VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution

Aziznagar Gate, C.B. Post, Hyderabad – 500075, Telangana, India.

B.Tech Syllabus (R-18)

Department of

Mechanical Engineering

ACADEMIC REGULATIONS (R18)

Definitions of Key Words

Academic Year: An academic year is referred as the period consisting of two consecutive semesters with 16 weeks each of instructional period followed by both the semester exams.

Course: A plan of study of a particular subject leading to an examination. All the courses need not carry the same weight. A course may be designed to comprise of lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars/ assignments/ presentations etc. or a combination of some of these.

Choice Based Credit System (CBCS): Choice Based Credit System (CBCS) is the program in which the students have a choice to choose from the prescribed courses and can learn at their own pace and the entire assessment is graded-based on a credit system.

Credit Point: It is the product of Grade Point and Number of Credits for a course.

Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/ field work per week.

Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student of all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to 2nd decimal place.

Grade Point: It is a numerical weight allotted to each letter Grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course.
Grades are denoted by letters O, A+, A, B+, B, C, P and F.
Programme: An Educational Programme leading to the award of a Degree.

Semester: Each semester will consist of 16-18 weeks of academic work equivalent to 90 actual teaching days.
Semester Grade Point Average (SGPA): It is a measure of performance of the work done by the student in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to 2nd decimal place.
Transcript or Grade Card or Certificate: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

Types of Courses: The Courses in under B. Tech, program may be of three kinds' viz., Core, Elective and Mandatory.

a) Core Course:

There may be a Core Course in every semester and are to be compulsorily studied by a student and is essential requirement for a given Programme.

b) Elective Course:

Elective Course is a course which can be chosen by the students from a pool of subjects. In general, the elective course is,

- Supportive to the discipline of study
- Providing an expanded scope of the course subjects
- Nurturing student's proficiency/skill.
- In case an elective is "Discipline centric" and is offered by the student's department itself, the elective is called **Professional elective**.
- On the other hand, if the elective is offered by the other departments or if the choice is given to the students to choose from other disciplines, the elective is called an "**Open Elective.**"

c) Mandatory Courses (Non-Credit Courses)

AICTE considers that the Course work of certain subjects is essential and as such for the award of a B.Tech degree a pass in these subjects is made mandatory. Therefore, such types of courses are referred as **mandatory courses**. As the AICTE also feels that only a familiarity with the subject content of these courses is essential, only a pass in each of these courses is required. Therefore, these subjects are included in the curriculum as non-Credit courses.

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2020-21 onwards.

1. Courses of Study:

The following Four-year Bachelor of Technology (B.Tech.) Programs under Choice Based Credit System (CBCS) are offered with effect from the Academic Year 2018-19 onwards:

S. No.	Branch	Branch Code
I	Civil Engineering	01
II	Electrical and Electronics Engineering	02
III	Mechanical Engineering	03
IV	Electronics and Communication	04
V	Computer Science and Engineering	05
VI	Information Technology	12

2. Admission Procedure

2.1. Admissions will be done as per the norms prescribed by the Government of Telangana State.

2.2. The Government orders with regard to the admissions in vogue shall prevail.

2.3. The candidate should have passed the prescribed qualifying examination on the date of Admission.

3. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he/she fulfills the following academic requirements:

3.1 The candidate shall register for 160 credits and secure all the 160 credits by securing a minimum CGPA of 5.0.

3.2 The external examination in all the subjects shall be conducted at the end of each semester for all the eight semesters.

3.3 Students joining the B.Tech. Programme shall have to complete the programme within 8 years from the year of joining. Similarly, the students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme within 6 years from the year of joining otherwise they shall forfeit they will not be permitted to pursue their studies nor will be allowed to write the exams.

4. Program details:

4.1 The course shall be of four Academic year's duration, each academic year having two semesters. Each semester shall have a minimum **16** weeks of instruction, with a minimum of **90** Instructional Days per Semester.

4.2 **Credits:**

Credits shall be assigned to each Subject/ Courses with symbols L: T: P: C, where L stands for Lecture Period, T for Tutorial Period, P for Practical Period, C for Credits and the details are given in the following Table,

Type of course		Clock hours/ week			
		L	**T**	**P**	**C**
Theory	1)	0	-	-	04
	2)	0	-	-	03
	3)	0	-	-	02
Practical		0	0	1	0.5
Drawing	1)	0	04	-	02
	2)	0	02	-	01
Mini project, Comprehensive Viva Voce Seminar, Major project		**-**	**-**	**-**	**17**

5. Attendance Requirements

5.1 A student is eligible to write the Semester End examinations only if he/ she acquire a minimum of 75% of attendance in aggregate of all the subjects/ Courses in that Semester.

5.2 Condonation for the shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical grounds with a documentary evidence approved by the Academic Committee.

5.3 A stipulated fee shall be payable towards condonation of attendance shortage.

5.4 Students, whose shortage of attendance is not condoned, are not eligible to write semester end examinations of that semester. Such students are detained and their registration for the examination stands cancelled.

5.5 A student detained due to shortage of attendance in a semester may seek re-admission into that semester, as and when offered, within four weeks from the date of the commencement of class work with the academic regulations of the batch into which he/ she gets admitted.

5.6 A student will be promoted to the next semester if he/ she satisfies the attendance requirement of the present semester.

5.7 For all mandatory, noncredit courses offered in a semester, a "Satisfactory Participation Certificate" shall be issued to the student, only after securing 75% attendance in such course. Letter Grade shall be allotted for these courses.

The courses offered in 8 semesters spread over 4 years have been classified into 8 categories under Choice Base Credit System (CBCS)

S. No.	Subject Categories	No. of Credits
1	Humanities and Social Sciences including Management course	11
2	Basic Science Course	26
3	Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc..	24
4	Professional core Courses (Theory)	46
5	Professional core Courses (Labs)	09
6	Professional Elective courses relevant to chosen specialization/	18
7	Open Elective subjects – Elective from other emerging subjects	09
8	Project work, seminar and internship in industry or appropriate work place/academic and research institutions in India/Abroad	**10+3+2+2 = 17**
9	Mandatory Course (Environmental Science & Gender Sensitization)	Nil
Total Number of credits		**160**

B. Tech Year wise distribution of credits under CBCS

S. No.	Year	Semester	Credits	Total
1	1st Year	I	18/20	**38**
		II	20/18	
2	2nd Year	I	20	**40**
		II	20	
3	3rd Year	I	21	**42**
		II	21	
4	4th Year	I	20	**40**
		II	20	
Total No. of Credits				**160**

6. Promotion regulations

6.1 A student shall be promoted from B.Tech., I Year to II Year only if he/she fulfils the academic requirements of securing 50% of total credits (19 credits out of 38 credits, up to I year II Semester), from all the examinations, whether or not the candidate takes the examinations.

6.2 A student shall be promoted from B.Tech., II Year to III Year only if he/she fulfils the academic requirement of securing 50% of total credits (39 out of 78 credits, up to II year II semester, from all the examinations, whether or not the candidate takes the examinations.

6.3 A student shall be promoted from B.Tech., III year to IV year only if he/she fulfils the academic requirement of securing 50% of total credits (60 out of 120 credits) up to III year II semester), from all the examinations, whether or not the candidate takes the examinations.

7. Minimum Academic Requirements

The following minimum academic requirements are to be satisfied in addition to the requirements mentioned under item no.5.

7.1 A student shall deemed to have satisfied the minimum academic requirements and has earned the credits allotted to each theory/ practical/ design/ drawing subject/ project and secured not less than 35% marks in Semester End Examination (SEE), and minimum 40% of marks in the sum total of the internal evaluation and Semester end examination taken together.

7.2 The student has to pass the failed courses by appearing the supplementary examinations as per the requirement for the award of degree.

7.3 A student shall register and put up minimum Attendance and earn all 160 Credits for the award of degree.

7.4 Student, who fails to earn 160 credits as indicated in the course structure within eight academic years from the year of his/her admission, shall forfeit the seat in B. Tech. course and admission stands cancelled.

7.5 When a student is detained due to shortage of attendance in any semester, no Grade allotments or SGPA/CGPA calculations will be done for that entire Semester in which a student got detained.

7.6 When a Student is detained due to lack of Credits in any year, he may be readmitted after fulfilment of the Academic Requirements, with the Academic Regulations of the Batch into which he gets readmitted. If there are any Professional Electives/ Open Electives, the same may also be re-registered if offered. However, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the same set of Elective Subjects offered under that category.

7.7 A student is eligible to appear in the End Semester Examination in any Subject/ Course, but absent at it or failed (thereby failing to secure P Grade or above), may reappear for that subject/ Course at the supplementary exam as and when the examinations are conducted. In such cases, his Continuous Internal Evaluation(CIE) assessed earlier for that subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examinations, for evaluating the performance in that subject.

7.8 A student with a final CGPA (at the end of the UGP) < 5.00 will not be eligible for the Award of the Degree.

8 Evaluation - Distribution and weight age of Marks

8.1 The performance of a student in each semester shall be evaluated Subject-wise (irrespective of Credits assigned) for a maximum of 100 marks for Theory or Seminar or Drawing/Design or Industry Oriented Mini-Project or Minor Course, etc. For Practical's a maximum of 75 Marks shall be evaluated. However, B. Tech. Project work (Major Project) will be evaluated for 200 Marks. These evaluations shall be based on 25% CIE (Continuous Internal Evaluation) and 75% SEE (Semester End Examinations) and a Letter Grade corresponding to the % marks obtained shall be given.

8.2 For theory subjects the distribution shall be 25 marks for Continuous Internal Evaluation (CIE) and 75 marks for the Semester End- Examination (SEE).

8.3 For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination will be conducted for 20 marks and consists of Part-A (Short Answer Questions) for 6 marks and Part-B (Long Answer Questions) for 14 marks with duration of 90 Minutes. First midterm examination shall be conducted for 2.5 units of syllabus and second midterm Examination shall be conducted for remaining 2.5 units. The Average marks secured by a student in I and II Midterm examination are considered and shall be taken as the final marks secured by the student towards Continuous Internal Evaluation in the theory subject.

8.4 In case a few students are absent due to health reasons or any other unavoidable circumstances, or if the performance of some of the students is very poor, all such cases will be referred to a standing committee consisting of the Controller of examinations (Chairman), HoD of the concerned dept. and the Academic coordinator. On the recommendation of the committee, a makeup test will be conducted on payment of fee fixed by the examination branch.

8.5 In order to improve the attendance and to encourage the students who are regular to the college, 5 marks in each subject will be given to the students as per the percentage of attendance shown in the table,

Table: - Marks for attendance

S. No	Percentage of attendance	Marks to be awarded
1.	Less than 75%	nil
2.	75% to 80%	3
3.	80% to 85%	4
4.	85% and above	5

8.6 The Semester End Examination will be conducted for 75 marks which consist of two parts viz. i). Part-A for 25 marks, ii). Part –B for 50 marks. Part-A is compulsory, which consists of ten questions (numbered from 1 to 10) two from each unit carrying 2/3 marks each. Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an "either" "or" choice (i.e., there will be two questions from each unit and the student should answer any one question).

8.7 For practical subjects there shall be a continuous evaluation during the Semester for 25 marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the concerned laboratory teacher.

8.8 The Practical End Semester Examination shall be conducted with an external examiner and the laboratory teacher for 50 marks. The external examiner shall be appointed by the Principal from the panel of examiners recommended by the Chairman, Board of Studies of respective departments.

8.9 For the subject having design and/ or drawing, (such as Engineering Graphics, Engineering Drawing, and Machine Drawing), the distribution shall be 25 marks for Internal Evaluation (5 marks for day-to-day work and 20 marks for internal tests) and 50 marks for Semester End Examination. There shall be one internal test in a semester and shall be considered for the award of marks for internal test.

8.10. There shall be an industry-oriented mini-Project, to be taken up during the vacation after III year II Semester examination. However, the mini project and its report shall be evaluated in IV year I Semester at the time of practical exams. The industry oriented mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 50 marks. The committee consists of an external examiner, Head of the department, the supervisor of mini project and a senior faculty member of the department. There shall be no internal marks for industry oriented mini project.

8.11. There shall be a seminar presentation in IV-year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, Seminar Supervisor and a Senior Faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for the seminar.

8.12 . There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a committee consisting of Head of the Department and two Senior Faculty members of the department and is evaluated for 100 marks. The Comprehensive Viva-Voce is intended to assess the students understanding of the subjects he studied during the B. Tech. course. There will be no External Examiner for the Comprehensive Viva-Voce.

8.13 . Out of a total of 200 marks for the major project work, 50 marks shall be for Internal Evaluation and 150 marks for the End Semester evaluation. The End Semester evaluation (viva-voce) shall be conducted by committee. The committee consists of an external examiner, Head of the Department, the supervisor of project and a senior faculty member of the department. The topics for industry oriented mini project, seminar and project work shall be different from each other. The evaluation of project work shall be conducted at the end of the IV year II Semester. The internal evaluation shall be on the basis of two seminars given by each student on the topic of his project.

8.14 . The Laboratory marks and the sessional marks awarded by the faculty are subject to scrutiny by the Institution whenever/wherever necessary. In such cases, the sessional and laboratory marks awarded by the teacher will be referred to a College Academic Committee. The Committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved as per the University rules and produced before the Committees of the University as and when asked for.

8.15 Candidates shall be permitted to apply for recounting/revaluation of SEE scripts within the stipulated period with payment of prescribed fee.

9.0. Malpractice Rules

S. No.	Nature of Malpractices/ Improper conduct during examinations	Punishment
	If the candidate:	
1 (a)	Possesses any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical).	a) Expulsion from the examination of the performance in that subject only of all the candidates involved. b) In case of an outside, he/she will be handed over to the police and a case is registered against him/ her.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	
3	Impersonates any other candidate in connection with the examination.	a) The candidate who has impersonated shall be expelled from examination hall. b) The candidate is also debarred and forfeits the seat in the college. c) The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/ year. d) The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	a) Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. b) The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. c) The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/ Assistant Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	a) The concerned students will be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. b) The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	a) Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work & shall not be permitted for the remaining examinations of the subjects of that semester/year. b) The candidate is also debarred for two consecutive semesters from class work and all Semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall (or) if a student comes in a drunken condition to the examination hall.	
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected with the examination.	
10.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the head of Institute for further action for a suitable punishment.	

All the cases pertaining to malpractices in examinations will be referred to a committee constituted by the Chief Controller of Examination and the committee will suggest action as per the guidelines mentioned above.

10. Grading Procedure:

10.1. Marks will be awarded to indicate the performance of each student in each theory subject, or Lab/Practical, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % marks obtained in CIE+SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified, and a corresponding Letter Grade shall be given.

10.2. As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed.

Letter Grade	Performance	Grade Points	% of marks Secured (Class Intervals)
O		10	Greater than or equal to 90%
A+	Excellent	9	80% and less than 90%
A	Very	8	70% and less than 80%
B+	Good	7	60% and less than 70%
B	Average	6	50% and less than 60%
C	Pass	5	40% and less than 50%
F	Fail	0	Below 40%
AB	Absent	0	Absent

10.3. A student obtaining F Grade in any subject shall be considered 'Failed' and will be required to reappear as 'Supplementary Candidate' in the end Semester Examination (SEE), as and when offered. In such cases; his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

10.4. A Letter Grade does not imply any specific % of Marks.

10.5. In general, a student shall not be permitted to repeat any Subject/Course (s) only for the sake of Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Subjects/Courses pertaining to that Semester, when he is detained.

10.6. A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ course. Credit Points (CP) = Grade Point (GP) x Credits for a Course.

10.7. The Student passes the Subject/ Course only when he gets GP ≥ 5 (P Grade or above).

11. Registration/ Dropping

11.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the academic calendar. It is absolutely necessary for the student to register for courses in time.

11.2. A student at the end of III year I semester either having the CGP of ≥ 7.0 or having passed all previous courses in first attempt with a minimum CGPA ≥ 5.0 is allowed to register an additional theory course with the recommendations of the faculty advisor & HOD of the dept.

11.3. Departments will notify at the time of registration about the minimum number of students to be enrolled for a particular open elective to be offered.

11.4. Any student may be barred from registering for any course for specific reasons like disciplinary action or any other illegal activities carried out by a student, which is detrimental to the discipline of the college.

11.5. Dropping of Courses: Within four weeks after the commencement of the semester, the student may, in consultation with his / her faculty advisor, drop one or more courses without prejudice to the minimum number of credits. The dropped courses are not recorded in the Grade Card.

11.6. After Dropping, minimum credits registered shall be 20.

12. Earning of Credits

A student shall be considered to have completed a Course successfully and earned the credits if he/she secures an acceptable letter grade in the range 'O' to 'P'. Letter grade 'F' in any Course implies failure of the student in that Course and no credits earned.

13. Passing Standards:

13.1. A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA ≥ 5.00 (at the end of that particular Semester).

13.2. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those obtained earlier. In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

13.3. A Student shall be declared successful or 'passed' in any Non-Credit Subject/ Course, if he secures a 40% marks or **P** grade in the end sem. exam conducted by the college along with the other examinations.

13.4. After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the registered students of that semester, indicating the Letter Grades and Credits earned. It will show the details of the courses registered (Course Code, Title, No. of Credits, Grade Earned etc.), Credits earned, SGPA, and CGPA.

14. Eligibility for the award of B.Tech. Degree

A student shall be eligible for award of the B. Tech degree if he/she fulfils all the following Conditions:

14.1. The students should successfully complete all the components prescribed in the Programme of study to which he/ she is admitted.

14.2. The student should also obtain CGPA greater than or equal to 5.0.

14.3. Not having any pending disciplinary action.

15. Evaluating of Grade Point Averages:

15.1. SGPA and CGPA the *credit index* can be used further for calculating the Semester Grade Point Average *(SGPA)* and the Cumulative Grade Point Average *(CGPA),* both of which being important performance indices of the student. While *SGPA* is equal to the *credit index* for a semester divided by the total number of *credits* registered by the student in that semester, *CGPA* gives the sum total of *credit indices* of all the previous semesters divided by the total number of *credits* registered in all these semesters. Thus, The Grade Point Average (GPA) will be calculated according to the formula:

Where Ci = number of credits for the course i, Gi = grade points obtained by the student in the course.

$$GPA = \frac{\sum CiGi}{\sum Ci}$$

15.2. Semester Grade Point Average (SGPA) is awarded to candidates considering all the courses of the semester. Zero grade points are also included in this computation. SGPA is rounded off to TWO Decimal Places.

SGPA will be computed as follows;

∑ [(Course *credits*) X (*Grade points*)] (for all Courses passed in that semester)

∑ [(Course *credits*)] (for all courses registered in that semester).

15.3. To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time. CGPA is rounded off to TWO Decimal Places.

CGPA will be computed as follows:

∑ [(Course *credits*) X (*Grade points*)] (for all Courses passed up to that semester)

∑ [(Course *credits*)] (for all Courses registered until that semester)

CGPA is thus computed from the I Year First Semester onwards, at the end of each Semester, as per the above formula. However, the SGPA of I year I Semester itself may be taken as the CGPA, as there are no cumulative effects.

15.4. **Illustrative Example:**

An illustrative example given in below Table below indicates the use of the above two equations in calculating SGPA and CGPA, both of which facilitate the declaration of academic performance of a student, at the end of a semester and at the end of successive semesters respectively. Both of them shall be normally calculated up to the second decimal position, so that the *CGPA,* in particular, can be made use of in rank ordering the student's performance in a class. If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* But, if it is not resolved even at this stage, the number of times a student has obtained higher grades like O, A, B etc shall be taken into account in rank ordering of the students in a class.

Year and Semester	**Course No.**	**Credits**	**Grade**	**Grade Points**	**Credit Points**
I Year I sem	XX101	5	A	8	40
I Year I sem	XX102	4	F	0	00
I Year I sem	XX103	3	A+	9	27
I Year I sem	XX104	4	F	0	00
I Year I sem	XX105	5	C	5	25
I Year I sem	XX106	5	P	4	20
Total		26(18*)			112
SGPA = 112/26 = 4.31			**CGPA = 4.31**		
I Year II Sem	XX107	5	B+	7	35
I Year II Sem	XX108	4	A	8	32
I Year II Sem	XX109	3	C	5	15
I Year II Sem	XX110	5	P	4	20
I Year II Sem	XX111	4	A+	9	36
I Year II Sem	XX112	2	F	0	00
I Year II Sem	Xx113	2	A	8	16
Total		25(23			154
SGPA = 154/25 = 6.16 CGPA = 266/51 = 5.22					

*Total No. of credits excluding those with 'F'; this is particularly important to keep track of the number of credits earned by a student up to any semester.

16. Award of Division

16.1. After a student has satisfied the requirements prescribed for the completion of the program and is Eligible for the award of B. Tech. Degree, he shall be placed in one of the following four divisions:

CGPA	Class Awarded	
≥8.00	First Class with	From the CGPA secured from 160 credits
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

16.2. The marks obtained in Internal Evaluation (IE) and Semester End Examination (SEE) will be shown in the memorandum of marks.

