple on aeroplane, naval ship and vehicles
5. Understand free and forced vibrations of single degree freedom systems
6. Explain the various type of damping and its characteristics

Course Outcomes: Students will be able to

1. Understand the difficulty of application of clutches and brakes in different working environment.
2. Identify, classify and choose the most appropriate type of dynamometer.
3. To classify the different governor mechanism and it application.
4. Formulate and solve different problems on gyroscopic couple.
5. To understand need of mechanical vibration in mechanical engineering.
6. Deploy skills effectively in the solution of damping problems in mechanical vibration

Curriculum Content **Hours**

Unit I Friction Clutches, Brakes 08

Introduction, Types of clutch, uniform wear and Uniform pressure for the clutch, Types of brakes, effect of braking of a vehicle.

Unit II Dynamometer 08

Absorption and transmission dynamometers, Study and analysis of absorption type dynamometer – Proney brake, Rope brake, dynamometers, Study and analysis of transmission type dynamometers.

Unit III Governors 08

Comparison between governors and flywheel, Typescentrifugal governors, inertia governors, Force analysis of gravity loaded governors– Watt, Porter, Proell, Force analysis of spring loaded governors Hartnell, hartung, Wilson Hartnell, Force analysis of spring and gravity loaded governor, Performance characteristics of governor stability, sensibility, isochronisms, Hunting, governor effort and governor power, coefficient of insensitiveness, introduction to MEMS based gyroscopes

Unit IV Gyroscope 06

Introduction- Gyroscopic couple and its effect on spinning bodies, Gyroscopic effect on naval ships during steering, pitching and rolling, Ship stabilization with gyroscopic effect. Two wheeler and four wheeler on curved path- effect of gyroscopic and centrifugal couples, maximum permissible speeds on curve paths, Gyroscopic effect due to lateral misalignment of rigid disc mounted on shaft.

Unit V: Introduction to Mechanical Vibration 08

Basic concepts and definitions; vibration measuring parameters- displacement, velocity, and acceleration, Single degree of freedom system, SHM, Undamped free vibrations, damped free vibrations, Types of damping. Forced Vibration: Effect of excitation, Excitation due to reciprocating and rotating unbalance, Vibration isolation and transmissibility, Vibration sensors and IOT.

Unit VI: Single Degree of Freedom Vibrating Systems 08

Viscous damped system- underdamped, critically damped, overdamped. Logarithmic decrement. Coulomb's damping. Combined viscous and coulomb's damping. Critical speed of shafts.

Suggested list of Tutorials and Assignments:

It shall consist of various assignments on above syllabus

General Instructions:

Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 Theory of Machines Ratan S.S Tata McGraw Hill New Delhi.
2 Theory of Machines P.L.Ballany Khanna Publication, New Delhi
3 Theory of Machines V.P. Singh Dhanpat Rai and Sons
4 Theory of machines Dr. R. K. Bansal Laxmi Publication

Suggested Reference Books:

1 Theory of Machines Thomas Bevan CBS Publishers, New Delhi.
2 Theory of Machines and Mechanism Shigley Oxford International
3 Theory of mechanism and machines Sadhu Singh Pearson
4 Theory of machines and Mechanism Jagdish Lal Metropolitin Book Company
5 Mechanism and Machines Gosh And Mallik East West Press
6 Theory of Machine Sarkar Tata Mc Graw Hill

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester V**					
Course Title	**:**	**Energy Engineering**			**Course Code:**	**:**	**ME 503**
Teaching Scheme (Hours)	**:**	**Lecture :**		**3 Hrs/week**	**Total Credits**	**:**	**03**
		Tutorial :		**Hrs/week**			
Evaluation Scheme (Marks)	**:**	**CIE=30 (20+10)**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Basic mechanical Engineering, Thermodynamics, Heat and Mass Transfer					
Course Domain	**:**	Professional Core course					

Course Objectives: The Course teacher will

1. To identify the present status of energy scenario.
2. To acquire the knowledge of renewable sources of energy and utilization.
3. To explain the basic concept of solar radiation
4. To understand the new trends in energy sectors.

Course Outcomes: Students will be able to

1. Identify renewable energy sources and their utilization.
2. Understand the working principle of solar photovoltaic cell and wind turbine
3. Explain the concepts and applications of fuel cell, bio gas plant, Tidal energy, etc.
4. Interpreting the solar radiation geometry and determine sun position and angles.
5. Analyze the present energy scenario.

Curriculum Content **Hours**

Unit I Introduction:

Sources of Energy and its classifications, Renewable energy sources, classification and systems, Overview of Global and Indian energy scenario, Overview of 1st , 2nd and 3rd law of thermodynamics 06

Unit II Solar Radiation and its Measurement

Solar Radiation geometry, Solar angles , Spectrum distribution of extra-terrestrial radiations and its variation, Solar time and equation of time, Measurements of diffuse & global & direct radiations, (Numerical on angle of incidence only) 06

Unit III Solar Energy Applications 09

Application of Solar energy in heating, cooling, pumping, power production, distillation, drying, solar cookers, solar pond

Solar Thermal System – Types of collector, Energy balance equation and Collector efficiency, concentrating collector, Comparison of Flat plate and concentrating collector

Solar Photovoltaic system - Introduction, Fundamentals of Photovoltaic conversion, Photo-cell materials, Cell module array, Series and parallel connections, Maximum power point tracking, Design of standalone system.

Unit IV Energy from Wind and Biomass 06

Energy from Wind - Types of turbines, Coefficient of Power, Betz limit, Wind electric generators, Power curve, wind characteristics and site selection, Present status

Energy from Biomass - Introduction, Biomass conversion Technologies, Photosynthesis, Biogas generation, Factors affecting Bio-digestion of gas, Classification of Biogas plant

Unit V Geothermal Energy and Tidal Energy 06

Geothermal Energy Sources and application of geothermal energy, various types of geothermal power plants.

Tidal Energy Tidal energy available in India, suitable locations, study of various tidal energy power plants

Unit VI: Energy Storage systems for Electric vehicles 06

Electrochemical Battery, Fuel Cell , Ultra Capacitors, Hydrogen generation and storage ,Energy Management System ,Electric vehicle charging station

Suggested Text Books:

1. "Solar Energy, S. P. Sukhatme and J. K. Nayak, Tata McGraw-Hill, 3rd Edition 2008.
2. "Non-Conventional Energy Sources G. D. Rai. - Khanna Publisher, 4th Edition 2014.
3. Solanki C. S. (2009); Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, Mehrdad Ehsani, CRC Press,2004

Suggested Reference Books:

1. Krieth and Krieder, "Principles Of Solar Engineering", Tata McGraw Hill Publishing Company Limited, New Delhi, 1994
2. "Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008..
3. "El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
4. "Energy Manager Training Manual, Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004.

Class and Semester	**:**	**T. Y. B. Tech. Mechanical Engineering ,Semester V**					
Course Title	**:**	**Tool Engineering**			**Course Code**	**:**	**ME504**
Teaching Scheme (Hours)	**:**	**Lectures : 4 hours/weeks = 4 x 13 weeks = 52hours**			**Total Credits**	**:**	**04**
		Tutorial :- hour/week , Practical :- 02 hours/week					
Evaluation Scheme (Marks)	**:**	**CIE=30 (20+10)**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**4 hours**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites (if any)	**:**	In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include study of Manufacturing Engineering – I, Applied Mechanics.					
Course Domain	**:**	Core					
Type of Course	**:**	Theory					

Course Rationale: Tool Engineering is the basic course of mechanical engineering involves designing and manufacturing of special purpose tools like jigs, fixtures and press tools as well as various non-conventional manufacturing process also contains introduction of advanced manufacturing processes such as CNC and rapid prototyping

Course Objectives: The Course teacher will

1. To study of metal cutting technology including the process, measurements, design and selection of various cutting tools.
2. To introduce the design practices of jigs, fixtures and die design for presswork.
3. To introduce the students to various non-conventional machining processes. .
4. To introduce advanced CNC and Rapid prototyping based manufacturing.

Course Outcomes: Students will be able to

1. Understand the metal cutting action with single point cutting tool and demonstrate cutting tool geometries.
2. Design of jigs and fixtures for simple components.
3. Design of press tool die for simple components.
4. Justify the need of various non-conventional machining processes.

Curriculum Content **Hours**

Unit I: Theory of Metal Cutting 09

Introduction to metal cutting, wedge action, concept of speed, feed and depth of cut, orthogonal and oblique cutting. Mechanics of metal cutting-Chip formation, Types of chips, cutting ratio, Theories of shear angle, shear plane and shear angle, velocity relationships, force measurement by tool dynamometers, estimation of cutting forces, Merchants circle of forces, cutting tool materials and their properties, machinability of metals- factors affecting, improvement and machinability index.

