JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., Act. No. 30 of 2008)
ANANTHAPURAMU–515 002 (A.P) INDIA

Academic Regulations (R15) for
B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year 2015-2016 onwards)

1. Award of B.Tech. Degree

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

i. Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation.

ii. Registers for 176 credits and secures all 176 credits.

2. Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled.

3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. course for non-autonomous, constituent & affiliated colleges from 2015-16

S.No.	Name of the Branch	Branch Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Electronics and Instrumentation Engineering	10
7.	Information Technology	12

and any other course as approved by the authorities of the University from time to time.

4. Credits:

i. *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 two hours of practical work/field work per week.

ii. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.

iii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses.

iv. Each course is assigned certain number of credits based on following

	Semester	
	Periods / Week	Credits
Theory	03	03
Practical	04	02
Comprehensive Viva-Voce	--	02
Technical Seminar	--	02
Project Work	20/24	10/12

5. Distribution and Weightage of Marks

5.1 The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Comprehensive Viva-Voce & Technical Seminar will be evaluated for 50 marks each and Project work shall be evaluated for 200 marks whereas audit courses shall be evaluated for a maximum of 30 internal marks.

i. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
ii. For practical subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.

5.2. Internal Examinations:

i. For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination consists of objective paper for 10 marks and subjective paper for 20 marks with duration of 1hour 50 minutes (20 minutes for objective and 90 minutes for subjective paper).

Objective paper shall be set for maximum of 20 bits for 10 marks. Subjective paper shall contain 5 questions of which student has to answer 3 questions evaluated* for 20 marks.
***Note 1:** The subjective paper shall contain 5 questions of equal weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 20 marks, any fraction (0.5 & above) shall be rounded off to the next higher mark.
***Note 2:** The midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall. Then the descriptive question paper and the answer booklet shall be distributed. After 90 minutes the answered booklets are collected back.

If the student is absent for the internal examination, no re-exam shall be conducted and internal marks for that examination shall be considered as zero.

First midterm examination shall be conducted for I, II units of syllabus and second midterm examination shall be conducted for III, IV and V units.

Final Internal marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage to the better mid exam and 20% to the other.

For eg:

Marks obtained in first mid : 25
Marks obtained in second mid : 20
Final Internal Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For eg:

Marks obtained in first mid : Absent
Marks obtained in second mid : 25
Final Internal Marks: (25x0.8)+ (0x0.2) =20

5.3. End Examinations:

i. End examination of theory subjects shall have the following pattern:

a. There shall be 6 questions and all questions are compulsory.
b. Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.
c. In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
d. Each of these questions from 2 to 6 shall cover one unit of the syllabus.

ii. End examination of theory subjects consisting of two parts of different subjects, for eg: Electrical & Mechanical Technology, shall have the following pattern:

a. Question paper shall be in two parts viz., Part A and Part B with equal Weightage.
b. In each part, there shall be 3 either-or type questions for 12, 12 and 11 marks.

Note: The answers for Part A and Part B shall be written in two separate answer books.

5.4. For practical subjects there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the laboratory shall be evaluated for 30 marks by the concerned laboratory teacher based on the regularity/record/ viva. The end examination shall be conducted by the concerned laboratory teacher and senior expert in the same subject of the department.

In a practical subject consisting of two parts (Eg: Electrical & Mechanical Lab), the end examination shall be conducted for 35 marks in each part. Internal examination shall be evaluated as above for 30 marks in each part and final internal marks shall be arrived by considering the average of marks obtained in two parts.

5.5. There shall be an audit pass course in Social Values & Ethics and Advanced English Language Communication skills lab with no credits. There shall be no external examination. However, attendance in the audit course shall be considered while calculating aggregate attendance and student shall be declared pass in the audit course only when he/she secures 40% or more in the internal examinations. In case if student fails, re-exam shall be conducted for failed candidates every six months/semester at a mutual convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

5.6. For the subject having design and/or drawing, such as Engineering Drawing, the distribution shall be 30 marks for internal evaluation and 70 marks for end examination.

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a

semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 5 questions of equal weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 15 marks, any fraction (0.5 & above) shall be rounded off to the next higher mark. There shall be no objective paper in internal examination. The sum of day to day evaluation and the internal test marks will be the final sessional marks for the subject.

In the end examination pattern for Engineering Drawing there shall be 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing is mentioned along with the syllabus.

5.7 There shall be two comprehensive online examinations conducted by the respective colleges, one at the end of II year and the other at the end of III year, with 100 objective questions for 100 marks on the subjects studied in the respective semesters. For each subject at least eight questions are to be framed. The Principals of the respective colleges are given the responsibility of preparing question bank/question paper and conducting the online examination maintaining confidentiality. A student shall acquire 1 credit assigned to each of the comprehensive online examination when he/she secures 40% or more marks. In case, if a student fails in comprehensive online examination, he/she shall reappear/re-register by following a similar procedure adopted for the lab examinations.

5.8 Laboratory marks and the sessional marks awarded by the college are not final. They are subject to scrutiny and scaling by the University wherever necessary. In such cases, the sessional and laboratory marks awarded by the college will be referred to a committee. The committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding.

5.9 The laboratory records and internal test papers shall be preserved for a minimum of 2 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

5.10. There shall be a Discipline Centric Elective Course through **Massive Open Online Course (MOOC)** in III year I semester and in IV year II semester. Where in the student shall register the course (Minimum of 40 hours) offered by authorized institutions/Agencies, through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered and the mentor appointed shall conduct the internal examinations following the guidelines given in 5.2. Further, the University shall conduct the external examination for the MOOC subject in line with other regular subjects (5.3) based on the syllabi of the respective subject provided in the curriculum. MOOCs courses may be studied either in MOOCs manner or in conventional manner.

5.11. There shall be an Open Elective/**Choice Based Credit Course (CBCC)** in III year II semester, where in the students have to choose an elective offered by various departments including his/her own department.

5.12. **Minor in a discipline** (Minor degree/programme) concept is introduced in the curriculum for all conventional B. Tech programmes in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme. In order to earn a Minor in a discipline a student has to earn 20 extra credits by studying four theory subjects and a minor discipline project.

a. Students who have a CGPA 8.5 (for SC/ST students CGPA 8.0) or above (up to II year-I semester) and without any backlog subjects will be permitted to register for Minor discipline programme. An SGPA and CGPA of 8.0 has to be maintained in the subsequent semesters without any backlog

subjects in order to keep the Minor discipline registration active else Minor discipline registration will be cancelled.

b. Students aspiring for a Minor must register from **third** year **first** semester onwards and must opt for a Minor in a discipline other than the discipline he/she is registered in. However, Minor discipline registrations are not allowed in the **Fourth** year.
c. Students are not allowed to register and pursue more than two subjects in any semester. Students may register for minor discipline project from **third** year **first** semester onwards and may complete the same before **fourth** year **second** semester.
d. Each department enlisted a set of subjects from its curriculum which are core for the discipline without any prerequisites. The Evaluation pattern of theory subjects and minor discipline project work will be similar to the regular programme evaluation. The minor discipline project shall be evaluated by the committee consisting of Head of the Department along with the two senior faculty members of the department.
e. Students are not allowed to pursue minor discipline programme subjects under Self study and/or MOOCs manner.
f. Student may enlist their choices of Minor discipline programmes in order of preference, to which they wish to join. It will not be permissible to alter the choices after the application has been submitted. However, students are allowed to opt for only one Minor discipline programme in the order of preference given by the student.
g. Minimum strength for offering Minor in a discipline is considered as One-Fifth (i.e., 20% of the class) of the class size and Maximum size would be Four-Fifth of Class size (i.e., 80% of the class).
h. Completion of a Minor discipline programme requires no addition of time to the regular Four year Bachelors' programme. That is, Minor discipline programme should be completed by the end of final year B. Tech. program along with the major discipline.
i. The Concerned Principal of the college will arrange separate course/class work and time table of the various Minor programmes. Attendance regulations for these Minor discipline programmes will be as per regular courses.
j. Reservations shall be followed as per state government of Andhra Pradesh i.e., State-wide Universities Presidential Order 371 Article D in consonance to Section 95 of the A.P. Reorganization Act, 2014 for admissions to Minor discipline programmes.
k. A Student registered for Minor in a discipline and pass in all subjects that constitute the requirement for the Minor discipline programme. No class/division (i.e., second class, fist class and distinction etc.) shall be awarded for Minor discipline programme.
l. This Minor in a discipline will be mentioned in the degree certificate as Bachelor of Technology in XXX with Minor in YYY. For example, Bachelor of Technology in **Computer Science & Engineering** with Minor in **Electronics & Communication Engineering**. The fact will also be reflected in the transcripts, along with the list of courses and a project taken for Minor programme with CGPA mentioned separately.

5.13. A mini project on **Water Resource Engineering** is introduced for 2 credits in the B. Tech Civil Engineering curriculum. It is introduced at the end of III Year II semester i.e., during summer vacation for at least 15 days period on topics of Water Resource Engineering. Topics can be found in the Civil Engineering curriculum. This shall be evaluated at the beginning of IV Year by a committee consisting of Head of Civil Engineering Department along with two senior faculty members of the department.

5.14. There shall be a **Technical 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/her understanding about the topic and submit to the department before presentation. The report and the presentation shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar shall be evaluated for 50 marks. A student shall acquire 2 credits assigned to the seminar when he/she secures 40% or more marks for the total of 50 marks. In case, if a student fails in seminar he/she shall reappear as and

when IV/II supplementary examinations are conducted. The seminar shall be conducted anytime during the semester as per the convenience of the department committee and students. There shall be no external examination for seminar.

5.15. There shall be a **Comprehensive Viva–Voce** in IV year II Semester. The Comprehensive viva-voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the department. The Comprehensive Viva–voce is aimed to assess the students' understanding in various subjects he/she studies during the B. Tech. course of study. The Comprehensive Viva-Voce shall be evaluated for 50 marks by the committee. There are no internal marks for the Comprehensive Viva-Voce. A student shall acquire 2 credits assigned to the Comprehensive Viva–voce when he/she secures 40% or more marks for the total of 50 marks. In case, if a student fails in Comprehensive Viva–voce he/she shall reappear as and when IV/II supplementary examinations are conducted. The Comprehensive Viva–voce shall be conducted anytime during the semester as per the convenience of the department committee and students. There shall be no external examination for Comprehensive Viva–Voce.