16.3. For the purpose of awarding first Class with Distinction (CGPA ≥ 8.0), the student must obtain the minimum required CGPA within 4 academic years or within 3 academic years in case of Lateral Entry candidates by clearing all the courses.

16.4. Candidates with disciplinary action pending/ prevented from writing the end semester examinations due to reason in any semester are not eligible for the award of First Class with Distinction. Such candidate's even if the CGPA ≥ 8.0 shall be placed in first class.

16.5. For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course shall be considered as per the regulations.

16.6. A student with final CGPA (at the end of the UGP) < 5.00 will not be eligible for the award of the Degree.

16.7. The CGPA can be converted to equivalent percentage of marks by using the equation., % of Marks = (CGPA - 0.5) X 10.

17. Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the four years B. Tech Programme.

18. Withholding of Results

If a student is having any discipline related issues pending, the result of the student will be withheld and will not be allowed to move into the next semester. His/ her degree will be withheld in such cases and the matter will be referred to the academic council for final decision.

19. Transitory Regulations

19.1. Discontinued, detained for attendance, detained for want of credits, or failed students are eligible for readmission as and when the course is offered during the subsequent academic year as per the college admission procedures.

19.2. Students on transfer from a non- autonomous or from an autonomous college shall complete all the courses of the concerned programme not covered in the earlier organization. However, he/she should take the remaining courses in the programme along with the other students.

19.3. There shall be no branch transfers after the cut-off date of admissions made in the B.Tech. I year.

20. Transcripts

After successful completion of the total program of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee.

21. Supplementary Examinations

In addition to the Regular end semester examinations, Supplementary Examinations for the previous semesters will be conducted along with end sem. Examinations. A student can appear for any number of supplementary examinations till he/she clears all courses which he/she could not clear in the first attempt. However, the maximum stipulated period cannot be relaxed under any circumstances.

22. Graduation Ceremony

22.1. The College shall have its own annual Graduation Ceremony for the award of degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

22.2. The College shall institute Prizes and Awards to meritorious students, for being given away annually at the Graduation Ceremony.

23. Termination from the Program

The admission of a student to the program may be terminated and the student may be asked to leave the Institute in the following circumstances:

23.1. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

23.2. The student fails to satisfy the norms of discipline specified by the institute from time to time.

24. Non-Credit Courses (Mandatory Courses)

24.1. Requirement of 75% attendance as per the college regulations is compulsory of completing the mandatory courses.

24.2. Specified number of Mandatory Courses among the designated ones is compulsory requirement for all the students for the award of B.Tech. Degree.

24.3. Although these courses do not carry any credits, performance in these subjects is evaluated following the procedure adopted for other subjects with the same marks. However, their performance will be indicated in the student's memo of marks as Satisfactory/ Unsatisfactory.

24.4. Although mandatory courses are Non-Credit Course, all the students should secure a minimum of 40% marks in the end sem. exam conducted by the college along with the other examinations for the award of B.Tech., degree.

25. Amendments

The Academic regulations here under are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

26. General

26.1. Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

26.2. The academic regulation should be read as a whole for the purpose of an interpretation.

26.3. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

26.4. The college may change the academic regulations, course structure & syllabi at any time.

ACADEMIC REGULATIONS FOR B. TECH. (LATERAL ENTRY STUDENTS)

Applicable for the students admitted into II Year B. Tech. (Lateral Entry Scheme) from the Academic Year 2019-20 and onwards.

1. Eligibility for award of B. Tech. Degree (LES)

1.1 The LES candidates shall pursue a course of study for not less than three academic years and not more than six academic years.

1.2 The candidate shall register for 122 credits and secure 122 credits by securing a minimum CGPA of 5.0 from the exams. of B.Tech. II to IV year for the award of B.Tech. Degree.

1.3 The students, who fail to fulfil the requirement for the award of the degree in six Academic years from the year of admission, shall forfeit their seats. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

2. Promotion Rule

2.1. A student shall be promoted from B.Tech., II Year to III Year if he/ she gets at least a minimum of 20 out of 40 credits, up to II year II semester, from all the examinations, whether or not the candidate takes the examinations.

2.2. A student shall be promoted from III year to IV year if he/ she gets a minimum of 41 out of 82 credits, up to III year II semester, from all the examinations, whether or not the candidate takes the examinations.

2.3. A student shall register and put up minimum attendance in all 122 credits and earn all 122 credits to be eligible for the award of B.Tech degree.

2.4. A student, who fails to earn 122 credits as indicated in the course structure within six academic years, shall forfeit his/ her admission in B.Tech. Course.

3. Award of Class

A student, who satisfies all the requirements prescribed for the completion of the B.Tech. program, is eligible for the award of the said degree, in any one of the following four classes:

CGPA	Class Awarded	
≥8.00	First Class with	From the CGPA secured from 122 credits
≥6.50 - <8.00	First Class	
≥5.50 - <6.50	Second Class	
≥5.00 - <5.50	Pass Class	

4. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B.Tech. (Lateral Entry Scheme).

5. The malpractice rules and procedures for evaluating the SGPA and CGPA mentioned under points 9 - 27, are also applicable to the later entry students.

COURSE STRUCTURE FOR B.TECH I YEAR

B.Tech I year I Semester:

S.No.	Course Category	Course Title	L	T	P	C
1	BS-1	Mathematics-I	3	1	0	4
2	BS-2	Chemistry	3	1	0	4
3	BS-Lab 1	Chemistry Lab	0	0	3	1.5
4	H&S-1	English	2	0	0	2
5	H&S-Lab 1	English Language Skills Lab (ELSL)	0	0	2	1
6	ES-1	Programming for Problem Solving-I	2	0	0	2
7	ES-Lab 1	Programming for Problem Solving Lab-I	0	0	2	1
8	ES-Lab 2	Engineering Workshop	0	1	3	2.5
Total Number of Credits			**10**	**3**	**10**	**18**

B.Tech I Year II Semester:

S.No.	Course Category	Course Title	L	T	P	C
1	BS-3	Mathematics-II	3	1	0	4
2	BS-4	Engineering Physics	3	1	0	4
3	BS-Lab 2	Engineering Physics Lab	0	0	3	1.5
4	ES-2	Engineering Mechanics	4	0	0	4
5	ES-3	Engineering Graphics & Modeling	1	0	3	2.5
6	H&S-Lab 2	English Communication Skills Lab (ECSL)	0	0	2	1
7	ES-4	Programming for Problem Solving-II	2	0	0	2
8	ES-Lab 3	Programming for Problem Solving Lab-II	0	0	2	1
Total			**13**	**2**	**10**	**20**

COURSE STRUCTURE FOR B.TECH II YEAR

B.Tech II Year I Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 5	Numerical Methods& Partial Differentiation	3	0	0	3
2	ES – 1	Materials Technology	3	0	0	3
3	PC – 1	Mechanics of Solids	3	1	0	4
4	PC – 2	Thermodynamics	3	0	0	3
5	PC – 3	Production Technology	3	0	0	3
6	H&S – 2	Professional Communication	2	0	0	2
7	PC Lab – 1	Metallurgy and Mechanics of Solids Lab	0	0	2	1
8	PC Lab – 2	Production Technology Lab	0	0	2	1
9	MC – 1	Environmental Sciences	2	0	0	0
		Total	**19**	**1**	**4**	**20**

B.Tech II Year II Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 6	Probability and Statistics	3	0	0	3
2	ES – 2	Basic Electrical Engineering	3	0	0	3
3	PC – 4	Machine Drawing & Drafting	3	0	0	3
4.	PC – 5	Kinematics of Machinery	3	0	0	3
5	PC – 6	Thermal Engineering	3	0	0	3
6	PC – 7	Mechanics of Fluids and Hydraulic Machines	3	0	0	3
7	PC Lab – 3	Mechanics of Fluids and Hydraulic Machines Lab	0	0	2	1
8	PC Lab – 4	Basic Electrical Engineering Lab	0	0	2	1
9	MC – 2	Gender Sensitization	2	0	0	0
		Total	**20**	**0**	**4**	**20**

COURSE STRUCTURE FOR B.TECH III YEAR

B.Tech III Year I Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	H&S – 3	Managerial Economics and Financial Analysis	4	0	0	3
2	PC – 8	Dynamics of Machinery	3	0	0	3
3	PC – 9	Design of Machine Members-I	3	0	0	3
4	PC – 10	Applied Thermodynamics	3	0	0	3
5	PE – 1	Automobile Engineering Composite Materials Additive Manufacturing	3	0	0	3
6	OE – 1	Elements of Mechanical Engineering Product Engineering	3	0	0	3
7	PC Lab – 5	Thermal Engineering Lab	0	0	2	1
8	H & S- Lab 3	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
		Total	**21**	**0**	**4**	**21**

B.Tech III Year II Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
		Total	**20**	**0**	**4**	**21**

B.TECH III Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
10	PC– 18	Production Planning & Control	3	0	0	3
		Total	**23**	**0**	**4**	**24**

COURSE STRUCTURE FOR B.TECH IV YEAR

B.Tech IV Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics Gas Dynamics Production And Operations Management	3	0	0	3
4	PE – 4	Operations Research Energy Conservation And Management Fluid Power Systems	3	0	0	3
5	OE – 3	Basic Automobile Engineering Material Science Engineering	3	0	0	3
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Instrumentation and Control Systems Lab	0	0	2	1
8	PC– 17	Industry Oriented Mini Project	0	0	0	3
		Total	**15**	**0**	**4**	**20**

B.Tech IV Year II Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 18	Production Planning & Control	3	0	0	3
2	PC- 19	Unconventional Machining And Processes	3	0	0	3
3	PC-20	Technical Seminar	3	1	0	2
4	PC-21	Comprehensive Viva Voce	0	0	0	2
5	PC-22	Major Project	0	0	0	10
		Total	**18**	**1**	**0**	**20**

B.TECH IV Year I Semester (Fast Track)

S.No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics	3	0	0	3
		Gas Dynamics				
		Production And Operations Management				
4	PE – 4	Operations Research	3	0	0	3
		Energy Conservation And Management				
		Fluid Power Systems				
5	OE – 3	Basic Automobile Engineering	3	0	0	3
		Material Science Engineering				
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Instrumentation and Control Systems Lab	0	0	2	1
8	PC – 17	Industry Oriented Mini Project	0	0	0	3
9	PC – 18	Unconventional Machining And Processes	3	0	0	3
		Total	**18**	**0**	**4**	**23**

B.TECH IV Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC-20	Technical Seminar	3	1	0	2
2	PC-21	Comprehensive Viva Voce	0	0	0	2
3	PC-22	Major Project	0	0	0	10
		Total	**3**	**1**	**0**	**14**

MATHEMATICS - I
(Matrices and Calculus)

I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Write the matrix representation of system of linear equations and identify the consistency of the system of equations.
2. Find the Eigen values and Eigen vectors of the matrix and discuss the nature of the quadratic form.
3. Analyze the convergence of sequence and series.
4. Discuss the applications of mean value theorems to the mathematical problems, Evaluation of improper integrals using Beta and Gamma functions.
5. Examine the extreme of functions of two variables with/ without constraints.

UNIT-I:
Matrices and Linear System of Equations:
Matrices and Linear system of equations: Real matrices – Symmetric, skew - symmetric, Orthogonal. Complex matrices: Hermitian, Skew – Hermitian and Unitary. Rank-Echelon form, Normal form. Solution of Linear Systems – Gauss Elimination, Gauss Jordan & LU Decomposition methods.

UNIT-II:
Eigen Values and Eigen Vectors:
Eigen values, Eigen vectors – properties, Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix- Quadratic forms: Reduction to Canonical form, Nature, Index, Signature.

UNIT-III:
Sequences & Series:
Basic definitions of Sequences and series, Convergence and divergence, Ratio test, Comparison test, Cauchy's root test, Raabe's test, Integral test, Absolute and conditional convergence.

UNIT-IV:
Beta & Gamma Functions and Mean Value Theorems:
Gamma and Beta Functions-Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.
Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems.

UNIT-V:

Functions of Several Variables:

Partial Differentiation and total differentiation, Functional dependence, Jacobian Determinant-Maxima and Minima of functions of two variables with constraints and without constraints, Method of Lagrange Multipliers.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, Jain & Iyengar, Narosa Publications.

Reference Books:

1. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. Advanced Engineering Mathematics (2nd Edition), Michael D. Greenberg.

CHEMISTRY

I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Acquire knowledge of atomic, molecular and electronic changes related to conductivity.
2. Apply the various processes of treatment of water for both domestic and industrial purpose.
3. Apply the knowledge of electrode potentials for the protection of metals from corrosion.
4. Analyze the major chemical reactions that are used in the synthesis of compounds.
5. Apply the knowledge of polymers in every day's life.

UNIT- I:

Atomic and Molecular Structure:

Introduction, Concept of atomic and molecular orbitals, LCAO, Molecular orbitals of di-atomic molecules, Molecular orbital energy level diagrams of diatomic molecules (N_2, O2 & F_2). Pi-molecular orbitals of butadiene and benzene.

Crystal field theory (CFT): Crystal field theory, Crystal field splitting patterns of transition metal ion d- orbital- tetrahedral, octahedral and square planar geometries.

UNIT- II:

Water Technology:

Hardness of water, expression of hardness ($CaCO_3$ equivalent), units and types of hardness. Estimation of temporary and permanent hardness of water by EDTA method. Numerical problems based on hardness of water. Potable water: characteristics, treatment of water for domestic supply. Desalination of brackish water: reverse osmosis. Alkalinity of water and its determination. Boiler feed water and its treatment: Internal treatment (colloidal, phosphate calgon conditioning of water). External treatment (ion –exchange process).

UNIT- III:

Electrochemistry and Corrosion:

Electrode, electrode potential, galvanic cell, cell reactions and cell notation, cell EMF, types of electrodes (Calomel electrode and Quinhydroneelectrode), Determination of P^H using quinhydrone electrode. Nernst equation, Numerical problems. Batteries: Introduction to cell and battery, Primary (lithium cell) and secondary cells, (lead-Acid cell, and Lithium ion cells). Fuel cells – Hydrogen – Oxygen fuel cell, advantages and engineering applications of fuel cells.

Corrosion: Introduction, types of corrosion: chemical and electrochemical corrosion, factors affecting the rate of corrosion: nature of the metal, position of metal in galvanic series, purity of metal, nature of corrosion product, nature of environment: effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection: sacrificial anode method and impressed current cathode method. Protective coatings: metallic coatings (anodic and cathodic), methods of application on metals, electroplating (of copper), electroless plating (of Ni), organic coatings- paints.

UNIT-IV:

Stereochemistry:

Structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity. Conformations of cyclic (cyclohexane) and acyclic systems (Ethane).

Organic Reactions and Synthesis of a Drug Molecule:

Introduction to reactions involving substitution (SN1 & SN2), addition (addition of HBr to propene, Markownikoff and Anti Markownikoff addition), elimination, oxidation (oxidation of alcoholsusing $KMnO_4$ & CrO_3), reduction (reduction of carbonyl compounds by $LiAlH_4$ & $NaBH_4$). Synthesis of a commonly used drug molecule- paracetamol and Asprin.

UNIT-V:

Polymer Chemistry:

Introduction, classification of polymers, types of polymerization (addition and condensation, mechanisms not included). Plastics- types of plastics -thermoplastics and thermosetting plastics. Preparation, properties and engineering applications of PVC, Teflon and Bakelite. Fibers: Nylon 6, 6 and Terelene (Dacron). Elastomers: natural rubber, structure, vulcanization. Synthetic rubbers: Buna-S, Butyl rubber & Thikol rubber. Conducting polymers: classification and applications.

Biodegradable polymers:Types, examples: Polyhydroxy butyrate (PHB) ,Poly-Hydroxybutyrate-co-b-Hydroxy valerate (PHBV) ,Polyglycolic acid (PGA) , Polylactic acid (PLA) ,Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.

Textbooks:

1. Engineering Chemistry, P.C Jain & Monica Jain, Dhanpat Rai Publications, 2017.
2. Engineering Chemistry, Bharathi Kumari. Y, VGS Publications, 2018.

Reference Books:

1. March's Advanced Organic Chemistry, Smith, Wiley Publications, 2017.
2. Engineering Chemistry, Shiva Sankar, TMH Publications, 2010.

CHEMISTRY LAB

I Year I Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Determination of parameters like hardness, alkalinity and chloride content in water.
2. Estimation of rate constant of a reaction from concentration-time relationships.
3. Determination of physical properties like adsorption, surface tension and viscosity.
4. Synthesize a small drug molecule and analyze a salt sample.
5. Calculation of strength of compound using instrumentation techniques.

Choice of 10-12 experiments from the following:

1. Estimation of total hardness of water by EDTA method.
2. Determination of alkalinity of water.
3. Determination of chloride content of water.
4. Estimation of HCl by conductometric titration.
5. Estimation of mixture of acids by conductometric titration.
6. Estimation of HCl by potentiometric titration.
7. Estimation of Fe^{2+} by potentiometry using $KMnO_4$.
8. Determination of the rate constant of a reaction.
9. Determination of surface tension.
10. Determination of viscosity of a lubricant.
11. Chemical analysis of a salt.
12. Synthesis of a polymer/drug.
13. Adsorption of acetic acid by charcoal.
14. Determination of Saponification /acid value of an oil.

Reference Books:

1. Practical Engineering Chemistry by Mukkanti, B.S. Publications, 2010.
2. Volga's Qualitative Inorganic Chemistry by PEAR Publications 2010.

ENGLISH

I Year I Semester

L	T	P	C
2	0	0	2

Course Outcomes:

1. Infer the importance of scientific discoveries in promoting social responsibilities.
2. Comprehend the given texts and respond appropriately for technical and professional purposes.
3. Communicate confidently and transfer information into various forms of writing.
4. Understand the importance of health and nutrition for a better society.
5. Present various forms of business writing skills for successful careers.

UNIT-I:

'The Raman Effect' from the prescribed textbook **'English for Engineers'**

Grammar : Articles & Prepositions

Reading : Reading and Its Importance- Techniques for Effective Reading.

Writing : Organizing principles of paragraphs in documents.

Vocabulary: The concept of word Formation, synonyms, antonyms, and standard abbreviations.

UNIT-II:

'Ancient Architecture in India' from the prescribed textbook **'English for Engineers'**

Reading : Improving Comprehension Skills – Techniques for good comprehension

Writing : Sentence Structures, Use of phrases and clauses in sentences
Writing Formal Letters - Eg. Letter of Complaint, Letter of Requisition, Job Application with Resume.

Vocabulary: Root words and acquaintance with prefixes and suffixes from foreign languages in English, to form derivatives

UNIT-III:

'Blue Jeans' from the prescribed textbook **'English for Engineers'**

Grammar: Tenses: Types and uses.

Reading : Sub-skills of Reading- Skimming and Scanning

Writing : Identifying Common Errors in Writing
Subject-Verb agreement in number, gender and person
Information Transfer-Process writing

UNIT-IV:

'What Should You Be Eating' from the prescribed textbook **'English for Engineers'**

Reading : Intensive Reading and Extensive Reading

Writing : Nature and Style of Sensible Writing
Describing & Defining
Identifying common errors in writing

UNIT-V:

'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook **'English for Engineers'**

Vocabulary : Technical Vocabulary and their usage

Reading : Reading Comprehension-Exercises for Practice

Writing : Cohesive Devices

Précis Writing

Technical Reports-Introduction, Characteristics of a Report – Categories of Reports, Formats- Structure of Reports (Manuscript Format) –Types of Reports - Writing a Report.

Textbooks:

1. English for Engineers, Sudarshana, N.P. and Savitha, C. Cambridge University Press, 2018.

Reference Books:

1. Effective Technical communication, Muhammed Rizvi, TMH, 2008.
2. Advanced English Grammar, Hewings, Cambridge University Press, 2010.

ENGLISH LANGUAGE SKILLS LAB

I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Reproduce speech sounds and improve fluency in language.
2. Understand syllables and consonant clusters for appropriate pronunciation.
3. Exhibit effective professional skills with rhetoric eloquence.
4. Deliver enthusiastic and well-practiced presentation.
5. Learn Task-Based Language Learning (TBLL) through various language learning activities effectively.

Exercise-I:
CALL Lab:
Introduction to Pronunciation- Speech Sounds, Vowels and Consonants- Practice for Listening
ICS Lab:
Ice-Breaking activity and JAM session

Exercise-II:
CALL Lab:
Silent Letters, Consonant Clusters, Homographs
ICS Lab:
Common Everyday Situations: Conversations and Dialogues

Exercise-III:
CALL Lab:
Syllables
ICS Lab:
Communication at Workplace, Social and Professional Etiquette

Exercise-IV:
CALL Lab:
Word Accent and Stress Shifts
ICS Lab:
Formal Presentations, Visual Aids in Presentations

Exercise-V:
CALL Lab:
Intonation, Situational dialogues for practice
ICS Lab:
Interviews, Types of Interviews

Reference Books:

1. A Textbook of English Phonetics for Indian Students, T. Balasubramanian, Macmillan Publishers, 2010.
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010.