A. Tool life - Types of wear, relationship with cutting parameters, Taylor's equation and improvement measures. Surface finish- Factors affecting, effect of cutting parameters, improvements. Heat generation in machining, its effect on cutting force, tool life and surface finish, types and selection criteria of cutting fluids.

B. Tool geometry- Parts, angles and types of single point cutting tools, tool geometry of single point cutting tool, tool geometry of multipoint cutting tools.-drills, milling cutters, reamers.

Unit II: Design of Jigs and Fixtures 10

Definition, Applications, basic elements, principles and types of locating, clamping and indexing elements, auxiliary elements like tenon, setting block etc. Type of Drilling jigs and Milling fixtures- Design consideration of Jigs and fixtures with respect to different operations.

Unit III: Press Tools 11

Elements of Dies and Punch set. Types of dies – simple, compound, combination and progressive dies and punches of various press working operations such as punching, blanking, drawing, bending, forming, coining etc. Design of Blanking die, Progressive die, Calculations of clearances, center of pressure, different forces, press tonnage, strip layout, sheet utilization ratio, methods of reducing forces.

Unit IV: Introduction of Unconventional Machining 05

Introduction to unconventional machining, Need for Unconventional machining process, Comparison between traditional and non-traditional machining, general classification Nonconventional machining processes, classification based on nature of energy employed in machining, selection of non-conventional machining processes, Specific advantages, limitations and applications of non-traditional machining processes.

Unit V: Unconventional Machining Methods. 10

Introduction, Classification. Introduction, Principle, Working and Applications of - Electrochemical Machining, Electric Discharge Machining, Electron Beam Machining, Ultrasonic Machining **,**Abrasive Jet Machining, Water Jet Machining,

Unit VI: Advanced manufacturing processes. 07

- CNC Technology and CNC tooling: Introduction, Construction and working of CNC, DNC and machining centre, Automatic Tool Changer (ATC) and Automatic Tool Setter, Automatic pallet changer (APC).
- Rapid prototyping: concept, advantages, applications, study of 3D printing, file formats.
- Applications of RP: Aerospace, Automotive, Biomedical, Product Development, Commercialization, Trends and Future Directions.

Note: 1. The unit no. II includes drawing a jigs/ fixtures for simple objects whereas unit no. III includes drawing sheet on press tools.
2. The course includes numerical treatment on the appropriate modules of various units.)

Suggested list of Tutorials and Assignments:
Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1 Chapman, “Workshop technology” vol. I,II and III, Edward Arnold Publication Ltd. London
2 S.K Hajra Chaudhary, “Workshop Technology”, Vol. I and II, Media Promoters and Publication, Mumbai.
3 R. K. Jain, “Production technology”, Khanna Publications.
4 Hoffman: “Introduction to Jigs and Fixtures”, Galgotia Publishers.
5 S. K Hajra Choudhury, “Elements of Workshop Technology” Vol. II, Media Promoters and Publishers, Mumbai.
6 P.C. Sharma, Text Book of “Production Engineering”, S. Chand Publication, 11th Edition.

7 "Machine Tool Engineering" G.R. Nagapal, Khanna Publication.
8 "Principles of Modern Manufacturing", Groover, Wiley Publication. 5th Edition.
9 T. A. Grimm and Associates, Users Guide to Rapid Prototyping, Society of Manufacturing Engineers (SME) ISBN 0872636976

Suggested Reference Books:

1 HMT Hand book- "Production Technology".
2 S. E. Rusinoff: "Manufacturing Processes", Times India Press. Doyle, Manufacturing Processes and Materials for engineers, Prentice Hall of India Press
3 S. K. Basu, "Fundamentals of Tool Design", Oxford IBH
4 Mr. Arshinnov, "Metal Cutting Theory and Tool design", MIR Publication
5 "Fundamentals of Tool Design" ASTME, Prentice-Hall of India Private Ltd., New Delhi Publication, (1976).
6 Donaldson, "Tool Design", THM Publication, 3rd Edition.
7 Sen and Bhattacharya, "Theory of Metal Cutting", New Central Book Agency, (1965)
8 Kempster "Jigs and Fixtures", ELBS.
9 Rapid Prototyping theory and practice, Manufacturing System Engineering Series, Ali K.
10 Rapid Prototyping- case book, J. A. McDonalds, C. J. Ryall, Wiley Eastern

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester, V**					
Course Title	**:**	**Heat and Mass transfer**			**Course Code:**	**:**	**ME 505**
Teaching Scheme (Hours)	**:**	**Lecture :**	**3 Hrs/week**		**Total Credits**	**:**	**3**
Evaluation Scheme (Marks)	**:**	**CIE=30 (20+10)**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Pre- requisites include Engineering Physics, Engineering Thermodynamics-I, Basics of Fluid Mechanics and Fluid Flow Operations**.**					
Course Domain	**:**	Core					

Course Rationale:

This course offers a method of heat transfer and understanding for engineering applications. This course produce graduates with mathematical, knowledge, skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.

Course Objectives: The Course teacher will

1 To familiarize the students with fundamental principles/laws of heat transfer by conduction, convection, and radiation and mass transfer by diffusion and convection.
2 To introduce the various mechanisms of heat and mass transfer that characterizes a given physical system.
3 To familiarize conservation equations along with models for heat transfer processes.
4 To prepare the analysis of one-dimensional steady and unsteady partial differential equations.
5 To develop representative models of real-life heat transfer processes and systems.
6 To introduce the various mechanisms of heat and mass transfer that characterizes a given physical system.

Course Outcomes: Students will be able to

1 Demonstrate the basic laws of heat and mass transfer and compute the heat transfer
2 Analyse problem involving steady and transient state heat transfer.
3 Analyse various types of applications related to heat transfer like fins, heat exchanger, wire insulation
4 Asses the heat exchanger performance by using the LMTD and NTU.

Curriculum Content **Hours**

Unit 1. Introduction to Heat Transfer 03

Introduction to Heat transfer, Difference between thermodynamics and heat transfer, Modes of Modes/laws of heat transfer, thermo-physical properties, Thermal conductivity and coefficient of heat transfer. Electrical analogy and thermal resistance in conduction, convection and radiation,

Unit II. Heat Conduction.

Heat conduction through a plane wall, cylindrical wall and sphere. Heat conduction through a composite slab, cylinder and sphere, effect of variable thermal conductivity, critical radius of insulation, Economic insulation, and thermal contact resistance. Numerical problems on One dimensional steady state heat conduction with heat generation for plane wall, cylinder and sphere. 09

Extended Surfaces Types and Applications of Fins, Heat transfer through extended surfaces, derivation of temperature distribution equations and heat transfer through fins of constant cross-sectional area, Effectiveness and efficiency of a fin.

Unsteady state heat conduction System with negligible internal resistance, Biot and Fourier numbers. Lumped heat capacity method,

Unit-III: Free and Forced Convection 07

Local and average convective coefficient, Hydrodynamic and thermal boundary layer, Laminar and turbulent flow over a flat plate and through a duct, Friction factor, Drag and drag co-efficient. Dimensional analysis in free and forced convection, physical significance of the dimensionless numbers related to free and forced convection, empirical correlations for free and forced convection for heat transfer in laminar and turbulent flow over a flat plate and through a duct.

Unit IV. Radiation. 09

Nature of thermal radiation, definitions of absorptivity, reflectivity, transmissivity, monochromatic emissive power, total emissive power and emissivity. Concept of black body and gray body. Kirchhoff laws, Wien's law and Planck's law. Deduction of Stefan Boltzmann equation. Lambert's cosine rule, Intensity of radiation. Energy change by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces. Geometric shape factor. Energy exchange by radiation between two gray surfaces without absorbing medium and absence of radiation and radiosity. Numerical problems on radiation network method, network for two surfaces

Unit V. Heat Exchanger 07

Heat Exchangers, Classification according to flow arrangement, Tubular heat exchangers. Fouling factor, mean temperature difference, LMTD for parallel flow, counter flow, mean temperature for cross flow, correction factor, and special cases. The effectiveness by NTU method, effectiveness of parallel, counter flow. Basic working of condenser and evaporator heat exchanger, types of condenser and evaporator. Numerical on LMTD and NTU methods.

Unit VI. Boiling and condensation. 05

Nucleate and film boiling phenomenon: drop wise and film wise condensation, Nusselt's theory of condensation nature of heat transfer in such phenomenon. Introduction to Mass Transfer: Introduction, modes of mass transfer, analogy between heat and mass transfer, Mass diffusion, Fick's law of diffusion.

Suggested list of Assignments:

1. Modes of heat transfer.
2. Conduction
3. Fins and Extended surface
4. Convection
5. Radiation
6. Heat exchanger
7. Boiling and condensation

General Instructions:

1. Students must be encouraged to solve assignment problems.
2. Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1. "Heat Transfer", J.P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition.
2. "Fundamentals of Heat and Mass Transfer", R.C. Sachdeva, Willey Eastern Ltd.,
3. "A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman, Hyderabad.