5.16. Out of a total of 200 marks for the **Project Work**, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination (Viva-voce). The Viva-Voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the University**.** Project work shall start in IV-I and shall continue in the semester break. The evaluation of project work shall be conducted at the end of the IV year–II semester. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty members of the department), on the basis of two seminars given by each student on the topic of his/her project.

6. Attendance Requirements:

6.1. A student shall be eligible to appear for University examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

6.2. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

6.3. Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

6.4. A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

6.5. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

6.6. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.

7. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

7.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together. In case of audit courses and technical seminar & comprehensive viva – voce he/she should secure 40% of the total marks.

7.2 A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits **(25 credits)** in the subjects that have been studied up to II year I semester

from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and one supplementary examinations of I year (I & II Semesters).
One regular examination of II year I semester

7.3 A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits **(43 credits)** in the subjects that have been studied up to III year I semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

One regular and four supplementary examinations of I year I Semester.
One regular and three supplementary examinations of I year II Semester.
One regular and two supplementary examinations of II year I Semester.
One regular and one supplementary examinations of II year II Semester.
One regular examination of III year I Semester.

And in case if student is detained for want of credits for particular academic year by sections 7.2 and 7.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the III Year or IV Year as the case may be.

7.4 A student shall register and put up minimum attendance in all 176 credits and earn all the 176 credits. Marks obtained in all 176 credits shall be considered for the calculation of aggregate percentage of marks obtained.

7.5 Students who fail to earn 176 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

8. Course Pattern:

8.1 The entire course of study is for four academic years. All years shall be on semester pattern.

8.2 A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

8.3 When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

9. With–holding of Results:

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

10. Grading

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade points Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i. A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains 'Ab' in end examination.

ii. For **audit** courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

10.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

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 S, A, B, C, D, E and F.

11. Award of Class:

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 classes

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

12. Gap Year:

Gap year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee shall be constituted by the University to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

13. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will be in the academic regulations into which the candidate is presently rejoining.

14. Minimum Instruction Days:

The minimum instruction days including exams for each semester shall be 90 days.

15. Medium of Instruction

The Medium of Instruction is **English** for all courses, laboratories, internal and external examinations, Comprehensive Viva-Voce, seminar presentations and project reports.

16. Student Transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the University from time to time.

17. General:

a. The academic regulations should be read as a whole for purpose of any interpretation.

b. Malpractices rules-nature and punishments are appended.

c. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

e. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.

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ACADEMIC REGULATIONS FOR B. TECH.(R15)
(LATERAL ENTRY SCHEME)

(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year 2016-2017and onwards)

1. Award of B.Tech. Degree

A student admitted in Lateral Entry Scheme (LES) will be declared eligible for the award of the B.Tech degree if he fulfills the following academic regulations:

a) Pursues a course of study for not less than three academic years and in not more than six academic years.

b) Registers for *134* credits and secures all *134* credits from II to IV year of Regular B. Tech. program.

2. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.

3. The regulations **3** to **6** are to be adopted as that of B. Tech. (Regular).

7. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.**6**

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together. For the Seminar & Comprehensive viva-voce he should secure 40% in the internal evaluation.

ii. A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of 26 *(40%)* credits from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.
   a. One regular and Two supplementary examinations of II year I semester.
   b. One regular and one supplementary examinations of II year II semester.
   c. One regular examination of III year I semester.

And in case if student is already detained for want of credits for particular academic year , the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

8. Course Pattern

8.1. The entire course of study is three academic years on semester pattern.

8.2. A student eligible to appear for the end examination in a subject, but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

8.3. When a student is detained due to lack of credits/shortage of attendance he may be re-admitted when the semester is offered after fulfillment of academic regulations, he shall be in the academic regulations into which he is readmitted.

9. The regulations **9** to **10** are to be adopted as that of B. Tech. (Regular).

11. Award of Class:

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 classes:

First Class with Distinction	70% and above	From the aggregate marks secured for 134 Credits (i.e. II year to IV year)
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	

12. The regulations **12** to **16** are to be adopted as that of B. Tech. (Regular). All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

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RULES FOR
DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, 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) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(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.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
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.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
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.	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. The candidate is also debarred for two consecutive semesters from class work and all University

		examinations. 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 marks.	Cancellation of the performance in that subject only.
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.	In case of students of the college, they shall 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. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. 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.	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. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all 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. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all 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. The candidate is also debarred and forfeits the seat.Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
11.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all 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.

12.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee**.**
13.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
3. A show cause notice shall be issued to the college.
4. Impose a suitable fine on the college.
5. Shifting the examination centre from the college to another college for a specific period of not less than one year.

Note: -

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., Act. No. 30 of 2008)

ANANTHAPURAMU – 515 002 (A.P.) INDIA.

Course Structure for B.Tech-R15 Regulations

Mechanical Engineering

B.Tech I – I Semester (ME)

S.No	Course code	Subject	L	T	P	C
1.	15A52101	Functional English	3	1	-	3
2.	15A54101	Mathematics – I	3	1	-	3
3.	15A05101	Computer Programming	3	1	-	3
4.	15A51101	Engineering Chemistry	3	1	-	3
5.	15A01101	Environmental Studies	3	1	-	3
6.	15A52102	English Language Communication Skills Lab	-	-	4	2
7.	15A51102	Engineering Chemistry Lab	-	-	4	2
8.	15A05102	Computer Programming Lab	-	-	4	2
		Total	15	5	12	21

I-II Semester

S.No	Course code	Subject	L	T	P	Drg	C
1.	15A52201	English for Professional Communication	3	1	-	-	3
2.	15A54201	Mathematics – II	3	1	-	-	3
3.	15A03201	Material Science and Engineering	3	1	-	-	3
4.	15A56101	Engineering Physics	3	1	-	-	3
5.	15A03101	Engineering Drawing	-	-	-	6	3
6.	15A03202	Material Science and Engineering Lab	-	-	4	-	2
7.	15A56102	Engineering Physics Lab	-	-	4	-	2
8.	15A99201	Engineering & IT Workshop	-	-	4	-	2
		Total	12	4	12	6	21

* L - Lecture hours
*T - Tutorial hours
*P - Practical hours
*Drg - Drawing
*C - Credits

II B. Tech – I Sem

S.No.	Course Code	Subject	L	T	P	C
1	15A54301	Mathematics - III	3	1	-	3
2	15A52301	Managerial Economics & Financial Analysis	3	1	-	3
3	15A01308	Mechanics of Solids	3	1	-	3
4	15A03301	Engineering Drawing for Mechanical Engineers	3	1	-	3
5	15A03302	Engineering Mechanics	3	1	-	3
6	15A03303	Thermodynamics	3	1	-	3
7	15A01309	Mechanics of Solids Lab	-	-	4	2
8	15A03304	Computer Aided Drafting Lab	-	-	4	2
		Total	18	06	08	22

II B. Tech – II Sem

S.No.	Course Code	Subject	L	T	P	C
1	15A54401	Probability and Statistics	3	1	-	3
2	15A99301	Basic Electrical and Electronics Engineering	3	1	-	3
3	15A03401	Machine Drawing	3	1	-	3
4	15A03402	Kinematics of Machines	3	1	-	3
5	15A03403	Thermal Engineering – 1	3	1	-	3
6	15A03404	Manufacturing Technology	3	1	-	3
7	15A03405	Thermal Engineering Laboratory	-	-	4	2
8	15A03406	Manufacturing Technology Laboratory	-	-	4	2
9	15A03407	Comprehensive Online Examination-I	-	-	-	1
		Total	18	06	08	23

B.Tech III-I Semester (ME)

S. No.	Course Code	Subject	L	T	P	C
1.	15A01510	Fluid Mechanics and Hydraulic Machines	3	1	-	3
2.	15A03501	Thermal Engineering - II	3	1	-	3
3.	15A03502	Dynamics of Machinery	3	1	-	3
4.	15A03503	Machine Tools	3	1	-	3
5.	15A03504	Design of Machine Members - I	3	1	-	3
6.	15A03505 15A03506 15A03507	MOOCS -I a. Entrepreneurship b. Nano Technology c. Micro Electro Mechanical Systems	3	1	-	3
7.	15A01511	Fluid Mechanics and Hydraulic Machines Laboratory	-	-	4	2
8.	15A03508	Machine Tools Laboratory	-	-	4	2
9.	15A99501	Audit course – Social Values & Ethics	2	0	2	0
		Total	20	6	10	22

B.Tech III-II Semester (ME)

S. No.	Course Code	Subject	L	T	P	C
1.	15A03601	Operations Research	3	1	-	3
2.	15A03602	Design of Machine Members – II	3	1	-	3
3.	15A03603	Heat Transfer	3	1	-	3
4.	15A03604	Finite Element Method	3	1	-	3
5.	15A03605	Metal forming Process	3	1	-	3
6.	15A03606 15A03607 15A03608 15A01608	CBCC-I a. Non Conventional Source of Energy b. Total Quality Management c. Mechatronics d. Intellectual Property Rights	3	1	-	3
7.	15A03609	Heat Transfer Laboratory	-	-	4	2
8.	15A03610	Computer Aided Engineering Laboratory	-	-	4	2
9.	15A52602	Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)			2	-
10.	15A03611	Comprehensive Online Examination - II	-	-	-	1
		Total	18	6	11	23

B.Tech IV-I Semester (ME)

S. No.	Course Code	Subject	L	T	P	C
1.	15A52601	Management Science	3	1	-	3
2.	15A03701	Automobile Engineering	3	1	-	3
3.	15A03702	CAD/CAM	3	1	-	3
4.	15A03703	Metrology and Measurements	3	1	-	3
5.	15A03704 15A03705 15A03706	CBCC-II a. Refrigeration and Air – Conditioning b. Tool Design c. Modern Manufacturing Methods	3	1	-	3
6.	15A03707 15A03708 15A03709	CBCC-III a. Computational Fluid Dynamics b. Automation and Robotics c. Production & Operations Management	3	1	-	3
7.	15A03710	CAD/ CAM Laboratory	-	-	4	2
8.	15A03711	Metrology and Measurements Laboratory	-	-	4	2
		Total	18	6	8	22

B.Tech IV-II Semester (ME)

S. No.	Course Code	Subject	L	T	P	C
1.	15A03801 15A03802 15A03803	MOOCS-II a. Industrial Engineering b. Product Design c. Composite Materials	3	1	0	3
2.	15A03804 15A03805 15A03806	MOOCS -III a. Power Plant Engineering b. Gas Turbines and Jet Propulsion c. Energy Management	3	1	0	3
3.	15A03807	Comprehensive Viva Voce	0	0	4	2
4.	15A03808	Technical Seminar	0	0	4	2
5.	15A03809	Project work	0	0	24	12
		Total	6	2	32	22

Minor Discipline in ME

S. No.	Course Code	Subject	L	T	P	C
1	15A03303	Thermodynamics	3	1	-	3
2	15A03403	Thermal Engineering-I	3	1	-	3
3	15A03501	Thermal Engineering-II	3	1	-	3
4	15A03603	Heat Transfer	3	1	-	3
5	15A03101	Minor Discipline Project	-	-	-	8
		Total	12	4	-	20

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A52101) FUNCTIONAL ENGLISH

(Common to All Branches)

Preamble:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, and advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

Objectives:

- To enable the students to communicate in English for academic and social purpose.
- To enable the students to acquire structure and written expressions required for their profession.
- To develop the listening skills of the students.
- To inculcate the habit of reading and critical thinking skills.
- To enhance the study skills of the students with emphasis on LSRW skills.