PROGRAMMING FOR PROBLEM SOLVING - I

L	T	P	C
2	0	0	2

I Year I Semester

Course Outcomes:

1. Design Algorithms and Flowcharts for real world applications using 'C'.
2. Know the usage of various operators in Program development.
3. Design programs involving decision and iteration structures.
4. Apply the concepts code reusability using Functions.
5. Analyze various searching and sorting techniques using Arrays.

UNIT-I:

Problem Solving Using Computers: Introduction, Algorithms, Flowcharts and Pseudo code, Applications of C language.

Overview of C Language: Introduction, Salient Features of C Language, Structure of a "C" Program.

C Language Preliminaries: Keywords and Identifiers, Constants, Variables, Data Types, and Input/ Output Statements with suitable illustrative "C" Programs.

UNIT-II:

Operators: Assignment Operators, Relational and Logical Operators, Increment and Decrement Operators, Bitwise Operators, Ternary Operator, Type Conversion, Precedence and Associativity with suitable illustrative "C" Programs.

UNIT-III:

Statements in C:

Conditional/Decision Statements: if, if-else, Nested if-else, else-if ladder, and Switch-Statement with suitable illustrative "C" Programs.

Loop Control Statements: while, do-while and for with suitable illustrative "C" Programs.

UNIT-IV:

Functions: Introduction to Functions, benefits of functions, types of functions, Function calls, return vs exit (), Parameter Passing mechanism: Call-by-Value, Recursion, and Storage Classes.

UNIT-V:

Arrays: Introduction to Arrays, One-Dimensional Arrays, Two-Dimensional Arrays, Arrays and Functions.

Searching and Sorting: Linear Search, Binary Search, Bubble Sort, and Insertion Sort.

Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education.

Reference Books:

1. Problem Solving Using C, M.T. Somashekara, PHI, 2nd Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, PradipDey and Manas Ghosh, Oxford University Press, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V., 4th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – I

I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Apply the specification of syntax rules for numerical constants and variables, data types.
2. Know the Usage of various operators and other C constructs.
3. Design programs on decision and control constructs.
4. Develop programs on code reusability using functions.
5. Implement various searching and sorting techniques using arrays.

Week 1:
Ubuntu and Linux Commands.

Week 2:
Designing of flowcharts and algorithms using raptor tool
1. Areas of Polygons.
2. Calculation of Simple and Compound Interest.
3. Swapping of Two numbers with and without temporary variable.
4. Checking whether a number is even or odd.
5. Sum of first 'n' natural numbers.
6. Checking a number whether it is divisible by any given number.
7. Evaluation of mathematical expressions.
8. Programs using scanf( ) and printf( ) statements.

Week 3:
Programs on operators. (Minimum 4 Programs)

Week 4, 5 & 6:
Programs on Conditional Statements. (Minimum 12 Programs)

Week 7, 8 & 9:
Programs on Control Statements. (Minimum 12 Programs)

Week 10 &11:
Programs on Functions. (Minimum 6 Programs)

Week 12:
Programs on One Dimensional Arrays. (Minimum 3 Programs)

Week 13:
Programs on Two Dimensional Arrays. (Minimum 2 Programs)

Week 14:
Implementation of Linear Search and Binary Search.

Week 15:
Implementation of Bubble Sort and Insertion Sort.

Week 16:
Review

ENGINEERING WORKSHOP

I Year I Semester

L	T	P	C
0	1	3	2.5

Course Outcomes:

1. Understanding the tools and methods of using to fabricate engineering components
2. Applying the measuring techniques to verify the dimensional accuracy
3. Evaluating various methods and trades of workshop in the component building

(i) Lectures & videos:

Detailed contents

1. Manufacturing Methods- Metal Forming, Machining, Advanced manufacturing methods (2 lectures)
2. CNC machining, Additive manufacturing (2 lectures)
3. Fitting operations & power tools (1 lecture)
4. House wiring (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding (1 lecture)
7. Metal casting (1 lecture)
8. Welding (1 Lecture)

(ii) Workshop Practice:

Detailed contents:

1. Machine shop (Lathe machine)
2. Fitting shop
3. Carpentry
4. House Wiring
5. Welding shop (Arc welding)
6. Tin Smithy

Reference Books:

1. Elements of Workshop Technology, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Manufacturing Engineering and Technology, Kalpakjian S. and Steven S. Schmid, 4th edition, Pearson Education India Edition, 2002.

MATHEMATICS - II
(Ordinary Differential Equations and Vector Calculus)

I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Classify the various types of differential equations of first order and first degree and apply the concepts of differential equations to the real world problems.
2. Solve higher order differential equations and apply the concepts of differential equations to the real world problems.
3. Find the Laplace Transform of various functions and apply to find the solutions of differential equations.
4. Evaluate the multiple integrals and identify the vector differential operators physically in engineering problems.
5. Evaluate the line, surface and volume integrals and converting them from one to another by using vector integral theorems.

UNIT-I:
First order Ordinary Differential Equations and their Applications:
Formation of Differential equations, Differential equations of first order and first degree: exact, linear and Bernoulli, Applications of ODE: Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-II:
Higher Order Linear Differential Equations:
Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^kV(x)$. Method of variation of parameters.

UNIT-III:
Laplace Transforms:
Laplace transform of standard functions Inverse transform first shifting Theorem, Transforms of derivatives and integrals Unit step function second shifting theorem Dirac's delta function Convolution theorem Periodic function Differentiation and integration of transforms Application of Laplace transforms to ordinary differential equations.

UNIT-IV:
Multiple Integrals & Vector Differentiation:
Multiple integrals double and triple integrals change of order of integration (Only Cartesian form) change of variables (Cartesian to Polar for double integral, Cartesian to Spherical for triple integral). Gradient- Divergence Curl and their related properties Potential function Laplacian and second order operators.

UNIT-V:
Vector Integration:
Line integral, work done, Surface and Volume integrals. Vector integrals theorems: Green's, Stoke's and Gauss Divergence Theorems (Only Statements & their Verifications).

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, Jain & Iyengar,Narosa Publications.

Reference Books:

1. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. Advanced Engineering Mathematics (2nd Edition), Michael D. Greenberg.

ENGINEERING PHYSICS

I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Interpret the forced damped harmonic oscillations and Transverse waves.
2. Identify various optical phenomena of light.
3. Explain the working principle of optical fibers and lasers.
4. Describe the crystalline structures of solids.
5. Classify magnetic and dielectric behavior of materials.

UNIT-I:

Oscillations and Waves:

Simple harmonic motion, equation of simple harmonic motion, Simple Pendulum, Torsional pendulum, damped harmonic motion-heavy, critical and light damping, energy decay in a damped harmonic oscillator, power dissipation, quality factor. Forced vibration, steady state motion of forced damped harmonic oscillator, Amplitude of forced vibration, Resonance, Electrical analogy of simple harmonic oscillator.Transverse waves in a stretched string, differential equation, reflection and transmission of transverse waves at a boundary, standing waves.

UNIT-II:

Wave Optics:

Huygen's principle, superposition of waves, coherence and methods to produce coherent sources, young's double slit experiment, interference by parallel thin film by reflection, Newton's rings. Diffraction: Introduction, Fraunhofer diffraction at single slit, plane diffraction Gratings and its resolving power. Polarization: Introduction, methods of polarization, double refraction- Nicol Prism.

UNIT-III:

Fiber Optics and Lasers:

Introduction, total internal reflection, acceptance angle and numerical aperture, losses associated with optical fibers, step and graded index fibers, applications of optical fibers. Introduction to interaction of radiation with matter: stimulated absorption, spontaneous emission and stimulated emission, Einstein's coefficients and their relation, characteristics of a laser, components of a laser: active medium, pumping source, optical resonator. Population inversion, Construction and working of Ruby laser, He-Ne laser and Semiconductor laser. Applications of lasers.

Unit-IV:

Crystal Structures, Crystal Planes and XRD:

Space lattice – Unit cell – Lattice parameter – Crystal systems – Bravais lattices, Atomic radius – Co-ordination number - Structures and Packing fractions of Simple Cubic – Body Centered Cubic – Face Centered Cubic crystals. Miller Indices for Crystal planes and directions – Inter planar spacing of orthogonal crystal systems –Diffraction of X-rays by crystal planes and Bragg's law–Powder method – Applications of X-ray diffraction.

UNIT-V:

Dielectric and Magnetic properties of Materials:

Dielectric polarization, permittivity and dielectric constant, polar and non-polar dielectrics, Electronic, Ionic and Orientation Polarization – Calculation of electronic and Ionic Polarizability – Internal fields – Claussius – Mossotti equation – Basic concepts of Piezo, Pyro and Ferro electricity, applications of dielectrics.Introduction to magnetism – Basic definitions - Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – properties of Anti ferro and Ferri magnetic materials, applications.

Textbooks:

1. Engineering Physics, P K Palanisamy, Scietech publication.
2. Engineering Physics, Hitendra K Malik, A K Singh, McGraw Hill Edition (I) Private Limited.

Reference Books:

1. A Text book of Engineering Physics, M N Avadhanulu, P G Kshirsagar; S Chand.
2. Physics Volume I & II, Resnick and Halliday, John Wiley and sons, Inc.

ENGINEERING PHYSICS LAB

I Year II Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Characterize the mechanical properties of given material.
2. Demonstrate various types of oscillation and rotational motion to determine mechanical parameters.
3. Evaluate the magnetic Induction along the axis of current carrying coil.
4. Apply optical phenomena to characterize optical sources and components.
5. Characterize LCR and RC circuits.

List of Experiments

1. Torsional pendulum: Determination of Rigidity modulus of a material.
2. Fly-wheel: Determination of moment of Inertia.
3. Melde's Experiment: Determination of frequency of electrically maintained tuning fork.
4. Sonometer: Determination of velocity of transverse wave in a string.
5. Newton's rings: Determination of the radius of curvature of the given lens by forming Newton's rings.
6. Diffraction grating: Determination of wavelength of given light using diffraction grating.
7. Dispersive power: Determination of dispersive power of the prism material using spectrometer.
8. Single Slit Diffraction using Lasers- Determination of Wavelength of a Monochromatic Source.
9. Stewart & Gee's experiment: Determination of magnetic field along the axis of current carrying coil.
10. LCR Circuit: Determination of Resonance frequency of forced electrical oscillator.
11. RC- Circuit: Determination of time constant of RC-circuit.
12. Optical Fiber: Determination of Numerical Aperture of Optical Fiber.

Note: Any 10 experiments are to be performed

ENGINEERING MECHANICS

I Year II Semester

L	T	P	C
4	0	0	4

Course Outcomes:

1. Understand the concepts of engineering mechanics
2. Apply the laws of mechanics for various engineering applications
3. Analyze the motion of body
4. Evaluate performance of various engineering components interms of their energy capacities

UNIT-I:

Introduction to Engineering Mechanics - Force Systems: Basic concepts, particle equilibrium in 2D & 3D, rigid body equilibrium, system of forces, coplanar concurrent forces, components in space, resultant, moment of forces and its application, couples and resultant of force system, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar systems and spatial systems.

UNIT-II:

Friction: Types of friction, limiting friction, laws of friction, static and dynamic friction, motion of bodies, wedge friction, screw jack & differential screw jack, centroid and centre of gravity, centroid of lines, areas and volumes from first principle, centroid of composite sections, centre of gravity and its implications, theorem of pappus.

UNIT-III:

Area Moment of Inertia: Definition, moment of inertia of plane sections from first principles, theorems of moment of inertia, moment of inertia of standard sections and composite sections, product of inertia, parallel axis theorem, perpendicular axis theorem

Mass Moment of Inertia: Moment of inertia of masses, transfer formula for mass moments of inertia, mass moment of inertia of composite bodies.

UNIT-IV:

Review of Particle Dynamics: Rectilinear motion, plane curvilinear motion, relative and constrained motion, work-kinetic energy, power, potential energy, impulse-momentum (linear, angular), impact (direct and oblique).

UNIT-V:

Kinetics of Rigid Bodies: Basic terms, general principles in dynamics, types of motion, D'Alembert's principle and its applications in plane motion and connected bodies, work energy principle and its application in plane motion of connected bodies, kinetics of rigid body rotation.

Textbooks:

1. Engineering Mechanics, Shames and Rao (2006), Pearson Education
2. Singer's Engineering Mechanics, Statics & Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar (2010),

Reference Books:

1. Engineering Mechanics, Timoshenko S.P and Young D.H., McGraw Hill International Edition, 1983.
2. Engineering Mechanics, Andrew Pytel, Jaan Kiusalaas, Cengage Learning, 2014.
3. Mechanics for Engineers, Beer F.P & Johnston E.R Jr. Vector, TMH, 2004.
4. Engineering Mechanics, Hibbeler R.C & Ashok Gupta, Pearson Education, 2010.
5. Engineering Mechanics – Statics & Dynamics, Tayal A.K., Umesh Publications, 2011.
6. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press, 2008.
7. Engineering Mechanics, Volume-II Dynamics, Meriam. J. L., John Wiley & Sons, 2008.

ENGINEERING GRAPHICS & MODELING

I Year II semester

L	T	P	C
1	0	3	2.5

Course Outcomes:

1. Understand the concepts of engineering drawing of planes, solids and the CAD drawing software.
2. Applying the principles of engineering graphics while drawing the engineering components.
3. Analyze the sectional views for their configurations.
4. Evaluate the surfaces of solids developed for further processing in the engineering applications.

UNIT– I:

Introduction to Engineering Drawing: Principles of engineering graphics and their significance, usage of drawing instruments, conic sections, including the rectangular hyperbola- General method only. Cycloid, Epicycloid, Hypocycloid. Scales – Plain & Diagonal only.

Introduction to CAD: Introduction to CAD software and its importance, standard toolbar/menus and navigation tools used in the software, using basic commands limits ,units, grid, test , move, offset ,mirror, rotate, trim, extend, fillet etc. drawing lines using line command. Drawing spline, ellipse, circle, rectangle etc.. Concept of layers and dimensioning.

UNIT-II:

Principles of Orthographic Projections: Conventions, projections of points, projections of lines (first angle projection) inclined to both planes (traces and midpoint problem to be excluded).

Implementation of CAD: Drawing orthographic projections of points and lines using a CAD package.

UNIT – III:

Projections of the Planes: Projections of regular planes inclined to both the planes.

Projections of Solids: Projections of regular solids inclined to both the planes (prisms, pyramids, cones and cylinders, change of potion method only).

Implementation in CAD: Drawing orthographic projection of planes and regular solids using a CAD package.

UNIT – IV:

Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone. Development of surfaces of right regular solids - Prism, Pyramid, Cylinder and Cone.

Implementation in CAD: Concept of hatching, drawing sectional views of solids and the development of right regular solids using a CAD package.

UNIT-V:

Principles of Isometric projection: Isometric scale, isometric views, conventions, isometric views of lines, planes, simple solids, conversion of isometric views to orthographic views and vice-versa, conventions.

Implementation in CAD: Drawing isometric views of simple solids. Drawing isometric views from giving orthographic views and vice-versa using a CAD package.

Note: Implementation in CAD (For Internal Evaluation Weightage Only)

Textbooks:

1. Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Charotar Publishing House.

Reference Books:

1. Engineering Graphics, Agrawal B. & Agrawal C. M. (2012), TMH Publication, Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah (2008), Scitech Publishers.
2. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. (2008), Pearson Education.
3. http://docs.autodesk.com/ACDMAC/2013/ENU/PDFs/acdmac_2013_users_guide.pdf

ENGLISH COMMUNICATION SKILLS LAB

I Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Understand the variants in pronunciation.
2. Identify the diverse purposes of listening and speaking.
3. Discuss ideas in diverse communicative settings.
4. Exhibit increased confidence in public speaking.
5. Display critical thinking, problem solving and decision making skills through GD's.

Exercise-I:
CALL Lab:
Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.
ICS Lab:
Spoken vs. Written language -Formal and Informal English- Introducing Oneself and Others.

Exercise-II:
CALL Lab:
Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
ICS Lab:
Features of Good Conversation – Strategies for Effective Communication Role-Play- Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise-III:
CALL Lab:
Information Transfer
ICS Lab:
Descriptions-Narrations-Giving Directions and Guidelines-Giving Instructions-Seeking Clarifications-Asking for and Giving Directions-Thanking and Responding-Agreeing and Disagreeing-Seeking and Giving Advice-Making Suggestions.

Exercise-IV:
CALL Lab:
Past Tense Marker and Plural Marker
ICS Lab:
Public Speaking- Exposure to Structured Talks - Non-verbal Communication- Making a Short Speech - Extempore

Exercise-V:
CALL Lab:
Intonation- Sentence Stress -Weak Forms and Strong Forms.
ICS Lab:
Group Discussion, Mock Group Discussion sessions

Reference Books:

1. A Textbook of English Phonetics for Indian Students, T. Balasubramanian Macmillan Publishers, 2010
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010

PROGRAMMING FOR PROBLEM SOLVING-II

L	T	P	C
2	0	0	2

I Year II Semester

Course Outcomes:

1. Identify various string handling functions in 'C'.
2. Develop programs with user defined data types.
3. Use Dynamic memory allocation functions with pointers.
4. Distinguish between Stacks and Queues.
5. Analyze various Dynamic Data Structures.

UNIT – I:

Overview of Arrays and Functions.

Strings: Introduction to Strings, String I/O, String Operations with and without built-in functions (strlen( ), strcmp( ), strcat( ),strcpy( ) and strrev( )).

UNIT -II:

Structures: Definition and Initialization of Structures, Accessing structure members, Nested Structures, Array of Structures, Structures and Functions, Unions, typedef, Enumerated Data types.

UNIT-III:

Pointers: Introduction to Pointers, Pointer Arithmetic, Pointers and Arrays, Pointer to Structure, Pointers and Strings, Parameter passing mechanism: Call by Reference, Pointer to Pointer, Dynamic Memory Allocation.

UNIT-IV:

Introduction to Data Structures: Lists and Operations, Linear and Nonlinear Data structures.
Stacks- Introduction to Stacks, Operations, Implementation of Stack using Arrays.
Queues- Introduction to Queues, Operations, Implementation of Queue using Arrays.

UNIT-V:

Linked Lists: Introduction to Linked List, Operations on Single Linked List (search, Insertion & Deletion).
Files: Introduction to Files, File Operations (Open, Close, read & Write).

Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education.

Reference Books:

1. Problem Solving Using C, M.T. Somashekara, PHI, 2nd Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, PradipDey and Manas Ghosh, Oxford University Press, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V., 4th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – II

L	T	P	C
0	0	2	1

I Year II Semester

Course Outcomes:

1. Build programs on various string handling functions.
2. Develop applications on user defined data types.
3. Apply dynamic memory allocation through pointers.
4. Implement linear data structures through stacks and queues.
5. Create linked list dynamically through stacks and queues.

Week 1:
Programs on Arrays and Functions. (Minimum 3 Programs)

Week 2 & 3:
Programs on Strings with and without string built-in Functions. (Minimum 6 Programs)

Week 4:
Programs on Accessing Structures and Nested Structures. (Minimum 3 Programs)

Week 5 & 6:
Programs on Array of Structures, Structures and Functions. (Minimum 5 Programs)

Week 7:
Programs on Unions, typedef and enum. (Minimum 4 Programs)

Week 8:
Programs on Pointers, pointer arithmetic, pointer expression, One Dimensional and Two dimensional arrays. (Minimum 4 Programs)

Week 9:
Programs on Pointer to structure, Call by Reference, Pointer to Pointer. (Minimum 3 Programs)

Week 10:
Programs on Dynamic Memory Allocation Functions. (Minimum 3 Programs)

Week 11:
Programs on Stacks and Queues using Arrays.

Week 12 & 13:
Programs on Single Linked List.