Suggested Reference Books:

1. "Heat Transfer – A Practical approach",Yunus. A .Cengel, Tata McGraw Hill.
2. "Heat Transfer" Chapman A.J., Tata McGraw Hill Book Company, New York.

3. "Fundamentals of Heat and Mass Transfer", Frank P.Incropera, David, P.Dewitt, Wisley India. 5^{th} Edition.

4. Useful Links
   1. http://www.sciencedirect.com/science/bookseries
   2. http://www.thermalfluidscentral.org/e-books
   3. http://www.elsevier.com/books/advances-in-heat-transfer

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester V**					
Course Title	**:**	**Laboratory Theory of Machines II**			**Course Code:**	**:**	**ME 502 L**
Teaching Scheme (Hours)	**:**	**Practical**	**2 Hrs/week**		**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE/IOE= Nil**	**EOE = 50**	**Total = 50**	**Duration of SEE**	**:**	**NIL**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Knowledge of Theory of Machine I, Strength of Material					
Course Domain	**:**	Core					
Course Rationale:							

Course Objectives: The Course teacher will

1. To Study the various types mechanical/transmission type dynamometer
2. To analyze physical principles and phenomenon of Vibrations.
3. To Study the Measure vibration parameters in single degree of freedom systems
4. To Analyze natural frequency of 1 dof (Degree of Freedom)

Course Outcomes: Students will be able to

1. Explain various types mechanical/transmission type dynamometer
2. Interpret physical principles and phenomenon of Vibrations.
3. Measure vibration parameters in single degree of freedom systems
4. Evaluate natural frequency of 1 DoF.

Experiments List

The students should perform the following experiments.

To study frictional properties of clutch/brake lining and to determine experimentally torque carrying capacity and slip of the clutch or brake.

To determine the coefficient of friction and wear of a given material.

Study of mechanical/transmission type dynamometer.

Verification of Gyroscopic principle and determination of gyroscopic couple

Experimental determination of natural frequency for longitudinal vibrations of helical springs, and springs in series and parallel.

Determination of damping coefficient of torsional vibrations.

Determination of node point of two rotor system.

Determination of critical speed of shaft of single rotor.

Experimental investigation of viscous and coulomb damping, prediction of system parameters (spring stiffness, damping coefficient) from damped oscillations.

The students should perform the following experiments.

Lab Manual

Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Text Books:

1 Theory of Machines Ratan S.S Tata McGraw Hill New Delhi.
2 Theory of Machines P.L.Ballany Khanna Publication, New Delhi
3 Theory of Machines V.P. Singh Dhanpat Rai and Sons
4 Theory of machines Dr. R. K. Bansal Laxmi Publication

Suggested Reference Books:

1 Theory of Machines Thomas Bevan CBS Publishers, New Delhi.
2 Theory of Machines and Mechanism Shigley Oxford International
3 Theory of mechanism and machines Sadhu Singh Pearson
4 Theory of machines and Mechanism Jagdish Lal Metropolitin Book Company
5 Mechanism and Machines Gosh And Mallik East West Press
6 Theory of Machine Sarkar Tata Mc Graw Hill

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering , Semester V**					
Course Title	**:**	**Laboratory Heat and Mass transfer**			**Course Code**	**:**	**ME 505L**
Teaching Scheme (Hours)	**:**	**Laboratory :**	**2 Hrs/week**		**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE: Nil** **IOE : Nil**	**EPE: 50** **EOE : Nil**	**Grand Total=50**	**Duration of Exam**	**:**	**2 hrs**
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Pre- requisites include Engineering Physics, Engineering Thermodynamics-I, Basics of Fluid Mechanics and Fluid Flow Operations.					
Course Domain	**:**	Core					

Course Rationale:

This course offers a heat transfer method understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.

Course Objectives: The Course teacher will

1. To understand and execute experiments
2. To understand measuring equipment's and apply
3. To Analyse the data from experiment and correlate to basic
4. To apply learning in evaluating heat exchanger performance

Course Outcomes: Students will be able to

1. Student will able to interpret results
2. Student will able to set process for experimentation
3. Student will able to understand basics of subject by experience
4. Student will able to compare, select and analyse right mode of heat transfer

Experimental List :-

Students have to perform following experiments**:**

1. Determination of thermal conductivity of insulating powder.
2. Determination of thermal conductivity of a given metal rod.
3. Determination of thermal conductivity of a given liquid.
4. Determination of thermal conductivity of composite slab.
5. Determination of heat Transfer Coefficient in Natural Convection from Cylinder.
6. Determination of heat Transfer Coefficient in Forced Convection from Cylinder.
7. Determination of Critical Heat Flux
8. Study of Performance of parallel and counter flow heat exchanger
9. Determination of emissivity of given surface
10. Determination of Stefan Boltzmann Constant.
11. Study and demonstration of heat pipe
12. Performance analysis of extended surfaces

Laboratory Manual:

Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester V**			
Course Title	**:**	**Laboratory Tool Engineering**	**Course Code**	**:**	**ME504L**
Teaching Scheme (Hours)	**:**	**Practical : 2 hr. /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**EOE : Nil, IPE : Nil, IOE : 50, EPE : Nil**	**Duration of Exam (in case of External Evaluation)**	**:**	**NIL**
Revision:	**:**	**Third**	**Month**	**:**	**June-22**
Pre-requisites	**:**	Laboratory work in workshop practice I and II			
Course Domain	**:**	Core			
Type of Course	**:**	Practical			

Course Rationale:

Tool Engineering practical's involves designing and drawing of special purpose tools like jigs, fixtures and press tools as well as study of various non-conventional manufacturing process also contains introduction of advanced manufacturing processes such as CNC and rapid prototyping.

Course Objectives:

1. To Study of cutting tools, their geometry and importance in cutting action.
2. To design and drawing of jigs, fixtures and press tools for simple objects.
3. To comparative study of various conventional and non-conventional machining processes.
4. To Understanding 3 D Printing

Course Outcomes: Students will be able to

1. Demonstrate understanding on single point cutting tool.
2. Design and drawing a jig, fixtures and press tool.
3. Select appropriate non-conventional machining process for a given application.
4. Deliver a seminar on 3 D printing

List of Experiments:

1. Study of single point cutting tool.
2. Study of various elements of jigs and fixtures.
3. Design and drawing of any one drilling jig.
4. Design and drawing of any one milling fixture.
5. Design and drawing of any one die set.
6. Study of non-conventional machining processes.
7. Study of CNC machines
8. Study of rapid prototyping – 3D Printing – presentation and report

General Instructions:

- Institutes Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.
- Batch wise practical's are to be conducted. The number of students per batch should be as per the practical batches.
- Each Student has to write practical journal.

Suggested Text Books:

1 Chapman, "Workshop technology" vol. I,II and III, Edward Arnold Publication Ltd. London

2 S.K.Hajara Chaudhary, "Workshop Technology", Vol. I and II, Media Prom and Publication, Mumbai.

3 Hoffman: "Introduction to Jigs and Fixtures", Galgotia Publishers

4. P.C. Sharma, "Text Book of Production Engineering", S. Chand Publication, 11th Edition.

5. P.H.Joshi, "Jigs and Fixture", Mc Graw Hill, new Delhi.

Class and & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester V**			
Course Title	**:**	**Laboratory Computer Aided Drafting (CAD)**	**Course Code**	**:**	**ME506L**
Teaching Scheme (Hours)	**:**	**2 hr /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE :- Nil EPE :- 50 EOE :- Nil IOE :- Nil**	**Duration of Exam (in case of External Evaluation)**	**:**	**02 hours**
Revision:	**:**	**Third**	**Month**	**:**	**June 2022**
Pre-requisites	**:**	Basic understanding of engineering graphics, machine drawing, understanding of various engineering components.			
Type of Course	**:**	Practical			
Course Domain	**:**	Core			

Course Objectives:

1. To understand importance of CAD in field of engineering drawing.
2. To learn various commands in CAD software
3. To interpret production drawings.
4. To give hands on training on CAD package.

Course Outcomes: At the end of course student will able to

1. Describe the significance of CAD in manufacturing.
2. Develop a 2D model of engineering components using various commands.
3. Develop a 3D model of engineering components using various commands.
4. Produce production drawings and interpret it

Experimental List :

1 Basic command to draw 2- D objects like line, point, circle, arc, ellipse, polygon, polyline, spline etc.

2. Edit Commands: Erase, extension, break, fillet, chamfer, trim, scale, etc

3.Commands like line type, Dimension, text style etc

4. Viewing and other: Zoom, pan, mirror, rotate, move objects, arrange blocks, offset etc.

5. Hatching of sections.

6. Use of layers in drawing.

7. Plotting of drawing.

8. Introduction to 3- D modeling – sketcher, part design, assembly and drafting workbenches.

9. Modify commands, view port, UCS, etc.

LAB WORK

1. Computer aided drafting and 3-D drawing of two simple components by using latest CAD Software version like AutoCAD and print out of the same.
2. Solid Modeling of two simple components by using latest 3D modeling software like Solidworks and print out of the same.