UNIT –I

Topics: Paragraph writing, writing letters, role play, reading graphs, prepositions, designing posters, tenses, making recommendations.

Text: ENVIRONMENTAL CONSCIOUSNESS' from *MINDSCAPES*
Climate Change - Green Cover – Pollution

UNIT –II

Topics: Compound nouns, imperatives, writing instructions, interpreting charts and pictures, note making, role play, prefixes, subject-verb agreement.

Text: EMERGING TECHNOLOGIES from *MINDSCAPES*
Solar Thermal Power - Cloud Computing - Nanotechnology

UNIT –III

Topics: Making conversations, homonyms and homophones, SMS and use of emotions, past participle for irregular verbs, group discussion, E - mail communication, antonyms, Preparing projects

Text: GLOBAL ISSUES from *MINDSCAPES*
Child Labour - Food Crisis - Genetic Modification - E-Waste - Assistive Technology

UNIT –IV

Topics: Group discussion, affixes, double consonants, debates, writing a book / film review, predicting and problem-solving-future tense, adverbs

Text: SPACE TREK from *MINDSCAPES*
Hubble Telescope - Chandrayan-2 - Anusat - Living Quarters - Space Tourism

UNIT –V

Topics: Compare and contrast, effective writing, group discussion, writing reports, writing advertisements, tweeting and blogging, types of interviews, framing questions.

Text: MEDIA MATTERS from *MINDSCAPES*
History of Media - Language and Media - Milestone in Media - Manipulation by Media - Entertainment Media - Interviews

Text Books:

1. MINDSCAPES: English for Technologists and Engineers, Orient Blackswan, 2014.

References:

1. A Practical Course in Effective English Speaking Skills by J.K.Gangal, PHI Publishers, New Delhi.2012
2. Technical Communication, Meenakshi Raman, Oxford University Press,2011.
3. Spoken English, R.K. Bansal & JB Harrison, Orient Longman,2013, 4Th edition.
4. Murphy's English Grammar with CD, Murphy, Cambridge University Press,3 Rd edition.
5. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO,2008.

Outcomes:

- Have improved communication in listening, speaking, reading and writing skills in general.
- Have developed their oral communication and fluency in group discussions and interviews.
- Have improved awareness of English in science and technology context.
- Have achieved familiarity with a variety of technical reports.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A54101) MATHEMATICS – I

(Common to All Branches)

Objectives:

- To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications.
- To prepare students for lifelong learning and successful careers using mathematical concepts of differential and Integral calculus, ordinary differential equations and vector calculus.
- To develop the skill pertinent to the practice of the mathematical concepts including the students abilities to formulate and modeling the problems, to think creatively and to synthesize information.

UNIT – I

Exact, linear and Bernoulli equations, Applications to first order equations; Orthogonal trajectories, Simple electric circuits.

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x).

UNIT – II

Method of variation of parameters, linear equations with variable coefficients: Euler-Cauchy Equations, Legendre's linear equation. Applications of linear differential equations- Mechanical and Electrical oscillatory circuits and Deflection of Beams.

UNIT – III

Taylor's and Maclaurin's Series - Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrange's method of undetermined Multipliers with three variables only. Radius of curvature.

UNIT – IV

Multiple integral – Double and triple integrals – Change of Variables – Change of order of integration. Applications to areas and volumes in Cartesian and polar coordinates using double and triple integral.

UNIT – V

Vector Calculus: Gradient – Divergence – Curl and their properties; Vector integration – Line integral - Potential function – Area – Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss's Divergence Theorem (Without proof). Application of Green's, Stoke's and Gauss's Theorems.

Text Books:

1. Engineering Mathematics-I, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher
2. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.

References:

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Outcomes:

- The students become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems.
- The students attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A05101) COMPUTER PROGRAMMING

(Common to All Branches)

Objectives:

- Understand problem solving techniques
- Understand representation of a solution to a problem
- Understand the syntax and semantics of C programming language
- Understand the significance of Control structures
- Learn the features of C language

UNIT - I

Overview of Computers and Programming - Electronic Computers Then and Now - Computer Hardware - Computer Software - Algorithm - Flowcharts - Software Development Method - Applying the Software Development Method.

Types, Operators and Expressions: Variable Names - Data Types and Sizes - Constants - Declarations - Arithmetic Operators - Relational and Logical Operators - Type Conversions - Increment and Decrement Operators - Bitwise Operators - Assignment Operators and Expressions - Conditional Expressions - Precedence and Order of Evaluation.

UNIT - II

Selections Statements – Iteration Statements – Jump Statements- Expression Statements - Block Statements.

Single Dimensional Arrays – Generating a Pointer to an Array – Passing Single Dimension Arrays to Functions – Strings – Two Dimensional Arrays – Indexing Pointers – Array Initialization – Variable Length Arrays

UNIT - III

Pointer Variables – Pointer Operators - Pointer Expressions – Pointers And Arrays – Multiple Indirection – Initializing Pointers – Pointers to Functions – C's Dynamic Allocation Functions – Problems with Pointers.

Understanding the scope of Functions – Scope Rules – Type Qualifiers – Storage Class Specifiers- Functions Arguments –The Return Statement.

UNIT - IV

Command line arguments – Recursion – Function Prototypes – Declaring Variable Length Parameter Lists

Structures – Arrays of Structures – Passing Structures to Functions – Structure Pointers – Arrays and Structures within Structures – Unions – Bit Fields – Enumerations – typedef

UNIT - V

Reading and Writing Characters – Reading and Writing Strings – Formatted Console I/O – Printf - Scanf – Standard C Vs Unix File I/O – Streams and Files – File System Basics – Fread and Fwrite – Fseek and Random Access I/O – Fprintf ( ) and Fscanf( ) – The Standard Streams – The Preprocessor Directives #define and #include.

Text Books:

1. "The Complete Reference C"- Fourth Edition- Herbert Schildt- McGrawHill Eduction.
2. "The C Programming Language" Second Edition- Brain W. Kernighan- Dennis M. Ritchie- Prentice Hall-India. (UNIT- I)

References:

1. Programming in C, Second Edition – Pradip Dey, Manas Ghosh, Oxford University Press.
2. "C From Theory to Practice"- George S. Tselikis- Nikolaos D. Tselikas- CRC Press.
3. "Programming with C"- R S Bichkar- University Press.
4. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education. (UNIT-I)
5. Computer Fundamentals and C Programming- Second Edition- P.Chenna Reddy- Available at Pothi.com (http://pothi.com/pothi/book/dr-p-chenna-reddy-computer-fundamentals-and-c-programming).

Outcomes:

- Apply problem solving techniques in designing the solutions for a wide-range of problems
- Choose appropriate control structure depending on the problem to be solved
- Modularize the problem and also solution

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A51101) ENGINEERING CHEMISTRY

(Common to ECE/EIE/ME/IT)

Objectives:

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand the concepts of chemistry and apply to various materials for engineering applications.

UNIT – I WATER QUALITY AND TREATMENT

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching powder, ozonisation)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralisation of brackish water: Reverse Osmosis and Electrodialysis

UNIT – II POLYMERS

i)Introduction: Basic concepts of polymerisation, Types of poloymerisation (Chain Growth (Addition), Step growth (Condensation)), Mechanism: cationic, anionic, free radical and coordination covalent.

Plastomers: Thermosetting and Thermoplatics, Preparation, properties and Engineering applications of PVC, Teflon, Bakelite and nylons.

Elastomers

Natural Rubber; Processsing of natural rubbers, Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, Buna-N, Polyurethene, Polysulfide (Thiokol) rubbers

ii) Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline.

iii) Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications

UNIT – III ELECTROCHEMISTRY

i) Galvanic cells, Nernest Equation, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries),Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen, Solid oxide)

ii) Corrosion: Introduction, type of corrosion (Concentration cell corrosion, Galvanic corrosion), Chemical (Dry) and Electrochemical (Wet) Theory of corrosion. Galvanic series, factors affecting the corrosion (Metal and environment). Prevention: Cathodic protection (Sacrificial anode and impressed current), Inhibitors (Anodic and cathodic), electroplating (Copper, nickel and chromium) and electroless plating (Copper and nickel)

UNIT – IV FUELS AND COMBUSTION

Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.

Solid Fuels: Coal-Classification and Analysis (proximate and ultimate), Coke :Characteristics of metallurgical coke, Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.

Liquid Fuels:

Petroleum: Refining of Petroleum, Gasoline- Octane Number, Diesel -Cetane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis

Power Alcohol: Manufacture, Advantages and Disadvantages of Power Alcohol

Gaseous Fuels: Natural gas, Producer gas, Water gas, Coal gas and Biogas. Determination calorific value of Gases fuels by Junker's calorimeter.

Combustion: Basic principles and numerical problems, Flue Gas analysis by Orsat's apparatus.