Week 14 & 15:
Programs on File Operations. (Minimum 6 Programs)

Week 16:
Review

COURSE STRUCTURE FOR B.TECH II YEAR

B.Tech II Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 1	Numerical Methods& Partial Differentiation	3	0	0	3
2	ES – 1	Materials Technology	3	0	0	3
3	PC – 1	Mechanics of Solids	3	1	0	4
4	PC – 2	Thermodynamics	3	0	0	3
5	PC – 3	Production Technology	3	0	0	3
6	H&S - 1	Professional Communication	2	0	0	2
7	PC Lab – 1	Metallurgy and Mechanics of Solids Lab	0	0	2	1
8	PC Lab – 2	Production Technology Lab	0	0	2	1
9	MC – 1	Environmental Sciences	2	0	0	0
		Total	**19**	**1**	**4**	**20**

B.Tech II Year II Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 2	Probability and Statistics	3	0	0	3
2	ES – 2	Basic Electrical Engineering	3	0	0	3
3	PC – 4	Machine Drawing & Drafting	3	0	0	3
4.	PC – 5	Kinematics of Machinery	3	0	0	3
5	PC – 6	Thermal Engineering	3	0	0	3
6	PC – 7	Mechanics of Fluids and Hydraulic Machines	3	0	0	3
7	PC Lab – 3	Mechanics of Fluids and Hydraulic Machines Lab	0	0	2	1
8	PC Lab – 4	Basic Electrical Engineering Lab	0	0	2	1
9	MC – 2	Gender Sensitization	2	0	0	0
		Total	**20**	**0**	**4**	**20**

NUMERICAL METHODS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

II Year I Semester

Course Outcomes:

1. Develop skills in solving engineering problems involving Algebraic and transcendental equations.
2. Acquires the knowledge of interpolation in predicting future out comes based on the present knowledge and also to fit different types of Curves.
3. To know various types of numerical methods in solving engineering problems.
4. Classify the nature of second and Higher order partial differential equations and find the
   solutions of linear and non linear PDE.
5. To apply Partial differential Equations in different engineering problems.

UNIT-I:

Numerical Techniques: Solution of Algebraic and Transcendental Equations:

Introduction - The Bisection Method- The Method of False Position- The Iteration Method- Newton-Raphson Method. Solving system of linear Non- Homogeneous equations by Jacobi's and Gauss- Seidel Iteration methods.

UNIT-II:

Curve Fitting and Numerical Integration:

Curve fitting: Fitting a straight line -second degree curve-exponential curve, power curve by method of least squares.

Numerical Integration – General Quadrature (Newton's Cote's formula), Trapezoidal rule, Simpson's rule $\left(\frac{1}{3}^{rd} \ \& \frac{3}{8}^{th}\right)$.

UNIT-III:

Numerical Solutions of Initial Value Problems:

Numerical solution of Ordinary Differential equations: Introduction- Solution by Taylor's series method- Picard's Method of successive approximations- Single step methods-Euler's Method - Runge-Kutta (second and classical fourth order) Methods- Predictor Corrector method- Adam's - Bashforth method .

UNIT-IV:

Partial Differential Equations:

Introduction- Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Solutions of first order Linear (Lagrange) Equation, Nonlinear Equations- Charpits Method.

UNIT-V:

Applications of Partial Differential Equations:

Introduction- Classification of general second order partial differential equations- Method of separation of variables for second order equations- Applications of Partial Differential Equations- One dimensional wave equation – One dimensional heat equation- Steady State two dimensional Heat equation (or Laplace equation).

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 35th Edition,
2. Numerical Methods, S. S. Sastry – PHI Publications

Reference Books:

1. Numerical Methods, E. Balaguruswamy, Tata-Mc Graw Hill
2. Numerical Methods, SRK Iyengar & RK Jain, New Age International Publishers
3. Ordinary and Partial Differential Equations: Theory and Applications, Shah and Nita H, PHI Publications.

MATERIALS TECHNOLOGY

B.Tech II Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding basic structure of metals and its relation to properties.
2. Applying the concepts of phase rules for building equilibrium diagrams.
3. Analyzing the effect of alloying elements on the microstructure during heat treatment.
4. Evaluation of the properties of different materials used in various engineering applications.

UNIT - I

Structure of Metals: Crystal structures-BCC, FCC and HCP, Crystal imperfections – point, line, surface and volume imperfections. Atomic diffusion: Phenomenon, Fick's laws of diffusion, Factors affecting diffusion.

Mechanical Behavior of Materials: Stress-Strain diagram for ductile and brittle materials, Fatigue: Description of the phenomenon, S-N diagram. Creep: Description of the phenomenon, creep curve.

UNIT – II

Phase Diagrams: Necessity of alloying, Hume - Rothery rules, Types of solid solutions, Phase rule. Construction and interpretation of phase diagrams, Lever rule, Binary phase diagrams, Isomorphous, Eutectic, Eutectoid, Peritectic, Peritectectoid transformations with examples. Detailed study of Iron-Carbon phase diagram and different phases with microstructures. Identification of zones of steel and cast iron in the diagram.

UNIT - III

Heat Treatment: Principles of heat treatment, Annealing, Normalizing, Hardening and Tempering. TTT curves, Continuous Cooling curves, Austempering, Martempering, Hardenability, Effect of Alloying elements.

Surface Hardening Methods: Carburizing, Nitriding, Cyaniding, Chromizing, Siliconizing, Flame hardening, Induction hardening and Age hardening.

UNIT – IV

Ferrous Materials: Classification of steels: Plain, low alloy and high alloy steels including stainless steels, tool steels and die steels. Cast Iron: Properties, composition and uses of grey cast iron, malleable iron, SG iron.

Non-Ferrous Materials: Properties, composition and uses of copper and its alloys, Aluminium and its alloys, Al-Cu, Al-Si, Al-Zn alloys, Titanium and its alloys.

UNIT - V

Ceramic Materials and Polymers: Crystalline ceramics, glasses, Cermets: Structure, properties and applications. Classification, Properties and Applications of Polymers.

Composite Materials and Nanomaterials: Classification, properties and applications of composites. Nanomaterials and High entropy alloys.

TEXT BOOKS:

1. Foundations of Materials Science and Engineering, Smith, 4th Edition, McGraw Hill, 2009.
2. Material Science and Engineering and Introduction, William D. Callister, Wiley, 2006.

REFERENCES:

1. The Science and Engineering of Materials, Donald R. Askland and Pradeep.P.Phule, Cengage Learning, 4lh Ed., 2003.
2. Materials Science and Engineering, V. Raghavan, PHI, 2002
3. Mechanical Metallurgy, George Ellwood Dieter, McGraw-Hill.
4. Engineering Materials and Metallurgy, U.C. Jindal, Pearson, 2011.

MECHANICS OF SOLIDS

L	T	P	C
3	1	0	4

B.Tech II Year I Semester

Course Outcomes:

1. Understanding different stresses in structural members.
2. Determining the stress pattern and deflections when subjected to various types of loads.
3. Analyse and design structural members, thin and thick cylinders.
4. Evaluate the strains and deformation that will result due to elastic stresses.

UNIT – I

Simple Stresses & Strains:

Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel –Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, Impact and shock loadings.

UNIT – II

Shear Force and Bending Moment:

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure

UNIT – III

Flexural Stresses:

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = F/Y = E/R$ Neutral axis –Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections.

Shear Stresses:

Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

Principal Stresses and Strains:

Introduction-stress on an inclined section of a bar under axial loading- compound stresses-Normal and tangential stresses on an inclined plane for biaxial stresses by using Mohr's circle method

Deflection of Beams:

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads and U.D.L

UNIT – V

Thin Cylinders:

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders

Thick Cylinders:

Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

TEXT BOOKS:

1. Engineering Mechanics of Solid, Egor P., Popov, PHI New Delhi, 2001
2. Strength of Materials, W.A Nash , TMH

REFERENCES:

1. Strength of Materials, R.Subramanian, Oxford University Press.
2. Mechanics of Materials, Ferdinad P. Been, Russel Johnson Jr and John J. Dewole, TMH, New Delhi, 2005
3. Fundamentals of Solid Mechanics, M.L. Gambhir, PHI.
4. Strength of Materials, S.S. Rattan, Mc Graw Hill.

THERMO DYNAMICS

L	T	P	C
3	0	0	3

B.TECH II Year I Semester

Course Outcomes:

1. Understand the concept of classical thermodynamics and the laws governing thermodynamics.
2. Applying the laws of thermodynamics to various engineering applications.
3. Analyze the thermodynamic cycles for engineering applications.
4. Evaluate the performance of energy conversion devices.

UNIT – I

Introduction: Basic Concepts: System, Control volume, Surrounding, boundaries, Universe. Types of systems, Macroscopic and Microscopic view points, Concept of Continuum. Thermodynamic Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process, irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Constant. Volume gas thermometer – Scales of temperature, Ideal gas scale.

First Law of Thermodynamics – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation.

UNIT – II

Second Law of Thermodynamics - Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin planck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of temperature, Clausius inequality.

Entropy - Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmhoultz functions, Maxwell Relations, Tds equations – Elementary Treatment of the third law of thermodynamics.

UNIT – III

Pure Substances - P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes, Joules Thomson co-efficient – Steam calorimetry.

UNIT –IV

Perfect Gas Laws – Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

Mixtures of Perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant. Molecular internal Energy, Enthalpy, specific. Heats and Entropy of Mixture of perfect Gases.

UNIT – V

Power Cycles : Otto, Diesel and Dual combustion cycles, – comparison, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis.

TEXT BOOKS:

1. Engineering Thermodynamics, PK Nag, TMH.
2. Thermodynamics, An Engineering Approach, Yunus Cengel & Boles, TMH

REFERENCES:

1. Thermodynamics for Engineers, Kenneth A. Kroos & Merle C. Potter, Cengage
2. Engineering thermodynamics, P. Chattopadhyay, Oxford University press
3. Engineering Thermodynamics, Jones & Dugan, PHI
4. Thermodynamics, J.P Holman, McGrawHill

PRODUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

B.TECH II Year I Semester

Course Outcomes:

1. Appreciating the concepts of different production processes.
2. Predict the process variables to produce defect free products.
3. Design the gates, risers, dies and other tools employed in the manufacturing of products.
4. Evaluate the production processes for their consequent applications in the production of different components.

UNIT I

Casting: Steps involved in making a casting, Advantages of casting and its applications. Patterns and pattern making – types of patterns, materials used for patterns, pattern allowances. Principles of gating – gating ratio and design of gating systems, Risers – types, function and design. Solidification of casting.

Special casting processes – centrifugal, die-casting and investment; Fettling of casting, casting defects – causes and remedies.

UNIT II

Welding: classification of welding processes, types of welded joints and their characteristics.

Arc welding – types, gas welding –equipment and types of flames, Resistance welding- types, Solid -state welding – types, Thermit welding.

Heat affected zones in welding, welding defects – causes and remedies, Destructive and Non-destructive tests of welds.

UNIT III

Metal Forming: hot working and cold working, strain hardening, recovery, recrystallization and grain growth.

Rolling – theory of rolling, types of rolling mills and products, forces in rolling and power requirements.

Forging – tools and dies, types of forging – smith forging, drop forging, roll forging and rotary forging, forging defects.

UNIT IV

Extrusion and Drawing : Basic Extrusion process and it's characteristics, hot extrusion and cold extrusion, forward extrusion and backward extrusion, Impact extrusion, Hydrostatic extrusion.

Drawing and its types – wire drawing and tube drawing.

Sheet metal operations –spring back effect, stamping operations – blanking, piercing, coining, embossing, bending and spinning.

UNIT V

High Velocity Forming: Explosive forming, Hydraulic forming, Magnetic pulse forming high velocity forming.

Plastics: Types, properties, applications and their processing methods.

TEXT BOOKS:

1. Manufacturing Technology, P N Rao Vol. 1, TMH.
2. Manufacturing Engineering & Technology, Serope Kalpakjian, Steven R. Schmid, Pearson

REFERENCES:

1. Production Technology, R K Jain, Khanna.
2. Introduction to Manufacturing Process, John A Chey, Mc Graw Hill
3. Principles of Metal Castings, Rosenthal, Mc Graw Hill.
4. Workshop Technology, Hazra Chowdry, Vol.1, Standard Publishers.

PROFESSIONAL COMMUNICATION

L	T	P	C
2	0	0	2

II Year I Semester

Course Outcomes:

1. Acquire enhanced personality
2. Exhibit appropriate professional etiquette
3. Practice team building with strong communication skills
4. Develop problem solving skills and decision-making
5. Demonstrate effective presentation skills

UNIT-I:

Self-Appraisal:

Self-Introspection/ Self Retrospection
Introducing self & others
Goal setting
SWOT Analysis,

UNIT- II:

Professional Etiquette:

Etiquette-Telephone Etiquette- Netiquette
Email, Social Network
Behavioural Traits
Case study

UNIT-III:

Team Building:

Leadership skills-Case Studies
Team Essentials
Negotiation Skills
Group Discussion-Functional Aspects

UNIT-IV:

Logical Thinking and Analytical Reasoning:

Decision Making
Problem Solving
Conflict management
Case Study

UNIT-V:

Presentation Skills:

Poster Presentation
Oral Presentation-Individual Presentation, Team Presentation, Thematic Presentation

Textbooks:

1. Effective Technical Communication, Ashrif Rizvi. Tata Mc Gahill, 2011

Reference Books:

1. Speaking and Writing for Effective Business, Soundaraja, MACMILLAN, 2010.
2. English for Professional Success, Hector Sanchez, THOMSON, 2010.

METALLURGY AND MECHANICS OF SOLIDS LAB

L	T	P	C
0	0	2	1

B.Tech II Year I Semester

Course Outcomes:

1) Understand and identify microstructure of metals and measure their mechanical properties.
2) Analyze the microstructure and mechanical properties of metals by applying metallurgical principles.
3) Compare the hardness and mechanical properties of treated and untreated steels tested.

(A) Metallurgy Lab:

1. Preparation and study of the Microstructure of pure metals like iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steel, low carbon steels, high Carbon steels.
3. Study of the Microstructure of Cast irons.
4. Study of the Microstructure of Non-Ferrous alloys.
5. Study of the Microstructure of Heat treated steels.
6. Hardenability of steels by Jominy End Quench test.
7. To find out the hardness of various treated and untreated steels.

(B) Mechanics of Solids Lab:

1. Direct tension test
2. Bending test on
    i. Simple supported
    ii. cantilever beam
3. Torsion test
4. Hardness test a) Brinell's hardness test, b) Rockwell hardness test.
5. Test on springs
6. Impact test

NOTE: Any 10 experiments from the above are to be performed taking at least 4 from each section.

REFERENCES:

1. Metallurgy and Material science, Raghavan, Prentice Hall of India (P) ltd.

PRODUCTION TECHNOLOGY LAB

L	T	P	C
0	0	2	1

B.TECH II Year I Semester

Course Outcomes:

1. Understand the operating methods of welding mechanical press and moulding machines.
2. Measuring the properties of moulding sand.
3. Evaluate the quality of welded joints and products made by mechanical press.

I. Metal Casting Lab:

1. Pattern Design and making – for one casting drawing.
2. Sand properties testing – Exercise for strengths and permeability
3. Moulding Melting and Casting

II. Welding Lab:

1. Spot Welding
2. Gas Welding
3. Soldering and Brazing

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing.
3. Bending operations.

IV. Processing of Plastics:

1. Injection Moulding
2. Blow Moulding

REFERENCES:

1. Manufacturing Technology, P.N.Rao, TMH.

ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

B.TECH II Year I Semester

Course Outcomes

1. Define and explain the structure and functions of ecosystem, value of biodiversity, threats and conservation of biodiversity.
2. Explain the limitations of the resources and impacts of over utilization of all natural resources.
3. Explain the sources and effects of environmental pollutions and list the available techniques to control the pollution.
4. Explain the global environmental issues like climate change, ozone hole and can explain the scope of EIA, Environmental Management Plan, and environmental audit and list the EIA methods.
5. Mention the salient features of environmental acts and rules, define the sustainable goals along with measures required for the sustainability.

UNIT- I

Ecosystem: Definition, Scope and Importance of ecosystem, Structure and Functions of ecosystem: Food chains, Food Web and Ecological Pyramids, Flow of energy; Bio-magnification.

Biodiversity and Biotic Resources: Introduction, Definition, levels of Biodiversity, Value of biodiversity, Hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity: In-Situ and Ex-situ conservation.

UNIT- II

Natural Resources: Classification of Resources, **Water resources**: use and over utilization of surface and ground water, Dams: benefits and problems, Rain water harvesting; **Energy resources**: growing energy needs, Renewable and Non Renewable Energy resources. **Land resources**: land degradation – Landslide and Soil Erosion; **Forest Resources –** Uses and Exploitation.

UNIT- III

Environmental Pollution And Control: Types of Pollution, Sources, Effects and Control measures of Air Pollution, Water Pollution, Soil Pollution and Noise Pollution.

UNIT- IV

Global Environmental Problems and Global Efforts: Greenhouse effect, Global Warming, climate change and their impacts on human environment; Ozone depletion and Ozone depleting substances (ODS); Aid Rains.

Environmental Impact Assessment (EIA): Scope of EIA and EIA methods, scope of Environmental audit and Environmental Management Plan.

UNIT- V

Environmental Policy, Legislation, Rules And Regulations: Salient features of Environmental Protection act, Air (Prevention and Control of pollution) Act- 1981, Water (Prevention and Control of pollution) Act-1974, Forest Conservation Act, Municipal solid waste, Hazardous waste, E-waste, Bio-medical waste, Radioactive waste Rules.

Towards Sustainable Future: Concept of Sustainable Development, Sustainable goals defined by UN, Threats to Sustainability, Environmental Education, Role of IT in Environment, Smart Cities, Concept of Green Building, Low Carbon Lifestyle, Life cycle assessment and Ecological Foot Print.

TEXT BOOKS:

1. Text Book of Environmental Studies by Anubha Kaushik (4th Edition), New age International Publishers.
2. Environmental studies by Erach Bharucha 2005, University Grants Commission, and University Press.

REFERENCES:

1. Text book of Environmental Science and Technology by M.Anji Reddy 2007
2. Environmental Science: Towards a Sustainable Future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.

PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

II Year II Semester

Course Outcomes:

1. To differentiate among random variables involved in the probability models which are useful for all branches of engineering.
2. Derive relationship among variety of performance measures using probability distributions.
3. Acquire elementary knowledge of parametric and non-parametric –tests and understand the use of observing state analysis for predicting future conditions.
4. Identify and examine situations that generate using problems and able to solve the tests of ANOVA for classified data.
5. Apply proper measurements, Indicators and techniques of Correlation and regression analysis.

UNIT-I:
Probability and Random Variables:
Introduction to Probability, Random variables- Discrete and Continuous, Expectation, Probability Distribution Function, Mass Function/ Density Function of a Probability Distribution.

UNIT-II:
Probability Distributions:
Fitting of Binomial, Poisson & Normal distributions and their properties (only Statements) Moment Generating Functions of the above three distributions and hence finding the mean and variance.

UNIT-III:
Sampling Theory & Testing of Hypothesis I:
Sampling Distribution-Definition of Sample, Population, and Types of Sampling. Estimation- Point estimation, Interval estimation, Testing of Hypothesis- Null hypothesis – Alternative hypothesis, Type I, & Type II errors – critical region confidence interval for mean, Testing of hypothesis for single mean and difference between the means for large samples.
Confidence interval for the proportions, Tests of hypothesis for the proportions- single and difference between the proportions for large samples

UNIT-IV:
Testing of Hypothesis II:
Small Samples - t-distribution, F-Distribution, χ^2 distribution, ANOVA for one-way classified data

UNIT-V:
Correlation, Regression & Curve Fitting:
Coefficient of Correlation-Regression coefficients- The lines of Regression - the Coefficient of Rank Correlation.
Curve Fitting- Fitting a Straight line- Second Degree Polynomial- Exponential, Power Curve by Method of Least Squares.

Textbooks:

1. Probability and Statistics for Engineers, Richard Arnold Johnson, Irvin Miller and John E Freund, New Delhi Prentice Hall.
2. Introduction to Probability & Statistics for Engineers and Scientists, Sheldon M. Ross.

Reference Books:

1. An Introduction to Probability and Statistics, 2nd, Vijay K. Rohatgi, A.K. Md. Ehsanes Saleh, Weley.
2. Probability & Statistics for Engineers & Scientists, Walpole, Myers.et.al, Prentice Hall.
3. Fundamentals of probability and statistics for engineers, T T Soong, Weley.

BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes:

1. Understand the fundamentals of basic circuit components and their characteristics.
2. Analyze basic electrical circuits with A.C excitation.
3. Understand the concepts of magnetic circuits and transformers.
4. Acquire the basic concepts of electrical motors.
5. Understand the concept of A.C generator and low voltage electrical installations.

UNIT I
INTRODUCTION TO ELECTRICAL ENGINEERING AND DC CIRCUITS:
Basic definitions, types of elements, types of sources, Kirchhoff's Laws, resistive networks, inductive networks, series, parallel circuits, Star- Delta and Delta- Star transformation, Network theorems- Superposition, Thevenin's - simple problems.

UNIT II
AC CIRCUITS:
Representation of sinusoidal waveforms, peak, rms and average values. Elementary treatment of single-phase AC circuits consisting of R, R-L, R-C, R-L-C combinations (series and parallel). Phase representation, real power, reactive power, apparent power, resonance concept. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III
MAGNETIC CIRCUITS &TRANSFORMERS:

Magnetic Circuits: Magnetic materials, Faraday's laws of Electromagnetic Induction, BH characteristics, Magnetic Circuits - concept of Self & Mutual Inductance.
Transformers: Ideal and practical single phase transformer, OC-SC tests, equivalent circuit, losses in transformer, regulation and efficiency - simple problems.