3. Building two composite assemblies of components (consisting at least five components) along with all relevant details using any appropriate high end CAD software like Solidworks.
4. One assignment on 3-D drawing of one simple component and plotting its 2-D views along with 3 D object drawing.
5. Redraw given production drawing and to interpret it.

Note: Latest computer aided drafting software version like AutoCAD and any 3D modeling software are to be used.

Instructions for practical examination:

1. Every student shall be given one problem each.

2. Oral shall be based on the problem solved in software package and the journal.

Lab Manual

- Institute‟s Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Reference Books

1. Ibrahim Zeid “CAD/CAM – Theory and Practice” Mc Hill, International edition, 1998
2. P. N. Rao “CAD/Cam principles and operations”, Tata McGraw Hill
3. M. P. Groover and E. W. Zimmers Jr., “CAD/CAM” - Prentice Hall of India Pvt. Ltd.
4. New Delhi, 18th Edition, 1999.
5. User manuals of particular software package
6. AutoCAD Manual.

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering, Semester V**				
Course Title	**:**	**Workshop Practice –III**		**Course Code**	**:**	**ME507L**
Teaching Scheme (Hours)	**:**	**Practical :**	**2 hr. /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE: Nil IOE: Nil EOE: Nil EPE: 50**		**Duration of Exam (in case of External Evaluation)**	**:**	**02 hrs**
Revision:	**:**	**Third**		**Month**	**:**	**June-22**
Pre-requisites	**:**	Machine Tools and processes, Machine Drawing, CAD, CAM software.				
Course Domain	**:**	Core				
Type of Course	**:**	Practical				

Course Rationale:

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hands on skills required by various engineering industries and workshops. This course includes study and demonstration of various manufacturing processes.

Course Assessment Methods: Practical Journal Assessment and External Practical Examination.

Course Objectives:

1. To discuss various Metal Removal Processes and Machine tools.
2. To demonstrate the application of various cutting tools used in various manufacturing process.
3. To Design the sequence of various processes required to manufacture the components
4. To understand the gear cutting and finishing processes used in industries.

Course Outcomes: Students will be able to

1. Prepare job using plain turning, taper turning, external threading and knurling operation with its process sheet.
2. Demonstrate thread manufacturing processes and gear train calculations
3. Select the suitable machining operations and prepare process sheet to manufacture component.
4. Explain gear manufacturing processes and finishing processes used in the industry.

Experimental List :

1. One job including basic operations of plain turning, taper turning, external threading and knurling operation with its process sheet.
2. Study and demonstration of one job on 3D printing machine.
3. Conceptualization of innovative product for domestic problem.
4. Study of thread manufacturing processes and gear train calculations.
5. Study of Setting of milling machine for gear cutting.
6. Study and demonstration of grinding machine (Surface, cylindrical and center less).
7. Industrial visit to machine shop and report submission.

General Instructions:

1. Assessment of journal based on above term work and industrial visit report is to be done by the teaching staff member assisted by workshop staff.
2. [During external practical examination submission carries 25 marks and external practical exam job carries 25 marks.]
3. Batch wise practical's are to be conducted. The number of students per batch should be as per the practical batches.
4. Each Student has to write journal
5. **Lab Manual:** Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Suggested Text Books:

1	"A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt.Ltd, New Delhi.
2	"Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition.
3	"Workshop Technology vol. II", W. A. J. Chapman, Viva Books Pvt.Ltd, New Delhi.
4	"Elements of Workshop Technology vol. II", S.K.Hajara Choudhury and A.K. Hajra Choudhury, Media promoters and Publishers Pvt.Ltd, New Delhi.
5	"Production technology", R. K. Jain, Khanna Publishers, Delhi.

Suggested Reference Books:

1	HMT Hand book- Production Technology
2	Campbell J.S.: Principles of manufacturing Materials and Processes, McGraw-Hill, New York.
3	ASTM Volumes on Welding, casting, forming and material selection
4	Manufacturing Processes And System 9E P. Ostwald, J. Munoz, John Wiley and Sons (asia) Pvt.Ltd

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester V**			
Course Title	**:**	**Internship- I And Seminar**	**Course Code**	**:**	**ME508L**
Teaching Scheme (Hours)	**:**	**Practical: 2 hrs. / week= 2 x13= 26 hours**	**Total Credits**	**:**	**01+ 01=02**
Evaluation Scheme (Marks)	**:**	**IPE : Nil EPE : Nil IOE : 50 EOE : Nil**	**Duration of Exam (in case of External Evaluation)**	**:**	**Nil**
Revision:	**:**	**Third**	**Month**	**:**	**June-2022**
Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command of English. Other Pre-requisites include study of basics engineering subjects.			
Course Domain	**:**	Core			
Type of Course		Practical			

Course Rationale:

Students will present information in a compelling, well-structured, and logical sequence and respond respectfully to opposing ideas, show depth of knowledge of complex subjects, and develop their ability to synthesize, evaluate and reflect on information.

Course Objectives:

1. To Identify and compare technical and practical issues in industrial as well as in social area.
2. To write, speak and demonstrate well in different contexts.
3. To Prepare a well-organized report of technical writing and innovative thinking.
4. To Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presentation.

Course Outcomes: Students will be able to

1. Establish motivation for any topic of interest and develop a thought process for technical presentation.
2. Organize a detailed literature survey and build a document with respect to technical publications.
3. Analysis and comprehension of concept and related data.
4. Effective presentation and improve soft skills.

General Instructions:

- Any topic of mechanical engineering application may be a seminar topic.
- The seminar may be based on proposed project work also.
- Seminar Load: - Maximum 9-10 students in one batch, Maximum 9-10 students shall work under one Faculty Member.
- Group of one student is not allowed under any circumstances.
- The faculty members can give a topics from their research domains.
- Interested students can approach and get allotted to faculty member.

- Report of Internship I will be submitted by each student along with its internship certificate.
- Students, through the seminar, will present various points / sections / structure / processes observed during internship. The assessment will be done by seminar guide.
- Internship of minimum four (4) weeks should be done after SY (Semester IV) in summer vacation and it's assessment will be done in TY (Semester V) based on report submitted.

For standardization of the seminar reports the following format should be strictly followed.

1. Page size : Trimmed A4
2. Top Margin: 1.00 Inches.
3. Bottom Margin : 1.32 Inches
4. Left Margin : 1.5 Inches
5. Right Margin : 1.0 Inches
6. Para Text : Font - Times New Roman; 12 point
7. Line Spacing : 1.5 Lines
8. Page Numbers: Right aligned and in footer.
9. Headings: Font Times New Roman; 12 point New Times Roman, 14 point, Boldface.
10. Certificate: All students should attach standard format of the entire seminar should be documented as one chapter.
11. References should have the following format.
    For Books: 1. "Title of Book"; Authors; Publisher; Edition;
    For Papers: 2. "Title of Paper"; Authors; Conference Details; Year.

Marks:

1. Seminar Report: 25
2. Presentation: 25

All students have to present their seminars individually in front of the faculties.

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester V**								
Course Title	**:**	**Research Methodology**						**Course Code**	**:**	**RM321**
Teaching Scheme (Hours)	**:**	**2 hr. /week= 2 x 14= 28 hours**						**Total Credits**	**:**	**Nil**
Evaluation Scheme (Marks)	**:**	**Assignments** **Viva-voce**	**:** **:**	**50** **25**	**Written Test** **Grand Total**	**:** **:**	**25** **100**	**Duration of SEE**	**:**	**Not Applicable**
Revision	**:**	**Fourth**						**Month**	**:**	**June 2022**
Pre-requisites	**:**	No								
Course Domain	**:**	Research Skills								

Course Rationale: Having studied this course, the researchers can formulate the path to be used in conducting any research and reporting its findings. The course helps in the search of literature, development of research questions and the creation of the most suitable study design. In a way research methodology is the constitution for research.