UNIT – V CHEMISTRY OF ENGINEERING MATERIALS

i) Cement: Composition, Classification, preparation (Dry and Wet processes), Setting and Hardening (Hydration and Hydrolysis)

ii) Refractories: Introduction, Classification , properties and applications

iii) Lubricants: Introduction, classification (Solid, liquid, semi solid, emulsion and synthetic),Theory of lubrication (Thin film, Thick film & Extreme pressure) , properties of lubricants and applications.

iv) Carbon clusters: Fullerenes and Carbon Nano Tubes (CNT)

Text Books:

1. Engineering Chemistry, First Edition, Jayaveera KN, Subba Reddy GVand Ramachandraiah C, McGraw Hill Higher Education, New Delhi, 2013.

2. A Text Book of Enigneering Chemistry, 15th Edition, Jain and Jain, Dhanapathi Rai
Publications, New Delhi, 2013.

References:

1. A Text book of Engineering Chemistry, 12th Edition, SS Dhara,Uma, S. Chand Publications, New Delhi, 2010.
2. Engineering Chemistry, First edition, K.B. Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Publications India Pvt Limited, 2010.
3. Engineering Chemistry, First edition, Seshamaheswaramma K and Mridula Chugh, Pearson Education, 2013.

Outcomes: The student is expected to:

- Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.
- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A01101) ENVIRONMENTAL STUDIES

(Common to ECE/EIE/ME/IT)

Objectives:

To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

UNIT – I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Text Books:

1. Text Book of Environmental Studies for Undergraduate Cources, Erach Bharucha, Universities Press Pvt Ltd, Hyderabad. 2nd Edition 2013.
2. Environmental Studies by Kaushik, New Age Pubilishers.

References:

1. Environmental Studies by Rajagopalan, Oxford Pubilishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

Outcomes:

- Students will get the sufficient information that will clarify modern environmental concepts like equitableuse of natural resources, more sustainable life styles etc.
- Students will realize the need to change their approach so as to perceive our own environmental issuescorrectly, using practical approach based on observation and self learning.
- Students become conversant with the fact that there is a need to create a concern for our environment thatwill trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
- By studying environmental sciences, students is exposed to the environment that enables one to find out solution of various environmental problems encountered on and often.
- At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted. This will enable every human being to live in a more sustainable manner.

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(15A52102) ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB

(Common to All Branches)

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives:

- To enable students to learn better pronunciation through stress on word accent, intonation, and rhythm.
- To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

UNIT - 1

1. Phonetics -importance
2. Introduction to Sounds of Speech
3. Vowels and consonants sounds
4. Phonetic Transcription

UNIT - II

5. Word Stress
6. Syllabification
7. Rules of word stress
8. Intonation

UNIT - III

9. Situational Dialogues
10. Role Plays
11. JAM
12. Describing people/objects/places

UNIT - IV

13. Debates
14. Group Discussions
15. Interview skills

UNIT - V

16. Video speech writing
17. Book reviews -oral and written

Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.
   System Requirement (Hardware component):

   Computer network with LAN with minimum 60 multimedia systems with the following specifications:

   i) P – IV Processor
      a) Speed – 2.8 GHZ
      b) RAM – 512 MB Minimum
      c) Hard Disk – 80 GB
   ii) Headphones of High quality

Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.

References:

1. A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian),2012.
2. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd
3. Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. A Hand book for English Laboratories, E.Suresh Kumar, P.Sreehari, Foundation Books,2011
5. Spring Board Succes, Sharada Kouhik, Bindu Bajwa, Orient Blackswan, Hyderbad, 2010.

Outcomes:

- Become active participants in the learning process and acquire proficiency in spoken English.
- Speak with clarity and confidence thereby enhance employability skills.

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(15A51102) ENGINEERING CHEMISTRY LAB

(Common to ECE/EIE/ME/IT)

Objectives:

- Will learn practical understanding of the redox reaction
- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology.

List of Experiments:

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler's method
4. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
5. Determination of Alkalinity of Water
6. Determination of acidity of Water
7. Preparation of Phenol-Formaldehyde (Bakelite)
8. Determination of Viscosity of oils using Redwood Viscometer I
9. Determination of Viscosity of oils using Redwood Viscometer II
10. Determination of calorific value of gaseous fuels by Junker's Calorimeter
11. Conductometric estimation of strong acid using standard sodium hydroxide solution

12. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.

13. Potentio metric determination of iron using standard potassium dichromate

14. Colorometric estimation of manganese.

15. pH meter calibration and measurement of pH of water and various other samples.

(Any 10 experiments from the above list)

References:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – Mendham J et al, Pearson Education, 2012.
2. Chemistry Practical– Lab Manual, First edition, Chandra Sekhar KB, Subba Reddy GV and Jayaveera KN, SM Enterprises, Hyderabad, 2014.

Outcomes:

- Would be confident in handling energy storage systems and would be able combat chemical corrosion
- Would have acquired the practical skill to handle the analytical methods with confidence.
- Would feel comfortable to think of design materials with the requisite properties
- Would be in a position to technically address the water related problems.

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(15A05102) COMPUTER PROGRAMMING LAB

(Common to All branches)

Objectives:

- Learn C Programming language
- To make the student solve problems, implement algorithms using C language.

List of Experiments/Tasks

1. Practice DOS and LINUX Commands necessary for design of C Programs.
2. Study of the Editors, Integrated development environments, and Compilers in chosen platform.
3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.
4. Practice programs: Finding the sum of three numbers, exchange of two numbers, maximum of two numbers, To read and print variable values of all data types of C language, to find the size of all data types, to understand the priority and associativity of operators using expressions, to use different library functions of C language.
5. Write a program to find the roots of a Quadratic equation.
6. Write a program to compute the factorial of a given number.
7. Write a program to check whether the number is prime or not.
8. Write a program to find the series of prime numbers in the given range.
9. Write a program to generate Fibonacci numbers in the given range.
10. Write a program to find the maximum of a set of numbers.
11. Write a program to reverse the digits of a number.
12. Write a program to find the sum of the digits of a number.
13. Write a program to find the sum of positive and negative numbers in a given set of numbers.
14. Write a program to check for number palindrome.
15. Write a program to evaluate the sum of the following series up to 'n' terms $e^{x}=1+x+x^2/2!+x^3/3!+x^4/4!+$--------
16. Write a program to generate Pascal Triangle.
17. Write a program to read two matrices and print their sum and product in the matrix form.
18. Write a program to read matrix and perform the following operations.
    i. Find the sum of Diagonal Elements of a matrix.
    ii. Print Transpose of a matrix.

iii. Print sum of even and odd numbers in a given matrix.

19. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters.
20. Write a program to insert a substring in to a given string and delete few characters from the string. Don't use library functions related to strings.
21. Write a program to perform the operations addition, subtraction, multiplication of complex numbers.
22. Write a program to split a 'file' in to two files, say file1 and file2. Read lines into the 'file' from standard input. File1 should consist of odd numbered lines and file2 should consist of even numbered lines.
23. Write a program to merge two files.
24. Write a program to implement numerical methods Lagrange's interpolation, Trapezoidal rule.
25. Write a program to read a set of strings and sort them in alphabetical order.
26. Write a program to read two strings and perform the following operations without using built-in string Library functions and by using your own implementations of functions.
    i. String length determination ii .Compare Two Strings
    iii. Concatenate them, if they are not equal iv. String reversing
27. Write programs using recursion for finding Factorial of a number, GCD, LCM, and solving Towers of Hanoi problem.
28. Write a program to exchange two numbers using pointers.
29. Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per JNTUA rules. Write the first class, second class, third class and failed students lists separately to another file.
30. A file consists of information about employee salary with fields employeeid, name, Basic, HRA, DA, IT, other-deductions, Gross and Net salary. Initially only employeeid, name, and basic have valid values. HRA is taken as 10% of the basic, DA is taken as 80% of basic, IT is 20% of the basic, other deductions is user specified. Compute the Gross and Net salary of the employee and update the file.
31. Write a program to perform Base (decimal, octal, hexadecimal, etc) conversion.
32. Write a program to find the square root of a number without using built-in library function.
33. Write a program to convert from string to number.
34. Write a program to implement pseudo random generator.
35. Write a program to generate multiplication tables from 11 to 20.
36. Write a program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six.

37. Write a program to generate a telephone bill. The contents of it and the rate calculation etc should be as per BSNL rules. Student is expected to gather the required information through the BSNL website.
38. Write a program to find the execution time of a program.
39. Design a file format to store a person's name, address, and other information. Write a program to read this file and produce a set of mailing labels

Note:

1. Instructors are advised to conduct the lab in LINUX/UNIX environment also
2. The above list consists of only sample programs. Instructors may choose other programs to illustrate certain concepts, wherever is necessary. Programs should be there on all the concepts studied in Theory. Instructors are advised to change atleast 25% of the programs every year until the next syllabus revision.

References:

1. "How to Solve it by Computer", R.G. Dromey, Pearson.
2. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. "Let us C", Yeswant Kanetkar, BPB publications
4. "Pointers in C", Yeswant Kanetkar, BPB publications.
5. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education.

Outcomes:

- Apply problem solving techniques to find solutions to problems
- Able to use C language features effectively and implement solutions using C language.
- Improve logical skills.

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(15A52201) ENGLISH FOR PROFESSIONAL COMMUNICATION

1. INTRODUCTION:

English is a global language and has international appeal and application. It is widely used in a variety of contexts and for varied purposes. The students would find it useful both for social and professional development. There is every need to help the students acquire skills useful to them in their career as well as workplace. They need to write a variety of documents and letters now extending into professional domain that cuts across business and research also. The syllabus has been designed to enhance communication skills of the students of engineering and pharmacy. The prescribed book serves the purpose of preparing them for everyday communication and to face the global competitions in future.

The text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and learner-centered. They should be encouraged to participate in the classroom activities keenly.

In addition to the exercises from the text done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

2. OBJECTIVES:

1. To develop confidence in the students to use English in everyday situations.
2. To enable the students to read different discourses so that they appreciate English for science and technologies.
3. To improve familiarity with a variety of technical writings.
4. To enable the students to acquire structure and written expressions required for their profession.
5. To develop the listening skills of the students.

3. SYLLABUS:

UNIT –I

Topics: Group discussion, cause and effect, events and perspectives, debate, if conditional, essay writing.