UNTI IV
DC MACHINES AND INDUCTION MOTORS:

DC Machines: Construction, Principle and Operation of DC Motor, Voltage- torque equations - simple problems
Three Phase Induction Motor: Construction, Principle and working of three phase Induction Motor, torque slip characteristics, -simple problems.
Single Phase Induction Motor: Single phase Induction Motor construction and working principle, capacitor start- applications

UNIT V

AC GENERATOR & ELECTRICAL INSTALLATION:

AC Generator: Construction, Principle of operation of Synchronous Generator, Pitch Factor- Distribution Factor (or winding factor) - EMF equation – simple problems.

Electrical Installation: Fuse, Circuit breakers, difference between fuse and circuit breaker, Types of Batteries, battery backup.

TEXT BOOKS:

1. Basic Electrical Engineering, D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited-2nd Edition.
2. Basic Electrical Engineering, T.K. Nagsarkar and M.S. Sukhija, Oxford University Press-3rd Edition.

REFERENCE BOOKS:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company limited, 5th Edition.
2. Basic Electrical Engineering, K.Uma Rao and A.Jayalakshmi, Pearson Publications.
3. Basic Electrical Engineering, D C Kulshreshtha, McGraw Hill Education Private limited, 1st Edition.

MACHINE DRAWING & DRAFTING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Prepare the engineering drawings by employing conventional representation.
2. Develop the assembly drawings using part drawings of machine components.
3. Applying the drawing practice using solid works software.

PART-A:

Drawing of Machine Components:

1. Conventional representation of materials, machine components and popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Riveted joints for plates : chain and Zig-Zag
4. Shaft couplings: flanged coupling, flexible coupling, universal coupling, oldham coupling
5. Journal, Bushed journal bearing and Foot step bearings.

PART-B:

Assembly Drawing Practice:

Draw different views of assembly drawings

1. Steam engine parts – stuffing box, steam engine cross head, Eccentric.
2. Machine tool parts: Tail stock, Square Tool Post, Machine Vice.
3. Other machine parts - Screw jack, Pipe vice, Plummer block, Connecting rod.
4. Machine drawing practice using SOLIDWORKS software.

TEXT BOOKS:

1. Machine Drawing, K.L Narayana, P.Kannaiah & K.Venkata Reddy, New Age publishers.
2. Machine Drawing, N.D Bhatt, Charotar

REFERENCES:

1. Machine Drawing, P.S. Gill, Kataria & Sons Publishers
2. Machine Drawing, Luzzader, PHI
3. Machine Drawing, Ajeet Singh, TMH.
4. A Textbook of Machine Drawing, R. K. Dhawan, S. Chand.

KINEMATICS OF MACHINERY

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes:

1. Identifying mechanisms based on their form and motion.
2. Computing the velocity, acceleration of the links for subsequent designing.
3. Design and analyse different mechanisms for optimal functioning.
4. Evaluate the relative motions obtained by the mechanisms for application in mechanical engineering components.

UNIT-I

Mechanisms: Elements or links – Classification – Rigid Link, Flexible and fluid link – Types of kinematic pairs – Types of constrained motion – kinetic chain. Mechanism - machine – Structure – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical advantage – Grubler's Criterion.

Straight-Line Motion Mechanism: Exact and approximate copied and generated types – Peaucellier- Hart – Scott Russel – Grasshopper – Watt – Tchebicheff's and Robert Mechanism – Pantographs

UNIT-II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation – centrodes and axodes – Three centers in the theorem - Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction – Coriolis acceleration – Determination of Coriolis component of acceleration.

UNIT-III

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackermann's Steering gear.

Hooke's Joint: Single and double Hooke's joint – velocity ratio – application – problems

UNIT-IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.

Analysis of Motion of Followers: Tangent cam with Roller follower.

UNIT-V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

Gear Trains: Introduction – Types – Simple – Compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box – Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines, Thomas Bevan, CBS
2. Theory of Machines, Rattan .S.S, TMH, 2009 Edition

REFERENCES:

1. Kinematics and Dynamics of Machinery, Charles E. Wilson, J. Peter Sadler, Pearson
2. Mechanism and Machine Theory, JS Rao and RV Dukkipati, NewAge
3. Theory of Machines and Mechanisms, Joseph E. Shigley, Oxford.
4. Kinematics & Dynamics Of machinery, Norton, Mc Graw Hill

THERMAL ENGINEERING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Understand the concepts of power cycles and working principles of IC engines.
2. Analyze the fuels and their combustion phenomenon in engines.
3. Synthesize the alternate fuels and their applications in engines with advanced features.
4. Evaluate the performance of IC engines under the operating conditions.

UNIT – I

I.C. Engines: Introduction- Classification- Valve and Port Timing Diagrams

Fuel Air Cycles and Their Analysis

Introduction- Significance- Composition of cylinder gases- Variable specific heats- Dissociation- Effect of number of moles- Comparison of Air Standard and Fuel Air Cycles- Effect of operating variables

Actual Cycles and Their Analysis

Introduction- Comparison between Air Standard and Actual Cycles- Time Loss Factor- Heat Loss Factor- Exhaust blow down- Loss due to Rubbing Friction- Actual and Fuel-Air Cycles of I.C. Engines.

UNIT – II

Combustion in S.I. Engines

Homogeneous mixture- Heterogeneous mixture- Stages of combustion- Flame front propagation- Factors influencing the flame speed- Rate of pressure rise- Abnormal combustion- Phenomenon of Knock- Types of Combustion chambers- Fuel requirements and fuel rating

UNIT – III

Combustion in C.I Engines

Combustion process- stages of combustion- Delay period and its importance- Factors affecting Delay period- Diesel Knock- Comparison of Knock in C.I and S.I engine- Combustion chambers in C.I. Engine- Fuel requirements and fuel rating

UNIT – IV

Measurements and Testing

Friction power- Indicated power- Brake power- Fuel consumption- Air consumption- Speed- Exhaust and Coolant temperature

Performance Parameters and Characteristics

Introduction- Engine power- Engine efficiencies- Engine Performance characteristics- Variables affecting Performance characteristics- Methods of improving engine performance- Heat balance

UNIT-V

Fuels

Classification of fuels- Complete combustion equation- Air fuel ratio and equivalence ratio- Flue gas analysis- Enthalpy of formation- Adiabatic flame temperature

Alternate Fuels

Liquid fuels: Alcohol- Methanol- Ethanol- Gaseous fuels: Hydrogen-Natural gas- CNG-LPG

Recent trends in IC Engines: HCCI, VTC, VVT, VCR engines

TEXT BOOKS:

1. I.C Engines, V. GANESAN, TMH
2. I.C Engines, Heywood, Mc GrawHill.

REFERENCES:

1. IC Engines, Mathur & Sharma, Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines, Pulkrabek, Pearson, PHI
3. High Speed Combustion Engines, Heldt P.M., Oxford & IBH.
4. Internal Combustion Engines & Air Pollution, R. Yadav, Central Book Publishers

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Understand the basic static, kinematic and dynamic principles of fluid flow.
2. Compute drag and lift co-efficient using the theory of boundary layer flows.
3. Develop the performance equations of hydraulic machines under different input parameter.
4. Evaluate the performance of hydraulic machines for various engineering applications.

UNIT – I

Fluid Properties and Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers.

UNIT - II

Fluid Kinematics: Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows.

Fluid Dynamics: Surface and Body forces, Euler's and Bernoulli's equation derivation, Application of Bernoulis Equation: Venturimeter, Orifice meter, Pitot tube, Navier stokes equation (explanation only), Momentum equation – applications.

UNIT - III

Close Conduit Flow: Reynolds Experiment, Darcy's equation, Minor losses - pipes in series, pipes in parallel, total energy line and hydraulic gradient line, numerical problems.

Boundary Layer Concepts: Definition, thickness, characteristics along thin plate, laminar and turbulent layers (No Derivation) boundary layer in transition, and separation of boundary layer submerged objects drag and lift.

UNIT – IV

Impact of Water Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and a tip-velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow turbines.

Hydraulic Turbines: Overshot and undershot water wheels, classification of Water turbines, Pelton Wheel, work done and working proportions, Francis, Kaplan turbines, draft tubes, types & its efficiency.

Performance of Turbines: Performance under unit head, unit quantities, performance under specific conditions, specific speed, performance characteristic curves, model testing of turbines, cavitation, governing of turbines, surge tanks. Water hammer.

UNIT – V

Centrifugal Pumps : Types Component parts and working, work done by the impeller, Manometric head losses and efficiencies, minimum starting speed, loss of head due to reduced or increased flow, diameters of impeller and pipes, Specific speed, Model testing of pumps, Multistage Pumps, Pumps in parallel, performance of pumps, characteristics curves, NPSH, Cavitation, priming devices, pump troubles and remedies.

Reciprocating Pumps: Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram.

TEXT BOOKS:

1. Fluid mechanics and Hydraulics Machinery MODI and SETH. Rajsons Publication.
2. Fluid Mechanics, John F.Douglas, Janusz M. Gasiorek, John A. Swaffield, Lynne B. Jack, Pearson

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering, D.S Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International.
3. Fluid Mechanics F.M.White, Mc Graw Hill.
4. Hydraulic Machines, Banga & Sharma, Khanna Publishers.

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

L	T	P	C
0	0	2	1

B.TECH II Year II Semester

Course Outcomes

1. Understanding the operating steps of machines.
2. Measuring the performance of hydraulic machines under different loads.
3. Evaluate the parameters discharge, friction and compared vis-a-vis with theoretical values.

LIST OF EXPERIMENTS:

1. Impact of jets on Vanes
2. Performance test on Pelton wheel
3. Performance test on Francis Turbine
4. Performance test on Kaplan Turbine
5. Performance test on single stage centrifugal pump
6. Performance test on Multi stage centrifugal pump
7. Performance test on Reciprocating pump
8. Calibration of Venturimeter
9. Calibration of Orifice meter
10. Determination of friction factor for a given pipe line
11. Determination of loss of head due to sudden contraction in a pipeline
12. Verification of Bernoulli's theorems

NOTE: Any 10 of the above experiments are to be performed

REFERENCES:

1. Fluid Mechanics and Fluid Machinery, Modi & Seth, SBH Publication

BASIC ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

B.TECH II Year II Semester

Course Outcomes:

1. Get an exposure to basic electrical laws.
2. Understand the response of different types of electrical circuits to different excitations.
3. Understand the measurement, calculation and relation between basic electrical parameters.
4. Understand the performance characteristics of D.C electrical machines.
5. Understand the performance characteristics of A.C electrical machines

List of experiments/ demonstrations:

Any 5 experiments from Part A and Part B should be conducted (Total 10 Experiments)

Part A

1. Verification of Ohms law
2. Verification of KVL and KCL
3. Verification of Thevenin's Theorem
4. Verification of Superposition Theorem
5. Transient Response of Series R- L and R - C circuits using DC excitation
6. Determination and Verification of Impedance and Current of RL and RC series circuits

Part B

1. Transient Response of R-L-C Series circuit using DC excitation
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. OC & SC Test on Single phase transformer
4. Brake test on DC shunt motor
5. Brake test on Three Phase Squirrel cage induction motor.
6. OCC of Three phase alternator.

REFERENCE BOOKS:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company Limited, 5th Edition.
2. Basic Electrical Engineering , by T.K. Nagsarkar and M.S. Sukhija, Oxford University Press, 3rd Edition
3. Basic Electrical Engineering , D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited, 2nd Edition

GENDER SENSITIZATION

II Year II Semester

L	T	P	C
2	0	0	0

Course Outcomes:

1. To develop awareness about gender discrimination and take measurable steps to counter it.
2. To identify the basic dimensions of biological, sociological, psychological and legal aspects of gender.
3. To acquire knowledge about gendered division of labour in relation to politics and economics.
4. To prepare the students against gender violence.
5. To prepare the students to work and live together as equals.

UNIT-I:

Understanding Gender:

Gender: Why Should We Study It?

Socialization: Making Women, Making Men

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II:

Gender and Biology:

Missing Women: Sex Selection and Its Consequences

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary

Two or Many? Struggles with Discrimination.

UNIT-III:

Gender and Labour:

Housework: the Invisible Labour

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV:

Issues of Violence:

Sexual Harassment: Say No!

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT-V:

Gender: Co – Existence:

Just Relationships: Being Together as Equals

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Textbooks:

1. **Towards a World of Equals: A Bilingual Textbook on Gender**, A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote,Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu Published by **Telugu Akademi**, **Hyderabad**,Telangana State, **2015**.

Reference Books:

1. Seeing like a Feminist, Menon, Nivedita, New Delhi, Zubaan, Penguin Books, 2012.
2. I Fought For My Life…and Won, Abdulali Sohaila,.

B.TECH III Year I & II Semester

B.TECH III Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	H&S – 2	Managerial Economics and Financial Analysis	4	0	0	3
2	PC – 8	Dynamics of Machinery	3	0	0	3
3	PC – 9	Design of Machine Members-I	3	0	0	3
4	PC - 10	Applied Thermodynamics	3	0	0	3
5	PE - 1	Automobile Engineering Composite Materials Additive Manufacturing	3	0	0	3
6	OE – 1	Elements of Mechanical Engineering Product Engineering	3	0	0	3
7	PC Lab – 5	Thermal Engineering Lab	0	0	2	1
8	H & S Lab	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total Number of Credits			**21**	**0**	**4**	**21**

B.TECH III Year II Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
Total Number of Credits			**20**	**0**	**4**	**21**

B.TECH III Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
10	PC– 18	Production Planning & Control	3	0	0	3
Total Number of Credits			**23**	**0**	**4**	**24**

MANAGERIAL ECONOMICS & AND FINANCIAL ANALYSIS

B.TECH III Year I Semester

L	T	P	C
4	0	0	3

Course Outcomes:

1. Understand the importance of certain basic issues governing the business operations namely demand and supply, production function, cost analysis.
2. Apply managerial tools and techniques in obtaining optimal solutions for business problems.
3. Differentiate the various forms of business organizations.
4. Evaluate and interpret the financial statements of companies using ratios.
5. Apply the methods of capital budgeting in effective investment decision making.

UNIT –I:

Introduction to Managerial Economics& Demand Analysis:

Definition, Nature and Scope of Managerial Economics.Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT –II:

Production & Cost Analysis:

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts (Opportunity cost vs outlay costs, Fixed, variable and semi variable costs, marginal cost vs average cost, out of pocket vs book cost, imputed cost, implicit & explicit cost, incremental and decremental cost, sunk vs future cost, separable and joint costs) Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT –III:

Markets & New Economic Environment:

Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organization: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT –IV:

Introduction to Financial Accounting & Financial Analysis:

Accounting concepts and Conventions - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis: Analysis and Interpretation of Liquidity Ratios (current ratio, quick ratio), Activity Ratios(inventory turnover ratio, debtors turnover ratio), and Capital structure Ratios(debt equity ratio, interest coverage ratio) and Profitability ratios(gross profit ratio, net profit ratio, operating profit ratio, P/E ratio, EPS). Du Pont Chart.

UNIT –V:

Capital Budgeting

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital, Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) ,Net Present Value Method (simple problems), IRR and PI method.

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
2. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.

REFERENCES:

1. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
2. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
3. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
4. Dwivedi: Managerial Economics, Vikas, 2012.
5. Kasi Reddy, Saraswathi, MEFA, PHI Learning, 2012.

DYNAMICS OF MACHINERY

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the behavior of members of machines under the influence of forces.
2. Compute the magnitude of forces, couples in each of the links of machines.
3. Analyze the effect of forces on each link and hence the overall effect on the machinery.
4. Evaluation of the forces and couples in members for application in the design of machine members.

UNIT – I

Precession: Gyroscopes, effect of precession, motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Brakes and Dynamometers: Simple block brakes, internal expanding brake, band brake of vehicle, Dynamometers absorption and transmission types.

UNIT –II

Clutches: Friction clutches Single Disc or plate clutch, Multiple Disc clutch, Cone clutch, Centrifugal clutch.

Governors: Watt, Porter and Proell governors, spring loaded governors Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronisms and hunting.

UNIT – III

Static and Dynamic Force Analysis of Planar Mechanisms: Introduction Free Body Diagrams Conditions for equilibrium two, three and four force Members Inertia forces and D' Alembert's Principle – planar rotation about a fixed center.

Turning Moment Diagram and Fly Wheels: Turning moment inertia Torque, connecting rod angular velocity and acceleration, crank effort and torque diagrams Fluctuation of energy fly wheels and their design.

UNIT –IV

Balancing: Balancing of rotating masses, single and different planes. Balancing of Reciprocating Masses, Primary and secondary balancing of reciprocating masses. Analytical and graphical methods unbalanced forces and couples Multi cylinder in line and radial engines, balancing of locomotive.

UNIT –V

Vibration: Free Vibration of mass attached to vertical spring Forced damped vibration, Vibration isolation & Transmissibility Whirling of shafts, critical speeds, Torsional vibrations of two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines, S.S. Ratan, Mc Graw Hill.
2. Theory of Machines, Shigley, Mc Graw Hill.

REFERENCES:

1. Theory of Machines, Sadhu Singh, Pearson
2. Kinematics and Dynamics of Machinery, R.L.Norton, Mc Graw Hill.
3. Theory of Machines, Thomas Bevan, CBS Publishers
4. Mechanism and Machine Theory, JS Rao and RV Dukkipati , Newage

DESIGN OF MACHINE MEMBERS-I

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

NOTE: Design Data books are not permitted in the Examinations.

Course Outcomes

1. Understanding the concepts of stresses under different loading conditions.
2. Analyze in terms of loads and criteria of failure with reference to the materials employed.
3. Design the machine members on strength and rigidity conditions.
4. Justifying the design with reference to standard data codes.

UNIT – I

Introduction: General considerations in the design of engineering components Materials and their properties selection manufacturing consideration in design.

Stresses in Machine Members: Simple stresses Complex stresses impact stresses stress strain relations static theories of failure factor of safety Design for strength and rigidity. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II

Stresses Due to Fatigue Loading: Stress concentration Theoretical stress Concentration factor Fatigue stress concentration factor notch sensitivity Design for fluctuating stresses Endurance limit Estimation of Endurance strength Fatigue theories of failure Goodman and Soderberg.

UNIT – III

Riveted Joints: Modes of failure of riveted joints Strength equations efficiency of riveted joints– eccentrically loaded riveted joints.

Welded Joints: Design of Fillet welds axial loads Circular fillet welds bending and torsion eccentrically loaded joints.

UNIT – IV

Bolted Joints: Design of bolts with pre-stresses Design of joints under eccentric loading bolt of uniform strength, Cylinder cover joints.

Axially Loaded Joints: Keys, cotters and Knuckle joints: Design of keys-stresses in keys Cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

UNIT – V

Design of Shafts: Design of solid and hollow shafts for strength and rigidity Design of shafts for complex loads Shaft sizes BIS code Design of shaft for a gear and belt drives.

Design of Shaft Couplings: Rigid couplings Muff, split muff and flange couplings, Flexible couplings Pin Bush coupling.

TEXT BOOKS:

1. Machine Design, V.Bhandari, TMH Publishers
2. Machine Design, R.L.Norton, Mc Graw Hill

REFERENCES:

1. Machine Design, Pandya & Shah,Charotar Publishing House Pvt. Ltd
2. Design of Machine Elements, V.M. Faires, Macmillan Coll Div
3. Design of Machine Elements, Kulkarni, Mc Graw Hill.
4. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

APPLIED THERMODYNAMICS

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Note: Steam Table Book are Permitted in the Examinations.

Course Outcomes

1. Understand the functionality of major components of steam and gas turbine plants.
2. Apply the laws of thermodynamics and thermodynamics cycles.
3. Compute the magnitude of work, power, efficiency in turbines, compressors and rocket engines
4. Analyze and subsequently evaluate the energy transfer took place in the systems.

UNIT – I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Boilers: Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principle. Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance

UNIT – II

Steam Nozzles: Function of nozzle Applications and Types- Flow through nozzles- Thermodynamic analysis-Velocity at nozzle exit-Ideal and actual expansion in nozzle- Condition for maximum discharge- Critical pressure ratio- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson Line

Steam Condensers: Requirements of steam condensing plant Classification of condensers Working principle of different types-Vacuum efficiency and Condenser efficiency Air leakage, sources and its affects, Air pump- Cooling water requirement

UNIT – III

Steam Turbines: Impulse Turbine - Mechanical details - Velocity diagram Effect of friction Power developed, Axial thrust, Blade or diagram efficiency Condition for maximum efficiency, De-Laval Turbine - its features, Methods to reduce rotor speed

Reaction Turbine: Mechanical details Principle of operation, Thermodynamic analysis of a stage, Degree of reaction Velocity diagram Parson's reaction turbine Condition for maximum efficiency.