Course Assessment Methods: The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives: The Course Teacher will

- Introduce research phenomenon and its key components to the students;
- Discuss the role and importance of research in the engineering sciences;
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project;
- Help identify various sources of information for literature review and data collection;
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting;

Course Outcomes: Students will be able to

- Understand some basic concepts of research and its methodologies;
- Explain key research concepts and issues;
- Read, comprehend, and explain research articles in their academic discipline;
- Select and define appropriate research problem and parameters;
- Follow research procedures of sampling, data collection, analysis and finally reporting of research work;

Curriculum Content **Hours**

Unit I: Introduction to Research: Definition and basic Types of research, Research process and steps in it, Concept of Hypothesis, Research proposals and aspects. 03

Unit II: Basic Statistics required for any research: Introduction to Descriptive Statistics, Statistical data, Variable, Classification of data, exploratory data analysis, Measures of central tendency, Dispersion-Standard deviation, Correlation and regression analysis. 06

Unit III: Introduction to Design of Experiment: Concept of design of experiment, its objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles, of replication. Guidelines of experiments. 06

Unit IV: Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, goodness of fit tests, Chi-Square test, Kolmogorov-Smirnov(K-S) test. 06

Unit V: Two factor Factorial Design: Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two-factor factorial design; Models-Effects, means and regression, Hypothesis testing. 07

Suggested Reference Books:

1. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009.
2. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, Wiley India.
3. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers, Wiley India.
4. J. Medhi, Statistics Methods, New Age Publications, New Delhi 2009.
5. Nabendu Pal and Saheb Sarkar, Statistics: Concepts and Applications, Prentice Hall of India Pvt. Ltd. New Delhi, 2004.
6. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester VI**					
Course Title	**:**	**Machine Design II**			**Course Code**	**:**	**ME 601**
Teaching Scheme (Hours)	**:**	**Lecture :**	**4 Hrs/week**		**Total Credits**	**:**	**04**
		Tutorial :	**Hrs/week**				
Evaluation Scheme (Marks)	**:**	**CIE=30**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
		(20+10)					
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Strength of Materials, Material Science and Machine Design I					
Course Domain	**:**	Professional Core course					

Course Rationale:

The purpose of learning this course is to understand the design procedures of different mechanical components and solve problems on it.

Course Objectives:

1. To study design against fluctuating load.
2. To study bearing selection procedure.
3. To study design procedure of spur gear, helical gear, bevel gear, worm and worm wheel.
4. To understand tribological considerations of bearing design

Course Outcomes:

1. Design of component for finite life and infinite life when subjected to fluctuating load.
2. Select bearings for a given applications from the manufacturers catalogue.
3. Design of elements like spur gears, helical gears, bevel gear, worm and worm wheel.
4. To study methods of lubrication and mounting of bearing.

Curriculum Content	**Hours**
Unit I: Design against fluctuating load Stress concentration, Causes and Remedies of Stress Concentration, Fluctuating Stresses, Fatigue Failure, Endurance limit, Notch sensitivity, Soderberg and Goodman diagram, Modified Goodman diagram, Fatigue design under combined stresses. **(Note: The unit includes numerical treatment on the appropriate topics.)**	**09**
Unit II: Sliding contact bearing Basic Modes of Lubrication, Hydrostatic step bearing, and Reynolds's equation, Bearing design- Selection of parameters, Bearing Constructions, Bearing Materials, Bearing Failure- causes and remedies. **(Note: The unit includes numerical treatment on the appropriate topics.)**	**08**
Unit III: Rolling contact bearing Types, Static and dynamic load carrying capacity, Load-life relationship, Selection of bearing from manufactures catalogue, Comparison of sliding and rolling contact bearing, Mounting of bearings. **(Note: The unit includes numerical treatment on the appropriate topics.)**	**08**

Unit IV: Design of spur gears **09**

Force analysis, Gear tooth failures and remedies, Number of teeth, Face width, Beam strength of gear tooth, Wear strength of gear tooth, Effective load on gear tooth, Design of spur gears,

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit V: Design of helical gears **09**

Terminology of Helical Gears, Virtual number of teeth, Tooth proportions, Force analysis, Beam strength of helical gears, Wear strength of helical gears, Effective load on gear tooth, Design of Bevel gears.

(Note: The unit includes numerical treatment on the appropriate topics.)

Unit VI: Design of worm gears **09**

Worm gear geometry and nomenclature, Force analysis, Strength rating of Worm Gears and Wear Rating of Worm gears, Worm gear thermal considerations, Design of Worm gears.

(Note: The unit includes numerical treatment on the appropriate topics.)

Text Books

1. Bhandari V.B. – "Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd.
2. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ. Co. Ltd.

Reference Books

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International.
2. Black P.H. and O. Eugene Adams – "Machine Design" – McGraw Hill Book Co.Ltd.
3. William C. Orthwein – "Machine Component Design" – West- publishing Co. and Jaico Publ.House.
4. "Design Data" – P.S.G. College of Technology, Coimbatore.
5. Juvinal R.C. – "Fundamentals of Machine Components Design" – John Wiley and Sons.
6. Hall A.S.; Holowenko A.R. and Laughlin H.G. – " Theory and Problems of Machine Design" Schaum's outline series

Class and Semester	**:**	**T. Y. B. Tech. Mechanical Engineering, Semester VI**				
Course Title	**:**	**Control Engineering**		**Course Code**	**:**	**ME602**
Teaching Scheme (Hours)	**:**	**Lectures 4 hours/weeks=4 x 13 weeks = 52 hours minimum** **Tutorial= -- hour/week** **Practical= -- hours/week**		**Total Credits**	**:**	**04**
Evaluation Scheme (Marks)		**CIE =30 (20+ 10)**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hours**
Revision:	**:**	**Third**			**Month**	**:**	**June 2022**
Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good command of English.				
Type of Course	**:**	Theory				
Course Domain	**:**	Core				

Course Objectives:

1. To Study the control system, its type and applications.
2. To prepare mathematical model of physical systems.
3. To Study concept of system stability and system response.
4. To Study various control actions.

Course Outcomes:

At the end of course student will able to

1. Understand control system, its type and applications.
2. Understand model of physical simple systems.
3. Determine system stability and system response.
4. Understand various control actions.

Curriculum Content **Hours**

Unit I: Introduction to Automatic Control

Generalized Control System Types, Open Loop and Closed Loop, Linear and Non-Linear, Time Variant and Time invariant Systems with examples. Advantages of Automatic Control Systems, Hydraulic/Pneumatic System, Hydraulic Servomotor, Jet – Pipe Amplifier, Pneumatic Amplifier. Thermal System, Gear Train **10**

Unit II: Block Diagram Algebra and Mathematical Modeling **14**

Rules for Reduction of Block Diagram, Control System Components – Tachometer, D.C. Servomotor , Stepper Motor, Mathematical Model of Control System: Mechanical Translational Systems, Rotational System, Grounded Chair Representation, Electrical Elements, Analogous Systems, Force – Voltage Analog, Force – Current Analog, Mathematical Model of Liquid Level System

Unit III: **07**

Transient Response: General Form of Transfer Function, Concept of Poles and Zeros, Distinct, Repeated and Complex Zeros. Response of systems (First and Second Order) to Various Inputs (Impulse, Step, Ramp and Sinusoidal). Damping Ratio and Natural Frequency. Transient Response Specification

Unit IV: **07**

Stability and Root Locus Technique: Routh‟s Stability Criteria, Significance of Root Locus, Construction of Root Loci, General Procedure, Effect of Poles and Zeros on the System Stability.

Unit V: **07**

State Space Analysis: System Representation, Direct, Parallel, Series and General Programming, Conversion of State Space Model to Transfer Function.

Unit VI: **07**

Frequency Response Analysis: Frequency Response Log Magnitude Plots and Phase angle Plots, Gain Margin, Phase Margin, Evaluation of Gain „K‟, Polar Plots. System Compensation: Types of Compensators, Lead, Lag, Lead-Lag Compensators.
(Note: The course numerical treatment on the appropriate topics of various units)

Text Books

1. Control System Engineering: R Anandnatarajan, P. Ramesh Babu, SciTech Publi.
2. Control Systems: A. Anand Kumar, Prentice Hall Publi.
3. Automatic Control Engineering: F.H. Raven (5th ed.), Tata McGraw Hill Publi.

Reference Books

1. Modern Control Systems: K Ogata, 3rd Ed, Prentice Hall Publi.
2. Automatic Control Systems: B.C. Kuo, 7th Ed, Willey India Ltd./ Prentice Hall Publi.
3. Automatic Control Engineering: D. Roy and Choudhari, Orient Longman Publi Calcutta
4. Modern Control Engineering K.Ogata Pearson Education

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester VI**					
Course Title	**:**	**Internal Combustion Engines**			**Course Code**	**:**	**ME603**
Teaching Scheme (Hours)	**:**	**Lecture:**	**4 Hrs/week**		**Total Credits**	**:**	**4**
		Tutorial:	**----------**				
Evaluation Scheme (Marks)	**:**	**CIE=30**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
		(20+10)					
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	Pre-requisite include knowledge of Engineering Physics, Chemistry, Engineering Thermodynamics					
Course Domain	**:**	Core					

Course Rationale:

This course presents the concepts and theories of operation of internal combustion engines based upon the fundamental engineering sciences of thermodynamics, gas dynamics, heat transfer and mechanics. Explains the operating characteristics of conventional spark-ignition (gasoline), compression-ignition (diesel) engines. Thermodynamic ideal cycles are analysed and compared to actual cycles. Combustion process of SI & CI engine as well as engine detonation & knocking are explained. Pollutant formation and control are discussed and engine performance characteristics are assessed.