Text: LESSONS FROM THE PAST from ***MINDSCAPES***

Importance of History - Differing Perspectives - Modern Corporatism - Lessons From The Past

UNIT-II

Topics: Idioms, essay writing, power point presentation, modals, listening and rewriting, preparing summary, debate, group discussion, role play, writing a book review, conversation

Text: 'ENERGY' from ***MINDSCAPES***

Renewable and Non-Renewable Sources - Alternative Sources - Conservation -Nuclear Energy

UNIT-III

Topics: Vocabulary, impromptu speech, creative writing, direct and indirect speech, fixed expressions, developing creative writing skills, accents, presentation skills, making posters, report writing

Text: 'ENGINEERING ETHICS' from ***MINDSCAPES***

Challenger Disaster - Biotechnology - Genetic Engineering - Protection From Natural Calamities

UNIT-IV

Topics: Vocabulary, Conversation, Collocation, Group discussion, Note-making,Clauses, Interpreting charts and tables , Report writing.

Text: 'TRAVEL AND TOURISM' from ***MINDSCAPES***

Advantages and Disadvantages of Travel - Tourism - Atithi Devo Bhava - Tourism in India

UNIT-V

Topics: Vocabulary, phrasal verbs, writing a profile, connectives, discourse markers, problem-solving, telephone skills, application letters, curriculum vitae, interviews (telephone and personal)

Text: 'GETTING JOB-READY' from ***MINDSCAPES***
SWOT Analysis - Companies And Ways Of Powering Growth - Preparing For Interviews

Prescribed Text

MINDSCAPES: English for Technologists and Engineers, Orient Blackswan, 2014.

REFERENCES:

1**. Effective Tech Communication,** Rizvi,Tata McGraw-Hill Education, 2007.

2. **Technical Communication,** Meenakshi Raman, Oxford University Press.

3. **English Conversations Prcatice,** Grant Taylor, Tata Mc GrawHill publications,2013**.**

4**. Practical English Grammar.** Thomson and Martinet, OUP, 2010.

Expected Outcomes:

At the end of the course, students would be expected to:

1. Have acquired ability to participate effectively in group discussions.

2. Have developed ability in writing in various contexts.

3. Have acquired a proper level of competence for employability.

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(15A54201) MATHEMATICS – II

(Common to All Branches)

Objectives: Our emphasis will be more on conceptual understanding and application of Fourier series, Fourier, Z and Laplace transforms and solution of partial differential equations.

UNIT – I

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 – Laplace transform of Periodic function.

Differentiation and integration of transform – Application of Laplace transforms to ordinary differential equations of first and second order.

UNIT – II

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions- Parseval's formula- Complex form of Fourier series.

UNIT – III

Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

UNIT – IV

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace's equation under initial and boundary conditions.

UNIT – V

z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
2. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Outcomes: The student gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and partial differential equations.

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(15A03201) MATERIAL SCIENCE AND ENGINEERING

Course Objective:
To gain and understanding of the relationship between the structure, properties, processing, testing, heat treatment and applications of metallic , non metallic, ceramic and composite materials so as to identify and select suitable materials for 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.

Learning outcome & Suggested Student Activities:
Students will get knowledge on bonds of solids and knowing the crystallization of metals. By knowing the grain size and shape through the crystallization, he may understand the effect of grain boundaries on the properties of metals and finally he determines the grain size that is very essential for analyzing the microstructures of metals.
Students are advised to refer the following websites www.physics.rutgers.edu/meis/pubs/BB_thesis.pdf www.ce.berkeley.edu/~paulmont/CE60New/alloys-steel.pdf for better understanding of this topic.

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, and Fe-Fe_3C

Learning outcome & Suggested Student Activities:
Students will be able to construct the equilibrium diagrams by experimental methods and knowing all types of equilibrium diagrams isomorphs alloy systems , electric systems, pertectic systems solid-state transformations etc. while studying all these diagrams he may able to know about lever

rule and phase rule.
Students are advised to visit the following URLs website www.freelance-teacher.com/videos.htm
www.susqu.edu/brake/aux/downloads/papers/foamcomp.pdf for better understanding of this topic.

UNIT III

CAST IRONS AND STEELS: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Learning Outcome &Suggested Student Activities:
Students will be able to learn the structure and properties of all cast irons, steels and Non-ferrous metal alloys of copper, Al and Titanium. Students are advised to visit any Machine shop in the industries like SAIL, Visakhapatnam steel plant etc.,Students are advised to visit the following website.www.buzzle.com, www.mhprofessional.comwww.eng.sut.ac for better understanding of this topic.

UNIT IV

HEAT TREATMENT OF ALLOYS: Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys. Heat treatment of plastics

Learning outcome & Suggested Student Activities:
Students will be able to learn the methods of different heat treatments i.e. annealing, normalizing and hardening. He also learns the different of alloying elements on Iron-Iron carbon system, the importance of TTT diagrams, Harden ability that are very essential for melting science. Finally, he learn about the heat treatment of cryogenic environment as an advance topic.
Students are advised to go through the URLs http://www.nptel.iitm.ac.in/and iisc.ernet.in for video lectures,http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv180-Page1.htm

UNIT V

CERAMIC MATERIALS: Crystalline ceramics, glasses, cermets.

COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of composites, particle – reinforced

materials, fiber reinforced materials, polymer composites, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Learning Outcome & Suggested Student Activities:

This unit helps the students to understand the importance of advanced composite materials in application to sophisticated machine and structure of components, These composite materials helps to develop the components with required properties which we cannot attain using the metals & metal alloys.

Examples of products maybe of composite materials are air cooler bodies, fiber reinforced hose pipes, boat bodies some automobile body frames etc. Students may refer the following website for better understanding www.susqu.edu/brake/aux/downloads/papers/foamcomp.pdf; .Asment ernation.orgwww.princeton.edu/~achaney/tmve/wiki100k/doc/metal_matrix_composite.html

Text Books:

1. *Introduction to Physical Metallurgy, Sidney H. Avner, US, 2nd Edition, 2007 Tata McGraw-Hill,*
2. *Essential of Materials Science and Engineering, Donald R.Askeland, USA, 3rd Edition, Cengage Publisher,2013.*

Reference Books:

1. *Material Science and Metallurgy, U.C. Jindal, pearson educations, 2011,*
2. *Elements of Materials Science and Engineering, Lawrance H. Van Vlack, pearson educations, 6th Edition,2002.*
3. *Material Science and Metallurgy, kodgire V.D, 12th Edition, Everest Publishing House,2002.*
4. *Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994, 2nd Edition 2013.*
5. *Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 1975.*
6. *Science of Engineering Materials, Agarwal, TMH.*
7. *Materials Science and Engineering, William D. Callister, 8th Edition,2010.*
8. *Elements of Material science, V. Rahghavan, PHI, 5th Editon.*
9. *Engineering Materials and Their Applications – R. A Flinn and P K Trojan, Jaico Books.*
10. *Engineering materials and metallurgy, R.K.Rajput, S.Chand, 1st Editon,2008.*

Web References:

www.asminternational.org
www.henry.wells.edu
www.ce.berkeley.edu
www.sjsu.edu

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(15A56101) ENGINEERING PHYSICS

Objectives:

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and non-destructive evaluation using ultrasonic techniques.
- To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.
- To open new avenues of knowledge and understanding semiconductor based electronic devices , basic concepts and applications of semiconductors and magnetic materials have been introduced which find potential in the emerging micro device applications.
- To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in emerging technologies are elicited.

UNIT - I

PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

Physical Optics: Interference (Review) – Interference in thin film by reflection –Newton's rings –Diffraction (Review) - Fraunhofer diffraction due to single slit, double slit and diffraction grating.

Lasers: Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients — Population inversion – Excitation mechanism and optical resonator – Nd:YAG laser - He-Ne laser – Semiconductor Diode laser - Applications of lasers

Fiber optics: Introduction - construction and working principle of optical fiber –Numerical aperture and acceptance angle – Types of optical fibers – Attenuation and losses in Optical fibers –Block diagram of Optical fiber communication system – Applications of optical fibers

UNIT – II

CRYSTALLOGRAPHY AND ULTRASONICS

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Powder method.

Ultrasonics: Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

UNIT – III

QUANTUM MECHANICS AND ELECTRON THEORY

*Quantum Mechanics: M*atter waves – de'Broglie hypothesis and properties - Schrodinger's time dependent and independent wave equations – Physical significance of wave function - Particle in one dimensional infinite potential well.

Electron theory: Classical free electron theory – Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution – Source of electrical resistance – Kronig-Penny model (qualitative treatment) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

UNIT – IV

SEMICONDUCTORS AND MAGNETIC MATERIALS

Semiconductors: Intrinsic and extrinsic semiconductors (Qualitative treatment) – Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors – Formation of p-n junction.

Magnetic materials: Introduction and basic definitions – Origin of magnetic moments – Bohr magnetron – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials (Qualitative treatment) – Hysteresis - Soft and hard magnetic materials, applications of magnetic materials.

UNIT – V

SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS

Superconductivity: Introduction - Effect of magnetic field - Meissner effect – Type I and Type II superconductors – Flux quantization – Penetration depth - BCS theory (qualitative treatment) — Josephson effects –Applications of superconductors.

Physics of Nanomaterials: Introduction - Significance of nanoscale and types of nanomaterials – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis of nanomaterials by Top down and bottom up approaches: ball mill, chemical vapour deposition, and sol gel –Applications of nanomaterials.

Text Books:

1. Engineering Physics – K.Thyagarajan, 5th Edition, MacGraw Hill Publishers, NewDelhi, 2014.

2. Physics for Engineers - N.K Verma, 1st Edition, PHI Learning Private Limited, New Delhi,2014.

References:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, 10th Edition, S.Chand and Company, New Delhi, 2014.
2. Engineering Physics – D K Pandey, S. Chaturvedi, 2nd Edition, Cengage Learning, New Delhi, 2013.
3. Engineering Physics – D.K Bhattacharya, Poonam Tandon, 1nd Edition, Oxford University Press, New Delhi, 2015.

Outcomes:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with defects in crystals and ultrasonic non-destructive techniques.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and the bases for the band theory are focused.
- The properties and device applications of semiconducting and magnetic materials are illustrated.

The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.