UNIT-IV

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

Rotary Compressor: Roots blower, vane sealed compressor, Lysholm compressor mechanical details and principle of working efficiency considerations.

Gas Turbines: Simple gas turbine plant Ideal cycle, essential components Parameters of performance Actual cycle Regeneration, Inter cooling and reheating closed and Semi-closed cycles.

UNIT – V

Jet Propulsion: Principle of Operation Classification of jet propulsive engines Working Principles with schematic diagrams and representation on T-S diagram Thrust, Thrust Power and Propulsion Efficiency Turbo jet engines Needs and Demands met by Turbo jet Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation Methods.

Rockets: Application Working Principle Classification Propellant Type Thrust, Propulsive Efficiency Specific Impulse Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering, Mahesh M Rathore, Mc Graw Hill
2. Thermal Engineering, Rajput, Lakshmi Publications.

REFERENCES:

1. Thermodynamics and Heat Engines, R. Yadav, Central Book Depot.
2. Thermal Engineering, Ballaney, Khanna Publications.
3. Gas Turbines, V.Ganesan, TMH.
4. Thermal Engineering – R.S. Khurmi & J.S.Gupta, S.Chand Pub

AUTOMOBILE ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the basic structure of an automobile and its functioning
2. Applying mechanical engineering principles and mechanisms in the constructional features of sub systems of an automobile
3. Develop the sub systems keeping in view of their effective working and improved performance of automobile
4. Appraise the automobile emission levels at national and international standards

UNIT – I

Introduction about Evolution of Modern Automobiles- Components of four wheeler automobile rear wheel drive, front wheel drive, 4 wheel drive types of automobile engines.

Engine Lubrication System: Splash and pressure lubrication systems.

Cooling System: Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system Radiators- Types- Cooling fans Water pump Thermostat Evaporating cooling- Pressure cooling.

S.I. Engines: Fuel supply systems, Mechanical and electrical fuel pump filters carburetor types – air filters – petrol injection. M.P.F.I system, GDI system

C.I. Engines: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT–II

Ignition System: Function of an ignition system, battery ignition system, auto transformer, Magneto coil ignition system, electronic ignition system, spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current voltage regulator starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge oil pressure gauge, engine temperature indicator.

UNIT – III

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive, torque converter. Propeller shaft Hotch- Kiss drive, Torque tube drive, universal joint, differential, gear axles types wheels and tyres.

Suspension System: Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system. Chassis-Types-Body of automobile, ergonomics and anthropometry

UNIT – IV

Steering System: Steering geometry – camber, castor, King pin rake, combined angle toe-in, center point steering. Steering gears – types, steering linkages.

Braking System: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes- Master cylinder, wheel cylinder, Requirements of brake fluid, Pneumatic, vacuum, parking and hand brakes.

UNIT – V

Pressure Changes in Engines Super chargers and turbo chargers

Emission from Automobiles Pollution standards National and international Pollution control Techniques. Noise pollution and controls. Energy Alternatives, Solar, Photo-Voltaic, hybrid vehicles

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2 ,Kirpal Singh,Standard Publishers Distributors Delhi
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication

REFERENCES:

1. Automotive Mechanics , G.B.S.Narang, Khanna Publishers
2. Automotive Mechanics , J.Heitner, CBS Publications
3. Automobile Engineering, William Crouse, TMHILL Publishers.
4. Automotive Engines , Srinivasan, MCgraw-Hill Education (India) Ltd

COMPOSITE MATERIALS

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1: Understand the concepts of composite materials.
2: Analyze macro and micro mechanical behavior of a lamina
3: Design the machine components with composite materials.
4: Evaluate the composite materials applications in aerospace and automobiles.

UNIT-I

Introduction to Composite Materials: Introduction, classification, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

Reinforcements: Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibers. Particulate composites, Polymer composites, Thermoplastics, Thermostats, Metal matrix and ceramic composites.

UNIT – II

Manufacturing Methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

Macro Mechanical Analysis of a "Lamina": Introduction, Definitions: stress, strain, Elastic Moduli, strain Energy. Hooke's Law for different types of materials, Hooks Law for a two dimensional unidirectional lamina, plane stress assumption, reduction of Hooks Law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of a lamina.

UNIT – III

Elastic Theory of Composites: Hookes Law for a Two-Dimensional Angle Lamina, Engineering constants of an Angle Lamina. Invariant Form of Stiffness and compliance Matrices for an Angle Lamina Strength Failure. Envelops, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress-Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress-Strain Relationships for a Angle Lamina.

UNIT– IV

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion .

UNIT- V

Macro Mechanical Analysis of Laminates: Introduction, Laminate Code, Stress- Strain Relations for a Laminate, In-Plane and Flexural Modules of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates.

Failure Analysis and Design of Laminates: Introduction Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

TEXT BOOKS:

1. Engineering Mechanics of Composite Materials, Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 1975.

REFERENCES:

1. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), Autar K. Kaw, CRC Publisher
2. Finite Element Analysis of Composite Materials, Ever J. Barbero, CRC Press, 2007.
3. Analysis and Performance of Fibre Composites, B. D. Agarwal and L.J. Broutman, Wiley-Interscience, New York, 1980.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.

ADDITIVE MANUFACTURING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the additive manufacturing technologies employing liquids solids and along with the relevant software.
2. Distinguish the additive manufacturing methods and their specific use.
3. Analyze various case studies for weighing the pros and cons of the processes.
4. Applying additive manufacturing technologies in engineering components.

UNIT – I

Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

UNIT – II

Liquid-Based AM Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid Ground Curing (SGC): Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Micro fabrication.

Solid-Based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – III

Powder Based AM Systems: Selective Laser Sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three Dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid

Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT – IV

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques.

AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, MeshLab.

UNIT –V

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customised Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Web Based Rapid Prototyping Systems.

TEXT BOOKS:

1. Rapid Prototyping: Principles and Applications - Chua C.K., Leong,World Scientific Publishing Co Pvt. Ltd
2. Rapid Prototyping, K.F. and LIM C.S, World Scientific publications, Third Edition, 2010.

REFERENCES:

1. Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou L.W. and Liou F.W, CRC Press, 2007.
2. Rapid Prototyping & Engineering Applications, Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.
3. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001
4. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000

ELEMENTS OF MECHANICAL ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the basic concepts of mechanical engineering.
2. Applying thermodynamic laws in IC engines.
3. Develop manufacturing methods to produce engineering components.
4. Comparing various standards relevant to automobiles.

UNIT-I

Thermal Engineering Basic Concepts: Zeroth Law of Thermodynamics- First law of Thermodynamics- Second Law of Thermodynamics- Boyles Law Charles Law Thermodynamic processes- Otto cycle Diesel cycle- Four stroke petrol and diesel engines. Brake Power, Indicated Power, Mechanical efficiency, Air Refrigeration, Vapour Compression Refrigeration.

UNIT-II

Theory of Machines : Types of Gears and Geartrains Transmission of power by Belts, Ropes and Chain drives- Cams and Followers. Free Vibration of mass attached to vertical spring Oscillation of pendulums Transverse loads.

UNIT-III

Production Technology: Metal Casting Sand Casting, Molten metal Pouring, Welding Arc Welding, Gas Welding, Brazing, Soldering. Metal Forming Forging, Drawing, Extrustion. Metal Cutting Lathe, Drilling, Milling operations.

UNIT-IV

Introduction To Design: Elasticity and plasticity Types of stresses and strains Hooke's law stress strain diagram for mild steel Working stress Factor of Safety Lateral Strain, Poisson's ratio and volumetric strain Temperature stresses.

UNIT-V

Automobile Engineering : Battery ignition system in Petrol engine, Injection system in Diesel engine, Cooling of engines, Electrical system, Braking system. Pollution standards, National and international Pollution Control Techniques Noise Pollution & control.

TEXT BOOKS:

1. Fundamentals of Mechanical Engineering, G.S Sawhmey PHI.
2. Elements of Mechanical Engineering, V. M. Maglik, PHI

REFERENCES:

1. Machine Design, V. Bandari, TMH Publishers
2. Theory of Machines, Rattan .S.S, TMH, 2009 Edition.
3. Elements of Mechanical Engineering, Mathur M.L. & F.S. Mehta & Tewari, Jain Brothers Publishers
4. Automobile Engineering ,Vol. 1 & Vol. 2 ,Kripal Singh,Standard Publishers Distributors Delhi.

PRODUCT ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the concepts of product design, documentation and manufacturing technologies.
2. Apply CAD principles for the product design
3. Develop RPT technologies in the product engineering.
4. Evaluating the processes with case studies

UNIT-I

Project Management

Introduction to Project Management (PM), Collaborative Working, PM Tutorials and their implementation for the same in their projects in tools such as Microsoft Projects.

UNIT-II

Ideation & Conceptual Design

Elements of design; Product development cycle overview; Market demands and trends for products; Product Lifecycle Management (PLM) overview; Ideation and conceptual design phase introduction; Benefits and use cases of ideation and conceptual design, Capturing Voice of the customer (VOC), Use of Trizz in ideation, Intellectual Property Rights (IPRs).

UNIT-III

Product Engineering Component Design

Product Design Phase I: The evolution of CAD: Benefits of Digital Prototyping Design: General 3D Design Concepts.

Product Design Phase–Part 2; Design for manufacturing, introduction; Design styled components.

Product Design Phase Part 3; top down and Bottom up Design Methods; Manufacturing and Engineering Bill of Materials (BOMs); Team and Collaborative based Design.

UNIT-IV

Product Engineering – Documentation (Drawings)

Design Documentation Requirements; Importance and benefits of design documentation; When do you need documentation and when do you not; Drawings requirements (Detailed drawings & Assembly Drawings), Design changes and Automation & Visualization Extending Design Data.

UNIT – V

Prototyping, Testing & User Trials

Need - Development of RP systems, RPT Technologies, Rapid Tooling & Case Studies.

TEXT BOOKS:

1. Joseph E. Shigley& Larry D. Mitchell, "Mechanical Engineering Design", Fourth Edition, McGraw-Hill International Book Company.
2. Machine Design - An Integrated Approach -- Robert L. Norton – Pearson Education.

REFERENCES:

1. Mastering Autodesk Inventor by Sybex
2. Autodesk Inventor 2012 for Designers by CAD CIM Technologies
3. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
4. Rapid Prototyping and Engineering applications: A tool box for prototype development, LiouW.Liou, Frank W.Liou, CRC Press, 2007.
5. Rapid Prototyping: Theory and practice, Ali K. Kamrani, EmadAbouel Nasr, Springer,2006
6. Engineering Design and Design for Manufacturing by Dixen & Poly, University of Mas. Press

THERMAL ENGINEERING LAB

B.TECH III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1: Understand the assembly/disassembly and their working of IC engines for performance measurement.
2: Analyze the output responses of the IC engines by applying thermodynamic principles.
3: Evaluate performance parameters for consequent applications.

List of Experiments:

1. I.C. Engines Valve / Port Timing Diagrams.
2. I.C. Engines Performance test (4 – Stroke Diesel Engines)
3. Evaluate of engine friction by conducting Morse test on 4 stroke Multi cylinder petrol engine.
4. Evaluate of engine friction by conducting motoring / retardation test on 4 stroke petrol engine.
5. Heat balance on IC Engines.
6. Determination of A/F Ratio and volumetric efficiency on IC engines
7. Determination of Economical speed test for fixed load on 4-stroke engine.
8. Disassembly / Assembly of engines.
9. Performance test on reciprocating air-compressor unit.
10. Study of boilers.

REFERENCES:

1. Automobile Engineering ,Vol. 1 & Vol. 2 , Kirpal Singh,Standard Publishers Distributors Delhi

ADVANCED COMMUNICATION SKILLS (ACS) LAB

B.TECH III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Develop sound communication skills in various situations with the help of enriched vocabulary.
2. Practice reading techniques for a faster and better comprehension.
3. Exhibit strong writing skills to express ideas effectively.
4. Demonstrate effective presentation skills.
5. Use appropriate verbal and non-verbal skills for a successful career.

UNIT-I:
Activities on Fundamentals of inter-personal Communication and Building Vocabulary Starting a conversation responding appropriately and relevantly using the right body language Role Play in different situations & Discourse Skills using visuals Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

UNIT-II:
Activities on Reading Comprehension General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.

UNIT-III:
Activities on Writing Skills Structure and presentation of different types of writing letter writing/ Resume writing/ Statement of purpose E-correspondence/ Technical report writing / Portfolio writing planning for writing improving one's writing.

UNIT-IV:
Activities on Presentation Skills Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.

UNIT-V:
Activities on Group Discussion and interview Skills Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video conference and Mock Interviews.

Reference Books:

1. Technical Communication, Meenakshi Raman &Sangeeta Sharma, Oxford University, 2nd Edition, 2011.
2. Functional English for Success, Orient Longman, 2014.

QUANTITATIVE METHODS & LOGICAL REASONING

B.TECH III Year I Semester

L	T	P	C
2	0	0	1

Course Outcomes:

1. To perform well in various competitive exams and placement drives.
2. To solve basic and complex mathematical problems in short time.
3. Quantitative Aptitude and Reasoning are very important in assessing various intangible skills of the students.
4. They are the instrumental in developing problem solving skills and analytical abilities, which play a great role in corporate and industry set up.
5. Therefore, it is essential to have thorough knowledge and understanding of these areas so as to be able to perform their job roles effectively to the corporate expectations.

Quantitave Aptitude and Reasoning:

Unit – I

1. Number System:

Speed maths, Numbers, Factors, prime & Co primes, LCM & HCF, Divisibility rules, finding unit place digit and last two digits of an expression

2. Ratio, Proportion and Variations:

Definition of ratio, ratio of Proportion, Comparison of ratios, Compound ratio, Direct and indirect proportion

3. Percentages:

Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings

4. Profit and loss:

Relation between Cost price and selling price, Discount and Marked price, Gain or Loss percentages on selling price

5. Simple and Compound Interest:

Problems on interest (**I**), amount (**A**), Principal (**P**) and rate of interest(**R**)
difference between the simple interest and compound interest for 2 and 3 years.

Unit-II

1. Partnership:

Relation between partners, period of investment and shares

2. Averages, Ages and Allegation

Average of different groups, change in averages by Adding, deleting and Replacement of objects, problems on ages. Allegation rule, mean value of the mixture, Replacement of equal amount of quantity.

3**. Time and Work:**

Men and Days, Work and Wages, pipes and cisterns, hours and work, Alternate days concept,

4. Time and Distance:

Difference between the average and Relative speeds, reaching the destination late and early, Stoppage time per hour, time and distance between two moving bodies Train crossing man, same and opposite directions, Speed of boat and stream

Unit-III

1. Progressions and Quadratic Equations

Arithmetic, Geometric and Harmonic Progressions, Arithmetic Mean, Geometric Mean and Harmonic Mean and their relations. General form of Quadratic equation, finding the roots of Quadratic equation, Nature of the Roots.

2. Permutation and Combination:

Fundamental rules, problems on permutations & combinations.

3. Probability

Definition of probability, notations and formulae, problems on probability.

4. Data Interpretation and Data Sufficiency:

Tabular and Pie-charts, Bar and Line graphs, Introduction to data sufficiency, problems on data sufficiency.

Unit-IV

1. Deductions:

Statements and conclusions using Venn diagram and Syllogism method

2. Series completion:

Number series, Alphabet series, letter series.

3. Coding and Decoding:

Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, Deciphering individual letter codes by analysis.

4. Analytical Reasoning Puzzles:

Problems on Linear, Double line-up and Circular arrangements, Selections and Comparisons.

5. Blood Relations:

Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Unit-V

1. Direction sense test:

Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.

2. Clocks:

Relation between minute-hour hands, angle vs time, exceptional cases in clocks

3. Calendars:

Definition of a Leap Year, Finding the Odd days, Finding the day of any random calendar date, repetition of calendar years.

4. Cubes and Dices:

Finding the minimum and maximum number of identical pieces and cuts, painting of cubes and cuts, problems on dice.

5. Venn diagrams:

Circular representation of given words, Geometrical representation of certain class, set theory based problems.

TEXT BOOKS:

1. R S Agarwal, (author) S.Chand, (publications) 'A modern approach to logical Reasoning' (Revised edition, 2016)
2. R S Agarwal, (author) S.Chand, (publications) 'Quantitative Aptitude ' (Revised edition, 2016)

REFERENCES:

1. Quantitative Aptitude-G.L BARRONS (new edition,2016)
2. Quantitative Aptitude-Abhijit Guha Mc Graw Hills(new edition,2016)
3. Quantitative Aptitude-U.Mohan Rao SCITECH (new edition,2016)

DESIGN OF MACHINE MEMBERS – II

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

NOTE: Design Data books are permitted in the Examinations.

Course Outcomes

1. Understand the functioning of engineering components, relevant design principles and the corresponding standards.
2. Estimate the life of bearings, gears and other parts under given service conditions.
3. Apply the design principles and subsequently analyze the components employing the criteria of failure.
4. Justifying the design with reference to standard data code.

UNIT – I

Sliding Contact Bearings: Types of Journal bearings basic modes of Lubrication Bearing construction bearing design bearing materials Selection of lubricants.

Rolling Contact Bearings: Types of rolling contact bearings selection of bearing type selection of bearing life Design for cyclic loads and speeds Static and dynamic loading of ball & roller bearings.

UNIT – II

Design of IC Engine Parts: Design of Connecting Rod; Thrust in connecting rod stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston Construction, Design and proportions of piston, Cylinder, Cylinder liners.

UNIT – III

Design of Belt and Rope Drives: Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes Pulleys for belt and rope drives.

Mechanical Springs: Stresses and deflections of helical springs – Extension – compression springs Springs for fatigue loading – natural frequency of helical springs – Energy storage capacity helical torsion springs.

UNIT – IV

Design of Spur and Helical Gear Drives: Spur and Helical gears – Load concentration factor Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Spur and Helical gears –check for plastic deformation, Check for dynamic and wear considerations.

UNIT – V

Design of Bevel Gear Drives: Bevel gears – Load concentration factor – Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Bevel gears –check for plastic deformation, Check for dynamic and wear considerations.

Design of Power Screws: Design of screw, Square ACME, Buttress screws, design of nut.

TEXT BOOKS:

1. Machine Design, V.Bhandari, TMH Publishers
2. Mechanical Engineering Design, Bahi and Goel, Standard Publications.

REFERENCES:

1. Machine Design, Pandya& shah, Charotar Publishing House Pvt. Ltd.
2. Machine Design, R.L.Norton, McGraw Hill
3. Design of Machine Elements, Kulkarni, McGraw Hill.
4. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

HEAT TRANSFER

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the three basic modes of heat transfer.
2. Compute the temperature variation in components by analytical approximate or empirical methods.
3. Formulate and analyze the modes of heat transfer employing mathematical gathering equations.
4. Design the devices such as heat exchangers and evaluate for the heat loss.

UNIT – I

Introduction: Modes and mechanisms of heat transfer Basic laws of heat transfer General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier's law of conduction General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. Simplification and forms of the field equation-steady, unsteady and periodic heat transfer- initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres overall heat transfer coefficient electrical analogy Critical radius of insulation.

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Variable thermal conductivity systems with heat sources or Heat generation, extended surface (Fins) Heat Transfer Long Fin, Fin with insulated tip and short Fin, Application to error measurement of temperature.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance Significance of Biot and Fourier Numbers Chart solutions of transient conduction systems Concept of Functional body.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, medium of flow Dimensional analysis as a tool for experimental investigation Buckingham Pi Theorem and method, application for developing semi empirical non dimensional correlation for convection heat transfer Significance of non-dimensional numbers Concepts of Continuity, Momentum and Energy equations.

Forced Convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer Flat plates and cylinders.

Internal Flows: Concepts of hydrodynamic and thermal entry lengths Division of internal flow based on this Use of empirical relations for horizontal pipe flow and annulus flow.

UNIT – IV

Free Convection: Development of hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for vertical plates and pipes

Boiling and Condensation: Pool boiling Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling. Film wise and Drop wise condensation on vertical and horizontal cylinders using empirical correlations.

UNIT – V

Heat Exchangers: Classification of heat exchangers overall heat transfer Coefficient and fouling factor LMTD and NTU methods Concepts and Problems

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation irradiation total and monochromatic quantities laws of Planck, Wien, Kirchoff, Lambert, Stefen and Boltzmann heat exchange between two black body's concepts of shape factor Emissivity heat exchange between grey bodies radiation shields electrical analogy for radiation networks.

TEXT BOOKS:

1. Fundamentals of Heat Transfer & Mass Transfer, Incropera & Dewitt, John Wiley Pub.
2. Heat and Mass Transfer, D. S Kumar , S.K.Kataria & Sons

REFERENCES:

1. Heat Transfer A Practical Approach Yunus Cengel, Boles, Mc GrawHill.
2. Heat Transfer , J.P. Holman, TMH
3. Heat Transfer , P.K.Nag , TMH
4. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International.