Course Objectives:

1. To make the students familiar with basics of thermodynamic cycles of I. C. engines
2. To make the students understand about the combustion phenomenon of SI and C.I. engines.
3. To understand various I. C. Engines systems.
4. To understand engine testing and performance analysis.
5. To teach the students Production and utilization of alternative solid, liquid and gaseous fuels and engines pollutants.

Course Outcomes: At the end of course, learners will be able to

1. Explain thermodynamic cycles of I. C. Engines.
2. Explain fuel supply systems, combustion and emission aspects of I.C. Engines and recent developments in I.C. Engines.
3. Explain I. C. Engines systems and various engines components.
4. Explain performance parameters and characteristics; and calculation of performance parameters.
5. Interpret different alternative fuels and its emissions and method to control these emissions.

Curriculum Content **Hours**

Unit No I: Basic Concepts **08**

Air standard cycles and fuel-air cycles Assumptions, Otto, Diesel & Dual cycles, comparison of cycles, fuel air cycle, Valve Timing diagram, Actual engine cycle.

Unit No- 2: S.I. Engines

Fuel Supply System, Theory of Carburetion, Electronic fuel injection system, GDI. Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion. Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion chambers. Rating of fuels in SI engines. Additives. **08**

Unit No- 3: C.I. Engines **08**

Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking. Types of combustion chambers, rating of fuels in CI engines. Additives; Comparison of knocking in SI & CI engines, Concepts of Supercharging and Turbo charging.

Unit No- 4: Engine systems and components **08**

Ignition system. (Battery, magneto & electronic), Lubrication system, Engine starting system, Engine cooling system, Governing system, Intake and exhaust systems (two valves & four valves)

Unit No-5: Performance characteristics & Testing of I.C. Engines **08**

Introduction to Indian Standards for testing of I.C. Engine, Mean effective pressure, indicated power, brake power, friction power, Methods to determine power and efficiencies , Variables affecting performance of engine, characteristic curves, heat balance sheet, Methods of improving engine performance; super & turbocharged engines.

Unit No- 6: Fuels and Emissions **08**

Chemical structure of the Petroleum, Refining process for petroleum, important qualities of the Engine fuels - (SI & CI engines), Diesel, and Gasoline fuels Indian specifications.

Alternate fuels (SI & CI engines)- Liquid fuels, gaseous fuels, hydrogen engines, Air pollution due to IC engine, Engine emissions, Hydrocarbon emissions, (HC) & PPM & Carbon monoxide emissions (CO), oxides of Nitrogen (NOx) Euro norms, Bharat stage norms, Introduction to carbon credit, Emission control methods for SI and CI engines, Electronic control module, Catalytic converters, EGR Concept of hybrid vehicles.

Suggested list of Tutorials and Assignments: Students has to write One assignment on each topic**.**

General Instructions:

1. Students must be encouraged to solve numerical problems.
2. Students must be encouraged to collect information about recent development in I.C. Engines.
3. Students must be encouraged to read Magazines related to I.C. Engines.

Suggested Text Books:

1 V. Ganesan, “Internal Combustion Engines”, Tata McGraw Hill, Second Edition.

2 Mathur and Sharma, “A Course in Internal Combustion Engines”, R. P. Dhanapat Rai

3 Heywood, “I.C. Engines Fundamentals”, McGraw Hill Publication

4 R. K. Rajput, “Internal Combustion Engines”, Laxmi publication, Delhi

Suggested Reference Books:

1 Edward E. Obert, “Internal Combustion Engines and Air Pollution”, Internal Educational

2 Dr. Kirpal Singh, “Automobile Engineering Vol. I and II”, Standard Publishers

3 Crouse W.H., “Automotive Mechanics”, McGraw Hill Publication

4 Willard W. Pulkrabek, “Engineering Fundamentals of the Internal Combustion Engine.

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester VI**					
Course Title	**:**	**Metrology And Quality Control**			**Course Code:**	**:**	**ME 604**
Teaching Scheme (Hours)	**:**	**Lecture :**	**4 Hrs/week**		**Total Credits**	**:**	**4**
		Tutorial :	**---**				
Evaluation Scheme (Marks)	**:**	**CIE=30**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
		(20+10)					
Revision:	**:**	**Third**			**Month**	**:**	**June-2022**
Pre-requisites	**:**	This course requires the basic knowledge of the following: 1. Metric and SI units of physical quantities 2. Statistics 3. Trigonometry and basics of manufacturing engineering					
Course Domain	**:**	Core					

Course Objectives: The Course teacher will

1. To identify techniques to minimize errors in measurement.
2. To Study method and devices for measurement of length, angle and gear and thread parameters, surface roughness and geometric features of parts
3. To Analyze and choose limits of plug and ring gauges.
4. To Study methods of measurement in modern machineries
5. To Study quality control techniques and its application
6. To Study quality control charts and Statistical tools

Course Outcomes: Students will be able to

1. Identify techniques to minimize the errors in measurement
2. Identify methods and devices for measurement of length, angle, and gear and thread parameters, surface roughness and geometric features of parts.
3. Choose limits for plug and ring gauges.
4. Explain methods of measurement in modern machineries
5. Select quality control techniques and its applications
6. Plot quality control charts and suggest measures to improve the quality of product and reduce cost using Statistical tools

Curriculum Content **Hours**

Unit I:

a) **Measurements:** International standards of length-Line and end measurement, Need of measurement, possible errors in measurement, slip gauges. **08**

b) **Tolerances and gauging:** Unilateral and bilateral tolerances, Limits, Fits, Types of Fits, IS specifications of limits. Importance's of limits, System in mass production, limit gauges used for plain and taper works.

Unit II: **08**

a) **Magnification :** Principles and characteristics of measuring instruments, Mechanical, Optical, electrical, Pneumatic method of magnification, different types of Verniers, Micrometers, Dial gauges, Mechanical and pneumatic, Types of comparators. Use of comparators in inspection.

b) **Measurement of angles, tapers and radius :** Bevel Protractor, Spirit level, Clinometers, angle Decker, standard balls and rollers for angle measurement, angle slip gauges, radius measurement of circular portion, measurement of concave and convex surface radius.

Unit III: **08**

a) **Interferometry:** Principle of Interferometry and application in checking of flatness, angle and height.

b)**Straightness and Flatness:** Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate (Theoretical treatment only) and surface roughness

Unit IV: **08**

a) **Surface finish:** Types of textures obtained during machine operation, range of C.L.A. value in different operations in numerical assessment of surface finish (B.I.S. Specifications of C.L.A. value)-sample length of different machining operations. Direction of lay, texture, symbols, instruments used in surface finish assessment. Introduction to Coordinate Measuring Machine.

b) **Quality control:** Concept of Quality and quality control, elements of quality and its growth, purpose, setup, policy and objective, factors controlling and quality of design and conformance, balance between cost and quality and value of quality. Specification of quality, planning through trial lots and for essential information.

Unit V: **08**

a) **Measurement of Spur Gears:** Run out checking, Pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment checking, errors in gears, checking of composite errors.

b) **Measurement of External Threads:** Different errors in screw threads, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer.

Unit VI: **08**

a) **Statistical Quality Control:** Importance of statistical method in quality control, measuring of statistical control variables and attributes. Measurement/inspection, different types of control charts(X Bars, R, P. charts) and their constructions and their application.

b) **Acceptance Sampling:** Sampling inspection and percentage inspection, basic concept of sampling inspection, operating characteristic curves, conflicting interests of consumer and producer, producer and consumers risks, AWQL, LTPD, ADGL, single and double sampling plans.

(Note: This course includes numerical treatment on the appropriate topics of various units.)

Suggested Text Books:

1. I. C. Gupta, "Engineering Metrology", Dhanpat ana Rai Publications, New Delhi, India.
2. M. S. Mahajan, "Statistical Quality Control", Dhanpat and Rai Publications.