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(15A03101) ENGINEERING DRAWING

Objectives:

- To gain and understanding of the basics of geometrical constructions of various planes and solids, understanding system of graphical representation of various objects and various views to draft and read the products to be designed and eventually for manufacturing applications.
- To learn about various projections, to understand complete dimensions and details of object.
- Ultimately student must get imaginary skill to put an idea of object, circuit, assembly of parts in black & white, to design a product and to understand the composition, which can be understood universally.

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance- Conventions in Drawing-Lettering – BIS Conventions. Curves used in Engineering Practice. a) Conic Sections including the Rectangular Hyperbola- General method only, b) Cycloid, Epicycloid and Hypocycloid

UNIT II

Scales: Plain, Diagonal and Vernier;

Projection of Points: Principles of orthographic projection – Convention – First angle projections, projections of points.

UNIT III

Projections of Lines: lines inclined to one or both planes, Problems on projections, Finding True lengths.

Projections of Planes: Projections of regular plane surfaces- plane surfaces inclined to both planes.

UNIT IV

Projections of Solids: Projections of Regular Solids with axis inclined to both planes.

Developments of Solids: Development of Surfaces of Right Regular Solids-Prism, Cylinder, Pyramid, Cone.

UNIT V

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Isometric projections of spherical parts. Conversion of isometric Views to Orthographic Views.

***Text Books**:*

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers

2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai

***References**:*

1. Engineering Drawing, Johle, Tata McGraw-Hill Publishers

2. Engineering Drawing, Shah and Rana,2/e, Pearson Education

3. Engineering Drawing and Graphics, Venugopal/New age Publishers

4. Engineering Graphics, K.C. John, PHI,2013

5. Engineering Drawing, B.V.R. Guptha, J.K. Publishers

Outcomes:

- Drawing 2D and 3D diagrams of various objects.
- Learning conventions of Drawing, which is an Universal Language of Engineers.
- Drafting projections of points, planes and solids.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech I-II Sem. (ME)

L	T	P	C
0	0	4	2

(15A03202) MATERIAL SCIENCE and ENGINEERING LAB

1. Mounting and preparation of Specimen.
2. Preparation and study of the Micro Structure of Ferrous metal
3. Preparation and study of the Microstructure of Non - Ferrous metals (Cu, Al….. etc)
4. Preparation and study of the Microstructure of Mild Steel, Low carbon Steels, High carbon steels
5. Study of the Micro Structures of Cast Irons.
6. Study of the Micro Structures of Non-Ferrous alloys.
7. Study of the Micro structures of Heat treated steels.
8. Hardeneability of steels by Jominy End Quench Test.
9. To find out the hardness of various treated and untreated steels.
10. Fracture testing of materials.
11. Fatigue testing of meterials.
12. Creep Testing of materials.

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B. Tech I-II Sem. (ME)

L	T	P	C
0	0	4	2

(15A56102) ENGINEERING PHYSICS LABORATORY

Objectives:

- Will recognize the important of optical phenomenon like Interference and diffraction.
- Will understand the role of optical fiber parameters and signal losses in communication.
- Will recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor
- Will understand the applications of B H curve.
- Will acquire a practical knowledge of studying the crystal structure in terms of lattice constant.
- Will recognize the application of laser in finding the particle size and its role in diffraction studies.
- Will learn to synthesis of the nanomaterials and recognize its importance by knowing its nano particle size and its impact on its properties.

Any 10 of the following experiments has to be performed during the I year I semester

1. Determination of radius of curvature of a Plano-convex lens by forming Newton's rings.
2. Determination of wavelength of given source using diffraction grating in normal incidence method.
3. Determination of Numerical aperture, acceptance angle of an optical fiber.
4. Energy gap of a Semiconductor diode.
5. Hall effect – Determination of mobility of charge carriers.
6. B-H curve – Determination of hysteresis loss for a given magnetic material.
7. Determination of Crystallite size using X-ray pattern (powder) using debye-scheerer method.
8. Determination of particle size by using laser source.
9. Determination of dispersive power of a prism.
10. Determination of thickness of the thin wire using wedge Method.

11. Laser : Diffraction due to single slit

12. Laser : Diffraction due to double slit

13. Laser: Determination of wavelength using diffraction grating

14. Magnetic field along the axis of a current carrying coil – Stewart and

Gee's method.

15. Synthesis of nanomaterial by any suitable method.

References:

1. Engineering Physics Practicals – NU Age Publishing House, Hyderabad.
2. Engineering Practical physics – Cengage Learning, Delhi.

Outcomes:

- Would recognize the important of optical phenomenon like Interference and diffraction.
- Would have acquired the practical application knowledge of optical fiber, semiconductor, dieclectric and magnetic materials, crystal structure and lasers by the study of their relative parameters.

Would recognize the significant importance of nanomaterials in various engineering fields.

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B. Tech I-II Sem. (ME)

L	T	P	C
0	0	4	2

(15A99201) ENGINEERING & I.T. WORKSHOP

ENGINEERING WORKSHOP

Course Objective:

The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

1. TRADES FOR EXERCISES:

a. Carpentry shop– Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock
b. Fitting shop– Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock
c. Sheet metal shop– Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet
d. House-wiring– Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.
e. Foundry– Preparation of two moulds (exercises): for a single pattern and a double pattern.

f. Welding – Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint.

2. TRADES FOR DEMONSTRATION:

a. Plumbing
b. Machine Shop
c. Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

References:

1. *Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009*
2. *Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.*
3. *Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, 4/e Vikas*
4. *Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House.*

I.T. WORKSHOP

Course Objective:

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To learn about Networking of computers and use Internet facility for Browsing and Searching.

Learning Outcome:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors
- Prepare Slide presentations using the presentation tool
- Interconnect two or more computers for information sharing
- Access the Internet and Browse it to obtain the required information
- Install single or dual operating systems on computer

Preparing your Computer (5 weeks)

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet (4 weeks)

Task 5: Networking: Students should connect two computers directly

using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc.

If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools (6 weeks)

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the

features studied. Students should submit a user manual of the word processor considered.

Task 9: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 10: Presentations : creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Optional Tasks:

Task 11: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material

- Air conditioner
- UPS and Inverter
- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

Task 12: Software: Students may submit a report on specifications of various software that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. The software may be proprietary software or Free and Open source software. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop operating system
- Server operating system
- Antivirus software
- MATLAB
- CAD/CAM software
- AUTOCAD

References:

1. Introduction to Computers, Peter Norton, Mc Graw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH

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B. Tech II-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A54301) MATHEMATICS-III
(Common to All Branches)

Objectives:

- This course aims at providing the student with the concepts of Matrices, Numerical Techniques and Curve fitting.

UNIT – I

Elementary row transformations-Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations. Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonolization of matrix. Calculation of powers of matrix and inverse of a matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

UNIT – II

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.

UNIT – III

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT – IV

Curve fitting: Fitting of a straight line – Second degree curve – Exponentional curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT – V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

TEXT BOOKS:

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

REFERENCES:

2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
3. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.

4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Outcomes: The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.

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B. Tech II-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A52301) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Relationship of Managerial Economics with Financial Accounting and Management. **Demand Analysis**: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)-Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole

Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT V: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcome: After completion of this course, the student will able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

TEXT BOOKS:

1. Managerial Economics 3/e, Ahuja H.L, S.Chand, 2013.
2. Financial Management, I.M.Pandey, Vikas Publications, 2013.

REFERENCES

1. Managerial Economics and Financial Analysis, 1/e, Aryasri, TMH, 2013.
2. Managerial Economics and Financial Analysis, S.A. Siddiqui and A.S. Siddiqui, New Age International, 2013.

Accounting and Financial Mangement, T.S.Reddy & Y. Hariprasad Reddy, Margham Publishers.

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B. Tech II-I Sem. (ME)

L	T	P	C
3	1	0	3

(15A01308) MECHANICS OF SOLIDS

Course Objective:

The objective of the subject is to learn the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationships. To accesses stresses and deformations through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & Theory of machines courses.

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 moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes-theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

Learning Outcome & Suggested Student Activities:

This unit gives the student how to measure the strength of materials based on calculating stresses, strains and deformations for basic geometries subjected to axial loading and thermal effects. Students are advised to visit the URL http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/1_1.pdf.

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 – Relation between S.F., B.M and rate of loading at a section of a beam.

Learning outcome & Suggested Student Activities:

This unit gives awareness for the students how to draw shear force and bending moment diagrams for calculating maximum shear force and maximum bending moment for different types of beams with different lateral loadings conditions. This topic can be downloaded from the URL http://vedyadhara.ignou.ac.in/wiki/images/a/ad/BME-017_B-1(Unit_4).pdf

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 – Design of simple beam sections, crane hooks.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I , T angle sections, shear centre.

Learning outcome & Suggested Student Activities:

This unit gives knowledge to the students about the strength of the beams with different sections by bringing the relationship between the bending stress and maximum bending moment, bringing the relationship between the shear stress and maximum shear force which are calculated from previous unit. This topic can be downloaded from the following URL http://web.mit.edu/emech/dontindex-build/full-text/emechbk_7.pdf.

UNIT IV

TORSION OF CIRCULAR SHAFTS- Theory of pure torsion- Derivation of torsion equations; $T/J=q/r=N\theta/L$ – Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus.

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, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

Learning outcome & Suggested Student Activities:

This unit gives awareness to the students how to calculate the shear strength of the solid and hallow shafts which are subjected to torsional loading in power transmitting. This topic related to torsion can be download from the following URLs

http://www.mae.ncsu.edu/zhu/courses/mae314/lecture/Lecture4_Torsion.pdf, and also gives better knowledge for students how to calculate deflections of beam using different methods under different boundary and loading conditions. Notes for this topic can be download from the web site http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/5_1.pdf.

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 – Riveted boiler shells – Thin spherical shells.

THICK CYLINDERS: Lame's equation – cylinders subjected to inside & outside pressure - compound cylinders.

Learning outcome & Suggested Student Activities:

This unit gives application to mechanics of solids for students in which how to calculate different stresses and strains for the thin and thick cylinders in identifying safe design for boiler shells and thick shells as such in like domestic cylinders, air compressor and high pressure vessels used in thermal plants etc. Notes for this topic can be download from the site

http://www.ewp.rpi.edu/hartford/users/papers/engr/ernesto/poworp/Project/4.%20Supporting_Material/Books/32658_09 & 10.pdf.