METROLOGY & MACHINE TOOLS

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the basic structure of machine tools used for machining and instruments employed for measurement.
2. Identifying the parameters for machining and working for optimality.
3. Analyze machining surfaces for their roughness and tolerances.
4. Evaluate the limits and fits with reference to design for manufacturing.

UNIT – I

Metal Cutting: Introduction, elements of cutting process orthogonal cutting, merchant circle, oblique cutting, Geometry of single point tools. ASA system. Chip formation and types of chips.

Engine Lathe: Principle of working, types of lathe, specifications. Taper turning Lathe attachments. Capstan and Turret lathe Single Spindle and Multi-Spindle automatic lathes tool layouts.

UNIT – II

Drilling and Boring Machines: Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications.

Shaping, Slotting and Planning Machines- Principles of working machining time calculations.

UNIT – III

Milling Machines: Principles of working Types of milling machines Geometry of milling cutters methods of indexing.

Grinding: Theory of grinding classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, Honing, comparison and Constructional features, machining time calculations.

UNIT – IV

Limits, Fits and Tolerances: Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Limit gauges: Taylor's principle, Design of GO and NO GO gauges. Measurement of angles, Bevel protractor, Sine bar. Measurement of flat surfaces: optical flat, auto collimator.

UNIT – V

Surface Roughness Measurement: Roughness, Waviness. CLA Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

Coordinate Measuring Machines: Types and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology, I C Gupta, Danpath Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

REFERENCES:

1. Production Technology, R.K. Jain and S.C. Gupta, Khanna Publications
2. Production Technology, Hindustan Machine Tools,McGraw Hill
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.

FINITE ELEMENT METHOD

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding fundamentals of finite element method for engineering applications.
2. Formulate finite element characteristic equation for different elements.
3. Apply FEM to solve problems in solid mechanics fluid mechanics and heat transfer.
4. Evaluate the solutions from ANSYS and numerical methods for comparison.

UNIT – I

Introduction To FEM: Basic concepts, historical background, Steps in FEM, applications of FEM, comparison of FEM with other methods, Basic equations of elasticity, Stress Strain and strain displacement relations, Rayleigh Ritz method, Galarkin's method, Problems.

UNIT – II

One Dimensional Problems: Stiffness matrix for a axial bar element, Assembly of Global stiffness matrix, properties of stiffness matrix, Finite element analysis of stepped and tapered bars subjected to mechanical and thermal loads, Quadratic shape functions, Problems.

UNIT – III

Analysis of Trusses: Finite Element Analysis of Trusses, Stiffness matrix of truss element, load vector, Problems.

Analysis of Beams: Analysis of 2-noded beam element with 2-DOF at each node, Hermite shape functions, stiffness matrix, load vector, problems with point load and uniformly distributed load.

UNIT – IV

2-D Structural Problems: CST element, Stiffness matrix and load vector for CST element, Introduction to LST element, Problems.

Isoperimetric element representation, Shape functions, Convergence requirements, two dimensional four-noded isoperimetric elements, Numerical integration, Problems.

UNIT – V

Analysis of Heat Transfer Problems: 1-D Heat conduction with lateral and edge convection, fin and composite wall analysis, 2-D heat transfer analysis, Problems.

Dynamic Analysis: Dynamic equations, Lumped and consistent mass matrices, Eigen Values and Eigen Vectors, mode shapes, Problems on stepped bars and beams.

TEXT BOOKS:

1. Concepts and Applications of Finite Element Analysis Robert Cook Wiley
2. The Finite Element Methods in Engineering, S.S.Rao, Elsevier, Pergamon

REFERENCES:

1. Finite Element Methods, Alavala, TMH
2. An Introduction to Finite Element Methods, J.N. Reddy, Mc Grawhill.
3. Introduction to Finite Elements in Engineering, Tirupathi K. Chandrupatla and Ashok D. Belagundu, Pearson
4. Finite Element Method, R. Dhanaraj & K. Prabhakaran Nair, Oxford

REFRIGERATION AND AIR CONDITIONING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Distinguish various types of refrigeration system.
2. Apply the principles of thermodynamics to refrigeration systems.
3. Thermodynamically analyze refrigeration and air conditioning systems.
4. Evaluate the performance parameters while designing the refrigeration and air conditioning system.

UNIT – I

Introduction to Refrigeration: Necessity and applications - Unit of refrigeration and C.O.P. Mechanical Refrigeration, Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle Brayton Cycle Open and Dense air refrigerationcycle - Air craft cooling systems.

UNIT – II

Vapour Compression Refrigeration: Introduction Working of simple VCR cycle Representation of cycle on T-S and p-h charts -Effect of sub cooling and super heating Actual VCR cycle Problems.

System Components: Compressors - General classification working principles **Condensers** classification Working Principles, **Evaporators** classification Working Principles, **Expansion Devices** Types Working Principles.

Refrigerants: Classification Desirable properties commonly used refrigerants Nomenclature.

UNIT III:

Vapor Absorption System: Introduction Description and working of NH_3- Water system, Calculation of Maximum COP Water Li-Br absorption system Triple Fluid absorption system.

Steam Jet Refrigeration System: Introduction Working Advantages and Disadvantages.

UNIT IV:

Psychometric: Introduction Psychometric terms Psychometric processes.

Inside and Outside Design Conditions: Introduction - Selection of inside design conditions Selection of outside design conditions.

UNIT – V:

Psychometric of Air Conditioning Systems: Introduction- Summer Air conditioning system inter Air conditioning system- All year air conditioning system.

Unitary refrigerant based systems.

Cooling Load Calculations: Introduction- Estimation of required cooling capacity.

TEXT BOOKS:

1. Refrigeration and Air Conditioning, CP Arora, TMH.
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpatrai

REFERENCES:

1. Principles of Refrigeration, Dossat, Pearson Education.
2. Refrigeration and Air Conditioning P.L. Bellaney, Khanna Publications
3. Refrigeration and Air Conditioning, Manohar Prasad, New Age.
4. Basic Refrigeration and Air Conditioning, Ananthanarayanan, TMH.

INDUSTRIAL MANAGEMENT

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the principles of management.
2. Compare management functions in different specializations of management.
3. Apply the concepts of materials management in reducing the total cost.
4. Evaluate the project cost time trade off values during application.

UNIT - I

Management and Organization Functions of Management Contributions of Taylor, Fayol, Douglas Mc-Gregor, Mayo Hertzberg and Maslow. Systems Approach to Management - Organisational Structures: Basic concepts related to Organization Departmentation and Decentralisation, Types of mechanistic and organic structures of organization and their merits, demerits and suitability.

UNIT- II

Operations Management-I: Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Types of plant layout various data analyzing forms-travel chart Work study: Method study and Work measurement. Inventory functions, types, Determination of Economic Order Quantity (EOQ), ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager, JIT System.

UNIT –III

Operations Management-II: Inspection and quality control, types of inspections - Statistical Quality Control-techniques- Charts for variables and attributes. Acceptance sampling plan-single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Functions of Marketing, Marketing vs. Selling, Marketing mix, Product Life Cycle.

Unit -IV

Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating Capability Maturity Model (CMM) Levels Performance Management System.

UNIT- V

PERT/ CPM: Project management, network modelling-probabilistic model, various types of activity time's estimation-programme evaluation review techniques- Critical Path-probability of completing the project, Critical Path Method (CPM) - Project crashing. Simple problems.

TEXT BOOKS:

1. Management Science, Aryasri, McGraw hill
2. Introduction to Management Science, Kumar, Rao and Chhalill, Cengage.

REFERENCES:

1. Manufacturing Organization and Management, Amrine, Pearson.
2. Operations Management, Chase, Jacobs, Aquilano, McGraw Hill.
3. Management, Pearson Education Stoner, Freeman, Gilbert, New Delhi.
4. Principles of Management, Koontz and Donell, McGraw Hill.

AUTOMATION IN MANUFACTURING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Summarize the facets of automation in a manufacturing activity.
2. Applying various elements like sensors, pneumatics, and hydraulics to append in manufacturing automation.
3. Design the assembly lines by considering the on line process analysis.
4. Evaluate the automation elements for low cost automation investment.

UNIT-I

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT-II

Introduction to Material Handling: Overview of Material Handling Equipment, Considerations in Material Handling System Design, Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT -III

Manual Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT-IV

Transfer Lines: Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT-V

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Eduction.
2. CAD CAM: Principles, Practice and Manufacturing Management, Chris Mc Mohan, Jimmie Browne, Pearson edu. (LPE)

REFERENCES:

1. Industrial Automation, W.P.David, John Wiley and Sons.
2. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.
3. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961
4. CAD / CAM/ CIM, Radhakrishnan,New Age International

OPTIMIZATION TECHNIQUES

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the mathematical models development.
2. Identifying the variables and constraints to suit a mathematic model.
3. Applying the appropriate algorithm to arrive at the solutions of the given systems.
4. Compare the optimization techniques for their exactness vis-a-vis with simulation methods.

UNIT – I

Introduction: Development, Definition, Characteristics and phases, Types of operation Research models, applications. Allocation:

Linear Programming Method: Problem formulation, Graphical solution, Simplex method, Artificial variables Techniques, Two – phase method, Big-M method, Duality principle.

UNIT – II

Transportation Problem: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy, Assignment problem, Formulation, Optimal solution, Variants of Assignment Problem, Travelling salesman problem.

UNIT – III

Theory of Games: Introduction, Minimax (maximin), Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, dominance principle, m X 2 & 2 X n games, graphical method.

Waiting Lines: Introduction, Single Channel, Poisson arrivals exponential service times, with infinite population and finite population models, Multichannel, Poisson arrivals, exponential service times with infinite population.

UNIT – IV

Sequencing: Introduction, Flow Shop sequencing n jobs through two machines n jobs through three machines, Job shop sequencing, two jobs through 'm' machines.

Replacement: Introduction, Replacement of items that deteriorate with time, when money value is counted, Replacement of items that fail completely, group replacement.

Inventory: Introduction, Single item, Deterministic models, Purchase inventory models with one price break and multiple price breaks, shortages are not allowed, Stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, Single period model.

UNIT – V

Dynamic Programming: Introduction, Terminology, Bellman's Principle of optimality, Applications of dynamic programming, shortest path problem, capital budgeting.

Simulation: Definition, Types of simulation models, phases of simulation, applications of simulation, inventory and Queuing problems, Advantages and Disadvantages, Brief introduction of simulation languages.

TEXT BOOKS:

1. Operations Research, S.D.Sharma, Kedarnath
2. Operations Research, J.K. Sharma, MacMilan

REFERENCES:

1. Operations Research, A.M. Natarajan, P.Balasubramani, A.Tamilarasi, Pearson
2. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman.
3. Operations Research, R.Pannerselvam, PHI Publications
4. Introduction to Operation Research, Taha, PHI

MAINTENANCE AND SAFETY ENGINEERING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the need for maintenance of industries for overall productivity improvement.
2. Classifying the maintenance methods in terms of time and condition of equipment.
3. Applying the concepts of quality, reliability and inventory for effective maintenance and safety.
4. Evaluate the maintenance policies to reduce the total cost.

UNIT – I

Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance strategy for the 21st Century Engineering Maintenance Objectives and Maintenance in Equipment Life cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual Maintenance, Facility Evaluation Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control indices.

UNIT – II

Types of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program, PM Program Evaluation and improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

UNIT – III

Inventory Control in Maintenance: Inventory Control Objectives and Basic inventory Decisions, ABC inventory Control Models Two Bin inventory Control and Safety Stock, spares Determination Factors spares calculation methods.

UNIT – IV

Quality and Safety in Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

UNIT – V

Reliability, Reliability Centered Maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement indicators, RCM Benefits and Reasons for its Failures, Reliability Versus Maintenance and Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

Maintainability: Maintainability importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS:

1. Reliability, Maintenance and Safety Engineering, Dr. A.K Guptha, Laxmi Publications.
2. Industrial Safety Management, L.M.Deshmukh, TMH

REFERENCES:

1. Maintenance Engineering & Management, R.C.Mishra, PHI
2. Reliability Engineering, Elsayed, Pearson
3. Engineering Maintenance a modern approach, B. S. Dhallon, C.R.R Publishers.
4. Industrial Safety Engineering, Garg, Danpathrai Publishers

HEAT TRANSFER LAB
(Consider Performance in Any 12)

B.TECH III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understand the structural features of heat transfer equipment and their mode of working.
2. Analyze the output responses by comparing with the heat transfer governing equations.
3. Evaluate the process parameters for designing the heat transfer devices.

LIST OF EXPERIMENTS:

1. Composite Slab Apparatus Overall heat transfer co-efficient.
2. Heat Transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere.
4. Thermal Conductivity of given metal rod.
5. Heat Transfer in pin-fin.
6. Experiment on transient heat conduction.
7. Heat Transfer in forced convection apparatus.
8. Heat Transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two – Phase flow.

REFERENCES:

1. Fundamentals of Heat Transfer & Mass Transfer, Incropera & Dewitt, John Wiley Pub.
2. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International.

METROLOGY & MACHINE TOOLS LAB

B.TECH III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes

1: Understand the kinematic structure of machine tools and their mode of working.
2: Perform the machining operations and the measurement of samples using instruments.
3: Evaluate the responses for their accuracy and precision.

SECTION – A

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and choral height of spur gear.
4. Machine tool alignment test on the lathe.
5. Tool maker's microscope.
6. Angle and taper measurements by Bevel protractor & Sine bars.
7. Use of spirit level in finding the flatness of surface plate.
8. Thread measurement by two wire / three wire method or Tool Makers' microscope.

SECTION – B

1. Introduction of general purpose machines – Lathe, Drilling Machine, Milling Machine, and shaper.
2. Planning Machine, Slotting Machine, and Cylindrical Grinder, Surface Grinder and Tool and Cutter grinder.
3. Step turning and Taper Turning on Lathe Machine.
4. Thread cutting and knurling on lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding

REFERENCES:

1. Engineering Metrology, I C Gupta, Danpath Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

PERSONALITY DEVELOPMENT AND BEHAVIOURAL SKILLS

III Year II Semester

L	T	P	C
2	0	0	1

Course Outcomes:

1. Practice optimistic attitude for an efficient, socially viable and multi-faceted personality.
2. Demonstrate functions of non-verbal *communication in formal context.*
3. Build effective individual & team dynamics for professional accomplishments.
4. Analyze appropriate strategic Interpersonal Skills for productive workplace relationships.
5. Correspond in multiple contexts, for varied audiences, across genres and modalities.

UNIT – I:

Personality Development:

Definition - Various Aspects of Personality Development - Behavioural Traits.
Importance of Soft Skills for personal and professional development - Success stories.

UNIT– II:

Non Verbal Communication:

Kinesics, Haptics, Proxemics, Vocalics, Oculesics
Body Language informal contexts such as Group Discussions, Presentations and Interviews.

UNIT– III:

Team Dynamics:

Different Types of Teams Role of an individual communicating as a group or team leader
Individual Presentations/ Team Presentation-Project Presentations- Case Studies

UNIT-IV:

Interpersonal Skills:

Time Management- Stress Management- Emotional Intelligence- Conflict Management- Relationship Management

UNIT-V:

Digital Correspondence:

Role of Multimedia in Communication in a Digital Edge (Video Conference Etc.)
Social Networking: Importance and Effects.

Textbooks:

1. Personality Development and Soft Skills, Preparing for Tomorrow, Shikha Kapoor 2nd Edition, 2020.

References:

1. Personality Development and Soft Skills, Barun, K Mitra, Oxford University Press, 2nd Edition, 2016.
2. Professional Ethics, R Subramanian, Oxford University Press, 2ndEdition, 2015.

B.TECH IV Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics Gas Dynamics Production And Operations Management	3	0	0	3
4	PE – 4	Operations Research Energy Conservation And Management Fluid Power Systems	3	0	0	3
5	OE – 3	Basic Automobile Engineering Material Science Engineering	3	0	0	3
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Instrumentation and Control Systems Lab	0	0	2	1
8	PC-17	Industry Oriented Mini Project	0	0	0	3
Total Number of Credits			**15**	**0**	**4**	**20**

B.TECH IV Year II Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC– 18	Production Planning & Control	3	0	0	3
2	PC – 19	Unconventional Machining And Processes	3	0	0	3
3	PC– 20	Technical Seminar	3	1	0	2
4	PC –21	Comprehensive Viva Voce	0	0	0	2
5	PC –22	Major Project	0	0	0	10
Total Number of Credits			**18**	**1**	**0**	**20**

B.TECH IV Year I Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics Gas Dynamics Production And Operations Management	3	0	0	3
4	PE – 4	Operations Research Energy Conservation And Management Fluid Power Systems	3	0	0	3
5	OE – 3	Basic Automobile Engineering Material Science Engineering	3	0	0	3
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Instrumentation and Control Systems Lab	0	0	2	1
8	PC – 17	Industry Oriented Mini Project	0	0	0	3
9	PC – 19	Unconventional Machining And Processes	3	0	0	3
Total Number of Credits			**18**	**0**	**4**	**23**

B.TECH IV Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 20	Technical Seminar	3	1	0	2
2	PC – 21	Comprehensive Viva Voce	0	0	0	2
3	PC – 22	Major Project	0	0	0	10
Total Number of Credits			**3**	**1**	**0**	**14**

INSTRUMENTATION AND CONTROL SYSTEMS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the measurement of various quantities using instruments
2. Applying relevant engineering principles while arriving at the absolute readings from instruments
3. Analyze the errors that occurred in the measuring process
4. Compare the quantities measured for their accuracy & range of the instruments

UNIT – I

Definition – Basic principles of measurement – Measurement systems, instrument-classifications, generalized configuration and functional descriptions of measuring instruments – examples. Static and Dynamic performance characteristics – input and output configuration of measuring instruments, calibration, sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement Piezo electric, inductive capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT – II

Measurement of Temperature: Classification ranges various principles of measurement Expansion, pressure thermometers, Electrical thermometers, Thermistors Thermocouples-laws of thermocouples – Pyrometers.

Measurement of Pressure: Units classification different principles used. Manometers, Bourdon pressure gauges, Bellows pressure gauges Diaphragm gauges, Dead weight tester.

Low Pressure Measurement: Thermal conductivity gauges ionization pressure gauges, McLeod pressure gauges.

UNIT – III

Measurement of Level: Direct method indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators Bubbler level indicators.

Flow Measurement: Rota meter, magnetic, ultrasonic, Turbine flow meters, hot wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical tachometers Electrical tachometers Stroboscope, Non-contact type of tachometers.

UNIT – IV

Measurement of Acceleration and Vibration: Different simple instruments Principles of seismic instruments Vibrometer and accelerometer using this principle

Stress Strain Measurements: Various types of stress and strain measurements electrical strain gauges – gauge factor method of usage of resistance strain gauge for bending compressive and tensile strains usage for measuring torque, strain gauge Rosettes, temperature compensation in strain gauges.

UNIT – V

Control Systems:

Open and closed loop translation and rotational elements of a mechanical system, Pneumatic control systems, Hydraulic control systems. Representation of Control Components and Systems, Mechanical Accelerometer.

TEXT BOOKS:

1. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
2. Instrumentation, Measurement & Analysis by B.C.Nakra & K.K.Choudhary, TMH

REFERENCES:

1. Mechanical Measurement and Instrumentation by A.K.Sawhney & Dhanpat Rai Publications
2. Experimental Methods for Engineers, Holman, Mc Graw Hill
3. Instrumentation & Mechanical Measurements by A.K.Tayal, Galotia Publications.
4. Instrumentation , N.V.S. Raju, BS Publications

CAD/ CAM

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the design and manufacture aspects of mechanical engineering components employing computers.
2. Apply mathematical techniques to generate different curves, surfaces and solids.
3. Develop the controlling methods using computer in the manufacturing and quality function.
4. Evaluate the products produced by CAD/CAM and reverse engineering methods.

UNIT – I

Introduction: Computers in industrial manufacturing, Product cycle, CAD/CAM hardware basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 2D and 3D transformations, viewing transformation, mathematics of projections, windowing and clipping, hidden surface removal.

UNIT – II

Geometric Modeling: Requirements, Geometric models, Curve representation methods, Surface representation methods, modeling facilities desired.

CAD Standards- Graphical kernel system, standards for exchange images, open graphics library, data exchange standards- IGES, STEP, and CALS etc.

UNIT – III

Numerical Control: NC, NC modes, NC machine tools structure of CNC machine tools, features of machining center, turning center, CNC part programming: Fundamentals, manual part programming methods, computer aided part programming.

Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, computer aided processes panning, retrieval type and generative type.

UNIT – IV

Computer Aided Quality Control: Terminology in quality control, computer applications, contact inspection methods, noncontact inspection methods – Optical, Noncontact, and inspection methods – non optical, Computer aided testing, integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems: Types of manufacturing systems, Machine tools and related equipment, computer control systems, human labour in the manufacturing systems, CIMS benefits.