Suggested Reference Books:

1. R. K. Jain, "Engineering Metrology", Khanna Publications, 17th edition, 1975.
2. K. J. Hume, "Engineering Metrology", McDonald Publications, 1st edition, 1950.
3. A. W. Judge, "Engineering Precision Measurements", Chapman and Hall, London, 1957.
4. K. L. Narayana, "Engineering Metrology", Scitech Publications, 2nd edition.
5. J. F. Galyer, C. R. Shotbolt, "Metrology for Engineers", Little-hampton Book Services Ltd., 5th edition, 1969.
6. V. A. Kulkarni, A. K. Bewoor, "Metrology and Measurements", Tata McGraw Hill Co. Ltd., 1st edition, 2009.
7. Amitava Mitra, "Fundamental of Quality Control and Improvement", Wiley Publication.
8. V. A. Kulkarni, A. K. Bewoor, "Quality Control", Wiley India Publication, 01st August, 2009.
9. Richard S. Figliola, D. E. Beasley, "Theory and Design for Mechanical Measurements", Wiley India Publication.
10. E. L. Grant, "Statistical Quality Control", Tata McGraw Hill Publications.
11. J. M. Juran, "Quality Planning and Analysis", Tata McGraw Hill Publications.

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester VI**					
Course Title	**:**	**Engineering Economics**			**Course Code:**	**:**	**ME605**
Teaching Scheme (Hours)	**:**	**Lecture :**	**3 Hrs/week**		**Total Credits**	**:**	**4**
		Tutorials :	**1 Hrs/week**				
Evaluation Scheme (Marks)	**:**	**CIE=30**	**SEE = 70**	**Grand Total=100**	**Duration of SEE**	**:**	**3 hrs**
		(20+10)					
Revision:	**:**	**Third**			**Month**	**:**	**June-22**
Pre-requisites	**:**	In order to complete course study successfully, it is important have a knowledge of manufacturing process and industrial engineering.					
Course Domain	**:**	Core					

Course Rationale:

The course focuses on economic and cost analysis of engineering projects, giving insights on modern techniques and methods used on economic feasibility studies relating to design and implementation of engineering projects.

Course Objectives: The Course teacher will

1. To acquaint students with the basic concepts of industrial engineering and economics.
2. To impart understanding of motion study and work study
3. To integration of applications of industrial engineering in Job Evaluation and Merit Rating
4. To prepare for making decisions regarding money as capital within a technological or engineering environment.
5. To provide a sound understanding of concepts and principles of engineering economy

Course Outcomes: Students will be able to

1. Apply the basic concept and importance of industrial engineering and engineering economics
2. Perform method study and work measurement.
3. Apply the method of Break-even analysis and Make or buy decision to make cost effective decision
4. Apply various types methods for making rational decisions regarding problems

Curriculum Content **Hours**

Unit 1. Introduction to Industrial Engineering 03

Definition, Scope, Responsibilities, Important contributors to I.E., Tools and techniques of Industrial engineering, Plants Layout.

Unit II. Motion study, Work study and measurement. 11

Motion Study- Process chart symbols, Outline and flow process charts, Flow diagrams, string diagram, flow process charts worker Material and equipment type, multiple activity chart – Man – Machine, Machine- Machine chart, Travel charts for workplace, Classification of movements, Two handed process chart, SIMO chart, Micro Motion study, Therbligs.

Work Study- Definition, Objectives, Procedure, Time study equipment, Performance rating, Allowances, Concept of normal time and standard time, Calculation of standard time, Work sampling, Predetermined motion time analysis. (Case study on motion and work study)

Unit-III: Job Evaluation and merits rating 5

Definition, Objectives, Procedure of job evaluation, Different incentive schemes and their advantages and disadvantages, Incentive schemes - Time, Piece, incentive systems, Halsey, Rowan, and Taylor's differential piece rate plan.

Unit IV. Basics of Engineering Economics. 5

Introduction to engineering economy, physical and economics environment, phases in engineering process, some economics concepts: value, utility, interest and interest rate, time value for money,

Unit V. Elements of costs. 7

Types of cost, Break even analysis, effects of fixed and variable cost on BEP, Economic order quantity, Inventory control models, safety stock inventory control systems, cost estimation method, make or buy decision, introduction to decision under risk criteria for: expected value and expected variance

Unit VI. Interest Evaluation. 7

Simple and compound interest, cash flow diagrams, interest for discrete compounding: single payment, equal series payment, uniform gradients series payments, geometrics gradient series payment, compound frequency of interest: nominal and effective interest rates.

General Instructions:

1. Students must be encouraged to solve assignment problems.
2. Each Student has to write at least 6 assignments on entire syllabus.

Suggested Text Books:

1. O.P. Khanna, Industrial Engineering and Management- Dhanpat Rai Publisher, 17th Edition 2017
2. Martand Telsang, Industrial Engineering and Production Management, S. Chand Publisher, 3rd Edition 2018
3. M. I. Khan, Industrial Engineering, New Age International Publisher, 1st Edition 2004.
4. Engineering Economics, (Panneerselvam), PHI.

Suggested Reference Books:

1. Geneva Indian Adaptation International Labour Office, 'Work study' *Publisher* : *Oxford* & *IBH Publishing* Co Pvt.Ltd; 3rd E*dition 2015*
2. Gavriel Salvendy, Handbook of Industrial Engineering: Technology & Operations Management, John Wiley & Sons; 3rd Edition 2007
3. Engineering Economic Analysis, (Newnan, Eschenbach & Lavelle), Oxford University Press.
4. Engineering Economy, (Blank & Tarquin), McGraw-Hill.
5. **Useful Links :**
   1. https://www.isixsigma.com/topic/most-maynard-operation-sequence-technique/
   2. https://nptel.ac.in/courses/112/107/112107209/#
   3. https://www.nitie.edu/
   4. iiie-india.com/

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester VI**						
Course Title	**:**	**Laboratory Machine Design - II**			**Course Code**	**:**	**ME 601L**	
Teaching Scheme (Hours)	**:**	**Practical's**	**:**	**2 Hrs/week**	**Total Credits**	**:**	**01**	
		Tutorial	**:**	**Hrs/week**				
		EOE : 50						
Revision:	**:**	**Third**			**Month**	**:**	**June-22**	
Pre-requisites	**:**	Strength of Materials, Material Science and Machine Design I						
Course Domain	**:**	Professional Core course						

Course Objectives:

1. To study design of industrial mechanical systems consists of different types of gears.
2. To make conversant with preparation of working drawings
3. Ability to solve different problems based on design of gears.
4. Ability to solve different problems based on selection of bearing and fluctuating loads.

Course Outcomes:

1. To prepare detailed design report on industrial mechanical systems consists of different types of gears.
2. To prepare working drawings of industrial mechanical system.
3. To solve problems on different types of gears.
4. To solve problems on selection of bearing and fluctuating loads.

Practical List

A) Total two design project

A detail design report and A 2 Size sheet containing working drawing of details and assembly of project based on any relevant mechanical system consisting of

i) Spur gear/ Helical gear.

ii) Bevel gear / Worm and worm wheel.

B) Assignments based on (Any four)

i) Five problems on fluctuating loads.

ii)Five Problems on Spur Gear Design

iii)Five Problems on Design of Worm Gears

iv) Study of Sliding contact Bearing and Rolling Contact Bearing.

v) Composite assignment based on types of gears.

Text Books

1. Bhandari V.B. – "Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd.
2. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ. Co. Ltd.

Reference Books

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International.
2. Black P.H. and O. Eugene Adams – "Machine Design" - McGraw Hill Book Co. Ltd.
3. William C. Orthwein – "Machine Component Design" – West- publishing Co. and Jaico Publ. House.
4. "Design Data" – P.S.G. College of Technology, Coimbatore.
5. Juvinal R.C. – "Fundamentals of Machine Components Design" – John Wiley and Sons.

Class, Part & Semester	**:**	**T. Y. B. Tech. Mechanical Engineering , Semester VI**			
Course Title	**:**	**Laboratory Metrology And Quality Control**	**Course Code**	**:**	**ME604L**
Teaching Scheme (Hours)	**:**	**2 hr /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE :- Nil , IOE :- Nil EPE :- Nil, EOE :- 50**	**Duration of Exam (in case of External Evaluati on)**	**:**	**NIL**
Revision:	**:**	**Third**	**Month**	**:**	**June 2022**
Pre-requisites	**:**	None			
Type of Course	**:**	Practical			
Course Domain	**:**	Core			

Course Objectives:

1. Study the measurement using linear, angular circular features, dimensional and geometric features
2. Analyze the surface roughness of component
3. Study calibration of metrological equipment

Course Outcomes:

At the end of course, student will able to

1. Measure linear, angular circular features, dimensional and geometric features
2. Measure surface roughness of components
3. Calibration of metrological equipment

Experimental List

1. Study and use of linear measuring Instruments
2. Study and Use of comparators
3. Study and Use of Angle Measuring instruments
4. Screw Thread measurement
5. Gear measurements and inspection.
6. Use of Optical profile projector
7. Study and Use of Control charts
8. Operating characteristics curves
9. Introduction to Advanced Measuring Instruments like 2-D Digital Height master, CMM (Coordinate Measuring Machine), Contracer to measure contours