Text Books:

1. *Strength of Materials by R.Subramaniam, oxford publishers.*
2. *Strength of Materials by R.K. Bansal, Laxmi Publishers, 5th Edition,2012.*
3. *Mechanics of Materials,Andrews Pytel,Jaan Kiusallaas & M.M.M.Sarcar (Second Edition),Cengage Learning Publishers.*

Reference Books:

1. *Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishers*
2. *Strength of Materials by R.K. Rajput, S.Chand& Company, 5th Edition,2012.*
3. *Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, 10th Edition,2013.*
4. *Strength of Materials by M.Chakraborti, S.K.Kataria& Sons, 2nd Edition,2011.*
5. *Strength of Materials by S S Rattan, The McGraw-Hill Companies, 2nd Editon,2011.*

Suggestions:

- *Students are advised to buy a text book for understanding problems then they may buy Strength of materials by R.K.Bansal, Laxmi Publishers& For further more problems Strength of Materials by R.K. Rajput, S.Chand& Company*
- *Students may go around some of the small scale industries and domestic orientated jobs gives better knowledge on to check strength of materials.*
- *Some basic knowledge regarding Engineering mechanics, Mathematics and Physics are required for understanding this subject.*

Web Resources:

http://nptel.iitm.ac.in/

www.learnerstv.com/Free-Engineering-video-lecture-courses.htm
http://en.wikibooks.org/wiki/Strength_of_Materials

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B. Tech II-I Sem. (ME)

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3	1	0	3

(15A03301) ENGINEERING DRAWING FOR MECHANICAL ENGINEERS

Course Objective: To enhance the student's knowledge and skills in engineering drawing of solids with interpenetration of solids and to present isometric and perspective projections.

Unit –I

Sections and Developments of Solids: Section Planes and Sectional View of Right Regular Solids-Prism, cylinder, Pyramid and Cone. True shapes of the sections and their development of Surfaces

Unit –II

Isometric projection: Isometric views of Sectional Planes, and Sectional Solids, Objects.

Unit –III

Conversion of Pictorial views to orthographic views –Conventions.

Unit –IV

Interpenetration of Right Regular Solids: Projections of Curves of intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Square Prism Vs Square Prism.

Unit –V

Perspective Projections: Perspective View of Plane Figures and simple Solids, Visual Ray Method, Vanishing point method.

Text Books:

1. Engineering Drawing, N.D. Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.

References:

1. Engineering Drawing, Johle, Tata McGraw-Hill Publishers,2014
2. Engineering Drawing, N.S Patha sarathy, vela murali, Oxford University Press,2015
3. Engineering Graphics D.A.Hindoliya, BSP publications, 2014
4. Engineering Graphics, K.C.John, PHI,2014

Suggestions:

Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

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B. Tech II-I Sem. (ME)

L	T	P	C
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(15A03302) ENGINEERING MECHANICS

OBJECTIVE: *This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.*

UNIT – I

Introduction of Engineering Mechanics – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT – II

Friction : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge and Screw jack

UNIT – III

Centroid and Center of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids – Moment of Inertia of composite masses.(Simple problems only)

UNIT – IV

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

UNIT – V

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple, Compound and Torsional pendulum- Numerical problems

***Text Books**:*

(1) Engineering Mechanics by Jayakumar, Kumar, PHI, 2014
(2) Singer's Engineering Mechanics Statics and Dynamics,Vijay Kumar Reddy, Suresh Kumar. BS Publications 2015
(3) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications, 2015

References:

(1) Engineering Mechanics by Seshigiri Rao, Rama Durgaiah, Universities Press, 2005
(2) Engineering Mechanics by Shames & Rao – Pearson Education.
(3) Engineering Mechanics by Fedrinand L.Singer – Harper Collings Publishers.
(4) Engineering Mechanics (Statics and Dynamics) byPytel, Kiusalaas; Cengage, 2015
(5) Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company
(6) Engineering Mechanics by Chandramouli, PHI publications.

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B. Tech II-I Sem. (ME)

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(15A03303) THERMODYNAMICS

Course Objective:
By this subject students will get the awareness on basic thermodynamic principles, skills to perform the analysis and design of thermodynamic systems, First law and second law of thermodynamics and its applications to a wide variety of systems, principles of psychrometry and properties of pure substances. And also understand the concept of various air standard cycles with the help of P-v and T-s Diagrams.

UNIT I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

WORK & HEAT TRANSFER: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

Learning Outcome & Suggested Student Activities:
Students can able to understand thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications. Students are advised to collect different types of thermometers, measure the temperature of a given room/substance and compare the values. Following URL is very useful for better understanding http://www.nptel.iitm.ac.in. Students may refer text book of Fundamentals of Engineering Thermodynamics By Michael J. Moran, Howard N. Shapiro.

UNIT II

FIRST LAW OF THERMODYNAMICS: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

FLOW SYSTEMS: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

Learning Outcome & Suggested Student Activities:
Student will learn how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balance equation to various applications.
Student is advised to observe the Nozzle, Diffuser, Throttling device, Turbine and compressor in laboratories or local industries and understand their working principles practically. Notes of First law of thermodynamics can be downloaded from the website http://nptel.iitm.ac.in/courses/103101004/downloads/chapter-3.pdf.

UNIT III

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II

Entropy: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability.

Learning Outcome & Suggested Student Activities:

Student will identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle. Also student can learn calculating entropy change for a process, maximum available energy. Student is advised to visit laboratories of Heat Engines, Refrigeration and Air conditioning and observe how they work. Student may refer text book Fundamentals of Classical Thermodynamics - G.J.VanWylen& Sonntag

UNIT IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties

Thermodynamic Relations: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius-clapeyron equation.

Learning Outcome & Suggested Student Activities:

After the completion of the unit, student will be able to understand the method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance. Student can learn the usage of steam tables and mollier diagrams in solving problems. Also, the student will learn the cooling / heating effect of throttling process. Thermodynamic relations.

Student is advised to do the experiment on water (To cool / heat water) from atmospheric conditions and observe freezing / boiling point temperatures, changes in volume etc. Repeat the same experiment under different pressure.

UNIT V

Properties of Gases and Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure , Specific Heats, Internal Energy and Enthalpy of Gas Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

Learning Outcome & Suggested Student Activities:

Student will learn basic laws of ideal gas and gas mixtures. After studying Gas Power Cycles, student will understand the concept of ideal cycles for different engines and their working principle. Student can know drawing P-V and T-S diagrams for various air standard cycles and calculating work output, efficiency, mean effective pressure of each cycle.

Student is advised to conduct experiments in I.C Engines lab to find out the actual thermal efficiencies of Diesel and Petrol Engines and compare them with respect to ideal cycles.

Text Books:

1. *Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition,2013.*
2. *Engineering Thermodynamics by P. Chattopadhya, Oxford,1st Revised ,2016*

Reference Books:

.

1. *Thermodynamics for Engineers, Kenneth A. Kroos,Marle C.Potter,V.Pandurangadu.*
2. *Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons*
3. *Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH, 2011.*
4. *Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.*
5. *An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,*
6. *Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.*

NOTE: *Steam tables, Mollier Diagrams should be supplied*

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B. Tech II-I Sem. (ME)

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(15A01309) MECHANICS OF SOLIDS LABORATORY

MECHANICS OF SOLIDS LAB

1. Direct tension test beam
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
5. Brinells hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

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(15A03304) COMPUTER AIDED DRAFTING LAB

LIST OF EXPERIMENTS:

I Introduction to Computer Aided Drafting software packages.
II. Practice on basic elements of a Computer Aided Drafting **p**ackages
III. Practice on features of a Computer Aided Drafting **p**ackage
IV Drafting of Solids, Intersection of Solids
V Drafting of Perspective views
VI Drafting of Orthographic views of simple parts

Note: Any of the standard Software Packages like – AUTO CAD, Pro-E, Uni – Graphics, Catia …. Etc may be used

References:

1. Computer – Aided Engineering Drawing, S. Trymbaka Murthy. University Press.
2. Engineering Graphics for Degree, K.C. John. PHI Publications.

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B. Tech II-II Sem. (ME)

L	T	P	C
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(15A54401) PROBABILITY AND STATISTICS

(Common to CSE, IT, Civil, Mech.)

Objectives: To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, Statistical Quality Control and Queuing theory

UNIT – I

Basic concepts of Probability – Random variables – Expectation – Discrete and continuous Distributions – Distribution functions. Binomial and poison distributions Normal distribution – Related properties.

UNIT – II

Test of Hypothesis: Population and Sample - Confidence interval of mean from Normal distribution - Statistical hypothesis - Null and Alternative hypothesis - Level of significance. Test of significance - Test based on normal distribution - Z test for means and proportions.

UNIT – III

Small samples - t- test for one sample and two sample problem and paired t-test, F-test and Chi-square test (testing of goodness of fit and independence).

UNIT – IV

Statistical Quality Control: Concept of quality of a manufactured product -Defects and Defectives - Causes of variations - Random and assignable - The principle of Shewhart Control Chart-Charts for attribute and variable quality characteristics- Constructions and operation of $\overline{X}$ - Chart, R-Chart,

p - Chart and C-Chart.

UNIT – V

Queuing Theory: Pure Birth and Death process, M/M/1 & M/M/S & their related simple problems.

TEXT BOOKS:

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
2. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.

REFERENCES:

1. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
5. Probability and Statistics by R.A. Jhonson and Gupta C.B.

Outcomes: The student will be able to analyze the problems of engineering & industry using the techniques of testing of hypothesis, Statistical Quality Control and Queuing theory and draw appropriate inferences.

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(15A99301) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART – A
BASIC ELECTRICAL ENGINEERING

Objective:
Basic Electrical Engineering contains basic Circuits, Network theorems, two port networks, DC generators & motors, Transformers, Induction motors. The objective is to study their performance aspects.

UNIT – I Introduction to DC & AC Circuits
Ohm's Law, R, L, C Components, Kirchhoff's Laws, Types of Sources, Simple problems on Resistive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Sinusoidal waveforms and Basic Definitions, Root Mean Square and average values of sinusoidal Currents and Voltages. Form Factor and Peak Factor.
Network Theorems: Thevenin's, Norton's, Maximum Power Transfer and Superposition Theorems for DC Excitations.
Two Port Networks: Two Port Network Parameters – Impedance, Admittance, Transmission and Hybrid Parameters and Their Relations.