UNIT – V

Reverse Engineering Technology: Introduction to reverse engineering, reverse engineering-Hardware and software, Applications of reverse engineering, reverse engineering process, fundamental reverse engineering operations, reasons for using reverse engineering.

TEXT BOOKS:

1. CAD/CAM: Computer- Aided Design and Manufacturing, Mikell P.Groover, Emory W.Zimmers, Pearson Education India, 1984.
2. CAD/CAM: Theory and Practice, Ibrahim Zeid, R Sivasubramanian, Mc Graw-Hill.

REFERENCES:

1. Automation, Production Systems & Computer Integrated Manufacturing", P. Groover, Pearson Education, 2016
2. Computer Numerical Control Concepts and Programming, Warren S. Seames, Vengage Learning, 2007.
3. Reverse Engineering: An industrial Perspective, Vinesh Raja, Kiran J. Fernandes, Springer, 2008.
4. Reverse Engineering: Technology of Reinvention, Wege Wang, CRC Press, 2010.

ROBOTICS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the basic components of robots.
2. Model forward and inverse kinematics of robot manipulators.
3. Analyze forces in links and Joints of a robot.
4. Design intelligent robots using sensors.

UNIT – I

Introduction: Automation and Robotics, Overview of Robotics, Classification of robots by coordinate system and control systems, Components of industrial robots, Advantages, disadvantages of and applications of robotics.

End Effectors: Classification of end effectors, Types and working principles of grippers, General considerations of gripper selection and design, Different tools used as end effectors.

UNIT – II

Motion Analysis: Basic translation and rotation matrices, Transformations, Composite transformations, Homogeneous transformation, Problems.

Manipulator Kinematics of Position: Joint coordinates and world coordinates, forward and inverse kinematics of position, Problems.

UNIT – III

Manipulator Kinematics of Orientation: Forward and inverse kinematics of orientation, RPY angles, Euler Angles, D-H notations.

Differential Kinematics: Differential kinematics of manipulators, differential translation and rotation matrices, Jacobian, Problems.

UNIT – IV

Robot Dynamics: Importance of dynamic modeling, Lagrange – Euler formulation, Newton – Euler formulation, Problems on planar two link manipulators.

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – Types of motion: Slew motion – joint interpolated motion – straight line motion – problems.

UNIT – V

Robot Actuators and Sensors: Actuators: Working principles, applications, advantages and limitations of Pneumatic, Hydraulic and Electric Actuators, Sensors: Classification of sensors, working principles of different types of sensors like position, velocity, tactile, proximity sensors etc.

Industrial Applications of Robots: Robot Applications in Manufacturing: Material handling, Processing, Assembly & Inspection.

TEXT BOOKS:

1. Industrial Robotics, Groover M.P, Pearson Edu.
2. Introduction to Robotic Mechanics and Control, JJ Craig, Pearson.

REFERENCES:

1. Robot Dynamics & Control – Mark W. Spong and M.Vidyasagar, John Wiley & Sons
2. Introduction to Robotics: Analysis,Control and Applications, Saeed.B.Niku, Wiley
3. Robotics, Fu K.S, McGraw Hill.
4. Robotic Engineering, Richard D. Klafter, Prentice Hall

GAS DYNAMICS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the features of different flows.
2. Comparing the flow in different cross sectional arcos.
3. Apply gas dynamics principles to Jet propulsion system.
4. Evaluate the effects with and without shocks during flow.

UNIT-I

Introduction: Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow. Properties of atmosphere, Standard atmosphere, Relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT-II

Isentropic Flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed, maximum speed, variation of Compressibility with mach number.

UNIT-III

Variable Area Flow: Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying back pressures.

Flow in Constant Area Duct: Adiabatic and isothermal-flow calculation of pressure, temperature, density, Mach number relationships, Limiting length of duct for adiabatic and isothermal flow, Fanno line, Diabatic flow, Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships, Limiting conditions, Rayleigh line.

UNIT-IV

Wave Phenomenon: Pressure disturbances in compressible fluid, type of shock waves – normal, shock pressure –density-velocity-temperature and Mach number relations for a plane normal shock-Shock tube-mach reflection- thin area prandtl theory.

UNIT-V

Shock: Shock intensity-Rayleigh-Pilot and Prandtl-Pitot equation for normal shock, introduction to oblique shockwaves and hypersonic flow- fenno flow.

TEXT BOOKS:

1. Gas Dynamics through Problems, Zoeb Hussain, Wiley Eastern ltd.
2. Fundamentals of Compressible flow, S.M. Yahya, New Age International.

REFERENCES:

1. Gas Dynamics, E.Radha Krishnan, P.H.I Publication.
2. Gas Dynamics for engineers, P.Balachandran, PHI, Easterr Economy Edition.
3. Gas Dynamics and Jet propulsion, S L Somasundaram, New age International Publishers.
4. Gas Dynamics, H.W.Lipman and A.Rashkho, John Wiley.

PRODUCTION OPERATION AND MANAGEMENT

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the importance of production and operations management for getting the competitive edge.
2. Analyze the factors effecting plant location and the volume of production to be made.
3. Apply the value engineering and work study method to standardize the manufacturing activity.
4. Evaluate the project management techniques to improve overall productivity.

UNIT-I:

Overview of Production & Operations Management (POM): Introduction-Definition-Importance-Historical Development of POM-POM scenario today

Product & Process Design: Role of product development- Product development process-Tools for efficient product development- Determination of process characteristics- Types of processes and operations systems- Continuous –Intermittent-Technology issues in process design- Flexible Manufacturing Systems- Automated Material Handling Systems

UNIT –II:

Value Analysis: Definition-Objectives-Types of Values-Phases- Tools -FAST diagram-Steps-Advantages-Matrix method-Steps.

Plant Location& Plant Layout: Factors affecting locations decisions-Location planning methods-Location factor rating -Centre of Gravity method-Load distance method. Plant layout- Definition-Objectives-Types of layouts-Design of product layout-Line balance-Terminology-RPW method.

UNIT- III:

Aggregate Planning: Definition- Objectives-Basic strategies for aggregate production planning-Aggregate production planning method-Transportation model- Master Production Scheduling. Material Requirement Planning: Terminology-Logic-Lot sizing methods-Advantages & Limitations

UNIT – IV:

Work Study: Work study: method study –definition-objectives-steps-Charts used- Work measurement-Time study- Definition-steps- Determination of standard time- Performance rating- Allowances. Work sampling- steps- comparison with time study.

Quality Management: Economics of quality assurance-Control charts for variables and for attributes – Acceptance sampling plans-Total Quality Management-ISO 9000 series standards-Six sigma

UNIT – V:

Scheduling: Need-basis for scheduling- Scheduling rules- Flow shop & Job shop scheduling. Line of Balance.

Project Management: PERT- Critical path determination- Probability of completing project in a given time- CPM- Types of floats- Critical path determination- Crashing of simple networks- Optimum project schedule.

TEXT BOOKS:

1. Operations Management for Competitive Advantages, Chase Aquinano, TMH, 2009
2. Operations Management: Theory and Practice, B.Mahadevan, Pearson.

REFERENCES:

1. Modern Production and Operations Managemet, Buffa, Wiley
2. Theory and Problems in Production and Operations Management, SN Chary, TMH.
3. Industrial Engineering and Management, Dr.Ravi Shankar, Galgotia Publications.
4. Operations Management 8e Process and Value Chains, Lee Krajewskiet,Pearson

OPERATIONS RESEARCH

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the mathematical models development.
2. Identifying the variables and constraints to suit a mathematic model.
3. Applying the appropriate algorithm to arrive at the solutions of the given systems.
4. Compare the optimization techniques for their exactness vis-a-vis with simulation methods.

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method –Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II

Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment Problem: Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines –two jobs through 'm' machines

UNIT – III

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

Waiting Lines: Introduction –Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

Inventory: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V

Dynamic Programming: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – budget allocation.

Network Scheduling: Critical path method, Programme evaluation and review technique, crashing of networks, resource leveling.

TEXT BOOKS:

1. Operations Research, Wagner, PHI Publications
2. Operations Research, ACS Kumar, Yesdee Publications

REFERENCES:

1. Operations Research, A.M. Natarajan, P. Balasubramaniam, A. Tamilarasi, Pearson.
2. Operation Research, J.K. Sharma, Mac Milan Publications.
3. Operations Research: Methods and Problems, Maurice Saseini, Arhur Yaspan and Lawrence Friedman, Literary Licensing Publishers
4. Introduction to O.R, Hillier & Libermann, TMH

ENERGY CONSERVATION AND MANAGEMENT

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the energy data to carry out audit.
2. Identifying the electrical, thermal and other systems with their energy consumption.
3. Perform energy audit of consumption of industries.
4. Evaluate the energy consumption of units by the economic concepts.

UNIT -I

Introduction

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT- II

Electrical Systems

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT- III

Thermal Systems

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT- IV

Energy Conservation in Major Utilities

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT-V

Economics

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, LifeCycle Costing –ESCO concept

TEXT BOOKS:

1. Industrial Energy Management and Utilisation, Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publ, Washington, 1988.
2. Energy Manager Training Manual (4 Volumes), www.energymanager training.com, A Website Administered By Bureau Of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government Of India, 2004.

REFERENCES:

1. The Efficient Use of Energy, Dryden. I.G.C., Butterworths, London, 1982
2. Energy Management Hand book, Turner. W.C., Wiley, New York, 1982.
3. Design and Management for Energy Conservation, Callaghn, P.W, Pergamon Press, Oxford, 1981.
4. Energy Management, Murphy. W.R. and G. Mc KAY, Butterworths, London 1987.

FLUID POWER SYSTEMS

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the properties fluid and fluid power systems.
2. Apply accessories and valves in the systems for effective functioning.
3. Design and analyze typical hydraulic circuits.
4. Evaluate the systems with different control units.

UNIT-I

Introduction to Oil Hydraulics and Pneumatics: Structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

UNIT-II

Hydraulic Actuators: Types and constructional details, lever systems, control elements direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

UNIT-III

Control Valves and Servo Valves: Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

UNIT-IV

Meter-in & Meter-out Circuits: Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

UNIT-V

Control Systems: Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time-dependent control, combined control, Program Control, Electro-pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

TEXT BOOKS:

1. Fundamentals of Fluid Power Control, John Watton, 1st Ed. Cambridge University Press,
2. Fluid Power Control, Blackburn J. F., G.Reethof, and J. L.Shearer, New York: Technology Press of M. I.T. and Wiley.

REFERENCES:

1. Hydraulic Operation and Control of Machine Tools, Ian Mencal, Ronald Press.
2. Hydraulic and Pneumatic Power for Production, Sterwart, Industrial Press.
3. Fluid Power with Applications, Anthony Esposito, Pearson Education.
4. Fundamentals of Pneumatics/Electro Pneumatics , Hasebrink J.P., and Kobler R., FESTO
5. Didactic publication No. 7301, Esslingen Germany, 1979.

BASIC AUTOMOBILE ENGINEERING

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the basic structure of an automobile and its functioning.
2. Applying a mechanical engineering principles and mechanisms in the constructional features of sub systems of an automobile.
3. Develop the sub systems keeping in view of their effective working and improved performance of automobile
4. Appraise the automobile emission levels at national and international standards.

UNIT – I

Introduction: Types of automobile engines.

S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump, filters, carburetor, types, air filters, petrol injection. M.P.F.I system

C.I. engines: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT - II

Engine Lubrication System: Splash and pressure lubrication systems.

Cooling System: Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system, Radiators: Types, Cooling fans.

UNIT – III

Ignition System: Battery ignition system, Magneto coil ignition system, electronic ignition system. Battery, Contact breakers, Spark plugs.

Electrical System: Charging circuit, generator, current, voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge.

UNIT – IV

Transmission System: Clutches, types-cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches gear boxes, types. Propeller shaft, Hotch- Kiss drive, Torque tube drive.

Suspension System: Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT – V

Steering System: Steering geometry, camber, castor, King pin rake, combined angle toe-in, center point steering.

Braking System: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes.

Emission from Automobiles: Pollution standards National and international, Pollution control Techniques. Noise pollution and controls.

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors Delhi
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication

REFERENCES:

1. Automotive Mechanics , G.B.S.Narang, Khanna Publishers
2. Automotive Mechanics , J.Heitner, CBS Publications
3. Automobile Engineering, William Crouse, TMHILL Publishers.
4. Automotive Engines , Srinivasan, MCgraw-Hill Education (India) Ltd

MATERIAL SCIENCE ENGINEERING

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding basic structure of metals and its relation to properties.
2. Applying the phase rules for building equilibrium diagrams.
3. Analyzing the effect of alloying elements on the microstructure and during heat treatment.
4. Evaluation of the properties of different materials used in various engineering applications.

UNIT – I

Structure of Metals: Bonds in Solids Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys determination of grain size. Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

Equilibrium of Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

UNIT –III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV

Heat Treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – V

Ceramic Materials: Crystalline ceramics, glasses, cermets, abrasive materials, Nanomaterials definition, properties and applications of the above.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C C composites.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avener, Mc Graw Hill
2. Material Science & Metallurgy, Kodgire, Everest Publishing House

REFERENCES:

1. Materials Science, Vijendra Singh, Standard Publishers
2. Material Science & Engineering, V. Rahghavan, PHI
3. Science of Engineering Materials, Agarwal
4. An Introduction To Material Science, W.G.vinas & HL Mancini, Princeton University Press

COMPUTER AIDED DESIGN AND MANUFACTURING LAB

B.Tech IV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understand the usage of relevant software and the syntax of CNC part program.
2. Develop the 2D, 3D models and conduct the analysis.
3. Evaluate the veracity between manual part program and the automated part program.

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting, study of script DXE and IGES FILES.

2. **Part Modeling**: Generation of various 3D Models through protrusion revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling, study of various standard translators, Design simple components.

3. (a) Determination of deflection and stresses in 2D and 3D trusses and beams.

   (b) Determination of deflections component and principal and von-mises stresses in plane stress, plane strain and axisymmetric components.

   (c) Determination of stresses in 3D and shell structures (at least one example in each case)

   (d) Estimation of natural frequencies and mode shapes harmonic response of 2D beam.

   (e) Steady state heat transfer analysis of plane and axisymmetric components.

4. (a) Development of process sheets for various components based on tooling Machines.

   (b) Development of manufacturing and tool management systems.

   (c) Study of various post processors used in NC Machines.

   (d) Determination of CNC part program for turning components and milling components.

Software Packages: SOLIDWORKS, ANSYS, CAM Software

REFERENCES:

1. CAD/CAM: Computer- Aided Design and Manufacturing, Mikell P.Groover, Emory W.Zimmers, Pearson Education India, 1984.
2. CAD/CAM: Theory and Practice, Ibrahim Zeid, R Sivasubramanian, Mc Graw-Hill.

PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION CONTROL SYSTEMS LAB

B.Tech IV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understanding the symbols and their representation on drawings.
2. Calibrate the measuring devices and analyze the errors in measurement.
3. Evaluate the instruments in terms of accuracy and precision.

PRACTICE-I

Conventional representation of materials- conventional representation of parts- screw joints, Springs, Gears, Electrical, Hydraulic and Pneumatic circuits – methods of indicating notes on drawings.

PRACTICE-II

Limits and fits: Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables.

PRACTICE-III

Form and positional Tolerances: introduction and indication of the tolerances of form and position on drawings, deformation of run out and total run out and their indication.

PRACTICE-IV

Surface roughness and its indication: Definitions, finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

PRACTICE-V

Heat treatment and surface treatment symbol used on drawings. Detailed and part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

INSTRUMENTATION CONTROL SYSTEMS LAB:

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for load measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an Engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure

REFERENCES:

1. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
2. Instrumentation, Measurement & Analysis by B.C.Nakra & K.K.Choudhary, TMH

INDUSTRY ORIENTED MINI PROJECT

B.Tech IV Year I Semester

L	T	P	C
0	0	0	3

Course Outcomes:

1. Apply the engineering principles in the execution of a sub system under mechanical engineering domain.
2. Predict and solve the related issues of the sub system.
3. Evaluate the effectiveness of the sub systems the light of technical, ethical and other standards.

The students in a group of 4 to 5 works on an industry oriented topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

PRODUCTION PLANNING & CONTROL

B.Tech IV Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Identify the milestones of production planning.
2. Illustrate the forecasting and its importance in production plan preparation and inventory stocking.
3. Analyze the alternate solutions in the execution stage of routing.
4. Estimate and summarize the aggregate plans of a company

UNIT-I

Introduction- Definitions, objectives of production planning and control- functions of production planning and control-elements of production control- types of production- organization of production planning and control, internal organizations department

UNIT-II

Forecasting - Importance of forecasting, types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III

Inventory Management Functions inventory, Relevant inventory cost, ABC analysis, VED Analysis- EOQ model, Inventory control systems, P- Systems and Q-Systems Introduction to MRP and ERP, Line of balance , JIT inventory, Japanese concepts.

UNIT- IV

Routing – Definition, routing procedure, Route sheets, Bill of material, factors affecting routing procedure. Schedule: Definition, difference with loading. Scheduling polices, techniques, standard scheduling methods, job shop, flow shop. Line balancing, aggregate planning, methods for aggregate planning, Chase planning, expediting, control aspects.

UNIT-V

Dispatching: Activities of dispatcher, dispatching procedure, follow up, definition, reasons for existence of functions, types of follow up, applications of computer in production planning and control

TEXT BOOKS:

1. Production and Operations Management R.Panneer Selvam, PHI.
2. Production Planning and Control& Industrial Management: K.C Jain,L.N.Agarwal-Khanna.

REFERENCES:

1. Operations Management(Theory and Practice), Dipak- Orient Blackswan
2. Operations Management, US.N. Chary I, TMH.
3. Production Planning and Control- Text & cases-SK Mukhopadhyaya, PHI
4. Production Planning and Control: M.Mahajan, Dhanpati ral & Co.

UNCONVENTIONAL MACHINING AND PROCESSES

B.Tech IV Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the difficulties in traditional machining process and the needs for nontraditional machining.
2. Choose the materials and processes for optimum machining responses.
3. Analyze the basic mechanisms and variables in the unconventional machining processes.
4. Summarize the advantages and feasibility considerations while applying the unconventional machining processes.

UNIT–I

Introduction: Need for non-conventional machining processes, Classification of non-conventional machining processes, considerations in process selection, materials, general characteristics and applications of non-conventional machining processes, Historical development.

UNIT–II

Mechanical Material Removal Processes: Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining: Basic principles, components, process variables, advantages and disadvantages, applications.

UNIT–III

Thermal Material Removal Processes: Electro Discharge Machining, Wire EDM, Laser Beam Machining, Electron Beam Machining, and Ion Beam Machining: Basic principles, components, process variables, advantages, limitations and applications.

UNIT–IV

Chemical Material Removal Processes: Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical Deburring: Basic principles, components, process variables, advantages, limitations and applications.

UNIT-V

Electron Beam Machining: Generation and control, Theory of electron beam machining, Comparison of thermal and non-thermal processes. General principle and application of laser beam machining Thermal features, Cutting speed and accuracy of cut.

Plasma Arc Machining: Application of plasma for machining, metal removal mechanism, Process parameters, Accuracy and surface finish and other applications of plasma in manufacturing industries.

TEXT BOOKS:

1. Advanced Machining Processes, VK Jain, Allied publishers.
2. Modern Machining Process, Pandey P.C. and Shah H.S., TMH

REFERENCES:

1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill
2. New Technology by Bhattacharya A, the Institution of Engineers, India 1984.
3. Non Traditional Manufacturing Processes, Gary F Benedict, CRC Press.
4. Non-Traditional Machining, P.K. Mishra, New Age.

TECHNICAL SEMINAR

B.Tech IV Year II Semester

L	T	P	C
3	1	0	2

Course Outcomes

1. Synthesizing information on any one specialized topic from text books, peer revised journals, hand books and other technical resources.
2. Generation a technical seminar report comprising of all relevant information with stipulated standards.
3. Judge the veracity of the topic with various time domains

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his/ her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he/ she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

COMPREHENSIVE VIVA VOCE

B.Tech IV Year II Semester

L	T	P	C
0	0	0	2

Course Outcomes

1. Revise the mechanical engineering principles postulations and other technical information in order to apply in various conditions.
2. Explain the relevance of a technical note for a given application.
3. Collate and justify the design by the acquired comprehensive technical knowledge and skill.

Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department along with an external examiner. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he/she studied during the B. Tech. course of study. The Comprehensive VivaVoce is evaluated by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

MAJOR PROJECT

B.Tech IV Year II Semester

L	T	P	C
0	0	0	10

Course Outcomes

1. Develop a model comprising of real time application in the industry.
2. Design a system under the domain of mechanical engineering.
3. Evaluate for simulation design, analysis and manufacturing facts of the system.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.