Lab Manual

- Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class, Part & Semester	**:**	**T. Y. B. Tech. (Mechanical Engineering) , Semester VI**				
Course Title	**:**	**Laboratory Internal Combustion Engines**		**Course Code**	**:**	**ME603L**
Teaching Scheme (Hours)	**:**	**Practical :**	**2 Hrs/week**	**Total Credits**	**:**	**1**
		Tutorial:	**Nil**			
Evaluation Scheme (Marks)	**:**	**IPE – Nil EPE- 50** **IOE – Nil EOE- Nil**				
Revision:	**:**	**Third**		**Month**	**:**	**June-22**
Pre-requisites	**:**	Knowledge of Engineering Physics, Chemistry, Thermodynamics-I				
Course Domain	**:**	Core				

Course Objectives:

1. To describe the testing and performance characteristics of I.C. Engines
2. To Explain the parts and complete knowledge of types of fuels used in I.C. Engine and the fuel supply systems.
3. To describe combustion process phenomenon in I.C. Engines
4. To understand different tests and methods for performance analysis of I.C. Engines
5. To explain the effects of emission and controlling techniques for I.C. Engines

Course Outcomes: At the end of course, learners will able to

1. Understand the complete operation of I.C. Engines
2. Find the performance of I.C. Engine and variation of various performance parameters with load and speed
3. Analyse the performance of the variable compression ratio engine with computerized set up
4. Analyse various Engines Systems and components.
5. Understand the emission formation of I.C. Engines, its effects and norms

Experiment List (Any Seven)

1. Study & demonstration of Four stroke Petrol Engines.
2. Study & demonstration of Four stroke Diesel Engines.
3. Trial on Single Cylinder Diesel Engines.
3. Morse Test on multi cylinder Petrol Engines.
4. Study of combustion Phenomenon of SI & CI Engines.
5. Trial on variable compression ratio Engines.
6. Study and demonstration of various engine systems.
7. Study of Alternative fuels.
8. Study of Engine Emissions from SI and CI Engines.
9. Visit to Engine or Engine Component Manufacturer or Engine Repairing Unit.

Class Part & Semester	**:**	**T. Y. B. Tech. (Mechanical Engineering , Semester VI**			
Course Title	**:**	**Laboratory Computer Aided Manufacturing (CAM)**	**Course Code**	**:**	**ME606L**
Teaching Scheme (Hours)	**:**	**2 hr /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE :- Nil EPE :-Nil IOE :- 50 EOE :- Nil**	**Duration of Exam (in case of External Evaluati on)**	**:**	**NIL**
Revision:	**:**	**Third**	**Month**	**:**	**June 2022**
Pre-requisites	**:**	Laboratory work Engineering graphics, Machine drawing, Manufacturing Engineering I and II.			
Type of Course	**:**	Practical			
Course Domain	**:**	Core			

Course Objectives*:*

1. To educate students by covering different aspects of computer Aided Manufacturing.
2. To inform students about latest software packages used in CAM.
3. To study automation in manufacturing.
4. To study various manufacturing systems.

Course Outcomes:

At the end of this course, student will able to

1. Demonstrate fundamental knowledge of CAM.
2. Identify the tool path for parts.
3. Write the CNC part program.
4. Apply the knowledge advanced manufacturing system.

Experimental List

1. Study of advanced machine tools.
2. Study of numerical control programming for machines tools.
3. Study of various software packages.
4. Study of automation systems in manufacturing.
5. Study of FMS
6. Study of agile manufacturing
7. Study of lean manufacturing systems
8. Industrial visit.

Lab Manual

- Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Text Books :

1. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010
2. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007

Reference Books

1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education Automation, Production Systems and Computer Integrated Manufacturing by Mikell Groover, Pearson Education.
2. Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy.
3. P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 1992
4. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.
5. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010
6. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007

Class, Part & Semester	**:**	**T. Y. B. Tech. (Mechanical Engineering) , Semester VI**			
Course Title	**:**	**Mini Project**	**Course Code:**	**:**	**ME607L**
Teaching Scheme (Hours)	**:**	**Practical : 2 hr /week= 2 x13= 26 hours**	**Total Credits**	**:**	**1**
Evaluation Scheme (Marks)	**:**	**IPE: Nil EPE: Nil IOE: 50 EOE: 50**	**Duration of SEE**	**:**	**NIL**
Revision:	**:**	**Third**	**Month**	**:**	**June -22**
Pre-requisites	**:**	Machine Tools and Processes, Tool Engineering, Machine drawing, Machine Design.			
Course Domain	**:**	Core			
Type of Course		Practical			

Course Rationale:

The purpose of mini project is to develop student's abilities to transmit technical knowledge, innovation, creative thinking and independent research ability in the form of their own small conceptual or practical based projects.

Course Assessment Methods: Assessment of mini project will be done by report presentation and demonstration of model.

Course Objectives:

1. To understand the Product Development Process including budgeting through Mini Project.
2. To plan for various activities of the project and distribute the work amongst team of two members.
3. To develop student's abilities to transmit technical information and test the same by working on Mini Project.
4. To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes: Students will be able to

1. Understand, plan and execute a Mini Project with the team.
2. Implement various manufacturing techniques, CAD learnt so far for designing and developing a prototype of a model.
3. Prepare a technical report based on the Mini project.
4. Deliver presentation on Mini Project work carried out.

Mini Project Completion and Assessment :

1. The purpose of mini project is to promote self-study, innovative, creative thinking and independent research ability. Students have to initiate their own small conceptual or practical based projects individually as a team of no more than 2 members. While making this exercise it is expected that the knowledge acquired by them through application of subjects leant so far is applied by them carrying out mini project work will certainly help the students to for satisfactory and successful complete of their major project in the final year.

2. A mini project report is to be written upon completion of the activity. For team projects, each member has to write his own report. The report should include academic content such as the background, objectives, product/system description, the work done, the achievements and difficulties encountered. Students will deliver report presentation and demonstration of their work. The assessment will be done by mini project guide

Class, Part & Semester	**:**	**Third Year B. Tech Mechanical Engineering, Semester VI**								
Course Title	**:**	**Introduction To Foreign Language**						**Course Code**	**:**	**LS311**
Teaching Scheme (Hours)	**:**	**2 hr. /week= 2 x 14= 28 hours**						**Total Credits**	**:**	**Nil**
Evaluation Scheme (Marks)	**:**	**Assignments** **Viva-voce**	**:** **:**	**50** **25**	**Written Test** **Grand Total**	**:** **:**	**25** **100**	**Duration of SEE**	**:**	**Not Applicable**
Revision	**:**	**Fourth**						**Month**	**:**	**June 2022**
Pre-requisites	**:**	No								
Course Domain	**:**	Language								

Course Rationale: This course provides a competitive edge for engineering graduates in their career choices. They will be able to communicate in a second language. The course enhances listening, reading skills and memory. Our graduates may be able to participate more effectively and responsibly in a multi-cultural world if they know another foreign language in addition to the English.

Course Assessment Methods: The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives: The Course Teacher will

- Help students to understand basics and deepen their knowledge in a chosen foreign language.
- Guide them to communicate and translate in the chosen foreign languages.
- Help them describe, narrate, and ask/answer questions in the foreign language in the present time about a variety of topics related to family, daily activities, eating, and traveling.
- Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations (spontaneous or recorded) that pertain to the topics mentioned above.
- Explain how to write sentences and short paragraphs on familiar topics relating to personal interests and practical needs.
- Narrate on how the foreign language functions with awareness and understanding of the language culture.

Course Outcomes: Students will be able to

- Learn alphabets and acquire knowledge of basic grammar of the foreign language, common words and phrases therein.
- Learn to read the simple texts in foreign language.
- Speak a little using the greetings, well wishes etc. in Foreign Language.
- Count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign Language.
- Translate both verbally and written, simple sentences in the foreign language.
- Achieve institute's mission with respect to global education and foreign language education.

Curriculum Content	**Hours**
Unit I: General Information on Basic Grammar of the foreign language, Introduction to alphabets.	05
Unit II: Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language.	05
Unit III: General Questions in foreign language, like What is your name/surname? Who/What is this? etc.	04

Unit IV: Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself. 05

Unit V: Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book. 05

Unit VI: Basic information on Country & Culture of language under study. 04

Suggested Reference Books:

1. V.N.Wagner and V. G. Ovsienko, "Russian Language", Russian, People's Publishing House, New Delhi.
2. S. Khavronina and A. Shirochenskaya, "Russian in Exercises", 1991.
3. "Genki – Japan Times".
4. Osamu & Nobuko Mizutani, "Aural Comprehension in Japanese".
5. Osamu & Nobuko Mizutani, "An Introduction to Modern Japanese".
6. Y. Yoshida, "Japanese for Today".
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