UNIT-II DC Machines
D.C Generators: Constructional details of D.C. machines, Principle of Operation of D.C. generators, Types of D.C Generators, E.M.F Equation, O.C.C. of a D.C. Shunt Generator
D.C Motors: Principle of Operation of DC Motors, Torque Equation, Losses and Efficiency Calculation, Speed Control of D.C. shunt motor (Armature voltage control and Field flux control). Swinburne's Test and Applications.

UNIT-III AC Machines
1-phase Transformers: Principle of Operation, Constructional Details, E.M.F. equation, Losses and Efficiency, OC & SC Tests, Regulation of Transformers.
3-Phase Induction Motors: Principle of Operation, Slip, Torque (Simple Problems), Slip-Torque characteristics.
3-phase Alternators: Principle of Operation-Constructional Details-EMF Equation.

OUTCOME:

After going through this course the student acquires knowledge on basics of Electrical Circuits, Network theorems, two port networks, DC generators & motors, Transformers, Induction motors and Alternators.

TEXT BOOKS:

1. Basic Electrical Engineering, V. N. Mittle and Arvind Mittle, Mc Graw Hill (India) Pvt. Ltd., 2nd Edition, 2005.

2. Basic Electrical Engineering, T.K.Nagsarkar and M.S. Sukhija, Oxford University Press, 2nd Edition, 2011.

REFERENCES:

1. Basic Electrical Engineering, M.S.Naidu and S. Kamakshiah, Tata Mc Graw Hill, 3rd Edition, 2009.

2. Electrical and Electronic Technology, Hughes, Pearson Education.

PART-B

UNIT I

Semiconductor Devices: Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction – Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

UNIT II

BJT and FETs: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between I_C, I_B and I_E. Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. Junction Field Effect Transistor (JFET)- Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET,MOSFET-The Enhancement and Depletion MOSFET, Static Characteristics of MOSFET, Applications of MOSFET.

UNIT III

Oscillators and Op-Amps: Sinusoidal Oscillators, Barkhausen Criteria for Oscillator Operation, Components of an Oscillator-Transistor Amplifier Circuits, Feedback Circuits and Oscillator Circuits, Classification of Oscillators, LC Tuned, RC Phase Shift Oscillator circuits.

Operational Amplifiers(Op-Amps)-Symbol of an Op-Amp, single Input and Dual Input Op-Amps(Differential Amplifier), Characteristics of an Ideal Op-Amp, Basic Forms of Op-Amps-Inverting & Non-Inverting Amplifiers, Applications of Op-Amps, summing, Differential, Integrator, differentiator Amplifier.

TEXT BOOKS:

1. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University
Press, 1st Edition, 2012.
2. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

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(15A03401) MACHINE DRAWING

Course Objective:
To make the students to understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.
To make the students to understand and draw assemblies of machine parts and to draw their sectional views

UNIT I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions

Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.

Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

Title boxes, their size, location and details-common abbreviations & their liberal usage

Learning Outcome & Suggested Student Activities:
This unit is useful to prepare the students for representing their ideas at International standards and will be able to convey in without much effort globally with ease. Students will acquire skills to draft on a drawing sheet without much effect. Students are advised to visit machine shop.

UNIT II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:

Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws,Keys, cottered joints and knuckle joint, Rivetted joints for plates, flanged &protected flanged joint.Shaft coupling, spigot and socket pipe joint.Journal, and foot step bearings.

Learning Outcome & Suggested Student Activities:
Students can represent various details of an object quickly without much time and ambiguity. These drawings can be easily prepared and understood by both the people in a manufacturing industry and the consumers too. Students are advised to visit machine shop.

UNIT III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.

Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.

Other machine parts- Screw jack, Machine Vice, single tool post.

Valves: Steam stop valve, feed check valve. Non return value.

Learning Outcome & Suggested Student Activities:
Students can understand the working principles of an assembly or subassembly so that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still produce any useful product serving effectively. It is not necessary that all the components to be made locally only. Students are advised to visit body building and assembly unit.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text Books:

1. *Machine Drawing – N Siddeswar, P. Kannaiah, VVS Sastry, Mc Graw Hill,2015*
2. *Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.*

Reference Books:

1. *Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012.*
2. *Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition,1998.*
3. *Machine Drawing – Ajeet Singh, McGraw Hill, 2012*
4. *Machine Drawing- Luzzader, PHI Publishers,11th Edition.*
5. *Textbook of Machine Drawing-K.C.John,2009, PHI learning, 1st Edition.*

NOTE:

- *The End exam will be for 4 hrs in the following format*
- *All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued.*
- *First Angle Projections*

Q1 Questions set on section I of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each-08 marks.

Q2 Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each-20 mrks.

Q3 Drawing of assembled views of section III items of syllabus with a weightage of 42 marks

Suggestions:

Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.
Student should visit an automobile shop while the unit is being disassembled / assembled.
Student should go through the exercises given under assembly drawings refereeing to various books in the library to improve his assimilation capacity.

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(15A03402) KINEMATICS OF MACHINES

Course Objective:
The objective of this course is to cover the kinematics and dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the kinematics and dynamics analysis of machine elements including linkages, cams and gears and also becomes familiar with gear terminology and drawing of the cam profiles.

UNIT I

MECHANISMS AND MACHINES: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain.Mobility of mechanisms. Straight Line Motion Mechanisms- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Learning outcome & Suggested Student Activities:
After completion of this unit students are in a position to identify different mechanisms, inversions of different kinematic chains and also to find mobility of mechanisms. To get more clarity on mechanisms and machines, the following URLs will be highly useful to the students to understand various concepts of mechanisms and machines. http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt2.html,
http://www.mhprofessional.com/downloads/products/0071704426/0071704426-ch01.pdf

UNIT II

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

Belt, Rope and Chain Drives : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

Learning outcome &Suggested Student Activities:
After completion of this chapter students are able to understand the mechanism of Hooke's joint, steering mechanisms and belt friction. And are also able to solve numerical problems on Hooke's joint, belt and rope drives. Students can go through the

textbooks for the problems on Hooke's joint, belt and rope drives. The following URLs will be highly useful to the students to understand various concepts of steering mechanisms and belt friction.
http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/pdf/mod13les1.pdf
http://www.youtube.com/watch?v=YzGM8Uc2HB0

UNIT III

KINEMATICS

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

Learning outcome & Suggested Student Activities:
After completion of this unit student are able to draw velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and instantaneous center method.Students can go through the textbooks given for the problems on analysis of mechanisms. The following URLs will be highly useful to the students to understand various concepts of velocity and acceleration diagrams.
http://www.freestudy.co.uk/dynamics/velaccdiag.pdf,
http://ebooks.library.cornell.edu/k/kmoddl/pdf/013_005.pdf

UNIT IV

GEARS: Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth-cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference.Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact.Introduction to Helical, Bevel and worm gearing.

GEAR TRAINS: Introduction –Types of gears – Simple, compound, reverted and Epicyclic gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains.Differential gear of an automobile.

Learning outcome & Suggested Student Activities:
After completion of this unit student are able to know gears terminology, types of gears, length of path of contact, contact ratio and interference in gears. Further students are also able to design the gears to avoid interference and to calculate train value for different gear trains.Students may go through text books given for more number of problems on gears and gear trains. Students may also refer the books authored by R.L. Norton and also by J.E.Shigley in addition to the textbooks for this unit to get more

clarity on this unit. The following URLs will be highly useful to the students to understand various concepts of gears and gear trainshttp://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_1.pdf, http://vedyadhara.ignou.ac.in/wiki/images/e/e8/BME-020_B-3(Unit_10).pdf http://www.youtube.com/watch?v=qLVwXZ2sS48

UNIT V

CAMS:Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

Learning outcome &Suggested Student Activities:

After completion of this unit the students are able to draw displacement diagram and cam profile for different types of motions of the follower. And also to find the displacement, velocity and acceleration of the follower at different positions of cam with specified contours. The following URLs will be highly useful to the students to understand various concepts of drawing the cam profile for different followers.http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/site/coursecontent/cntmod10.htm,http://www.youtube.com/watch?v=UpS8OjdXSow

Text Books:

1. *Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition,2013.*
2. *Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers,1st Edition, 2009.*

Reference Books:

1. *Theory of Machines and Mechanisms, 3rd Edition, J.E. Shiegley et. al, Oxford International Student Edition.*
2. *The theory of Machines, Ballaney, Kanna Publishers*
3. *Theory of Machines, Thomas Bevan, Pearson (P) 3rd Edition, 2012.*

***NOTE** : Exam should be conducted in Drawing Hall*

Suggestions:

Students may visit nearby machine tool shops and automobile workshops to know about different mechanisms, gears, gear trains, flexible drives and cams. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

WEB References:
http://nptel.iitk.ac.in
http://ptumech.loremate.com/tom1/node/1
http://www.youtube.com/watch?v=6coD3oOuhr8

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(15A03403) THERMAL ENGINEERING – I

Course Objective:
The objective of this subject is to impart the knowledge of engine components, working principles of IC engines, auxiliary systems, the combustion aspects of SI and CI engines in addition to the methods of improving performance. The students shall become aware on the latest developments in the field of IC engines like MPFI , CRDI etc. and also shall become familiar about the working of Reciprocating and Rotary Compressors. The student also shall apply the thermodynamic concepts in IC engines and compressors.

UNIT I

I.C. ENGINES: Definition of Engine And Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

Learning Outcome & Suggested Student Activities:
*After completion of the unit, student can know working of both S.I and C.I engines with the help of indicator diagrams. Student can differentiate the working of 2-S and 4-S engines and also can draw valve and port timing diagrams. Student can know applications of IC engine in the automobile industry. Students are advised to visit nearby automobile service center/station and engines laboratory for Knowing the various engines and engine components. Student can also see various types of engines fitted to two wheelers, four wheelers, and diesel power plants. The following URLs will be highly useful to the students to understand various aspects of I.C.Engines*http://www.youtube.com/watch?v=XfJjvRTQP3M *, http://www.youtube.com /watch?v=MNrVYG_NdD4.*http://www.youtube.com/watch?v=W8oWq2Iv_W4,www.yoututube.com/user/Techtrixinfo.

UNIT II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems..

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication.

Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

Learning Outcome & Suggested Student Activities:
Student can understand the fuel supply systems, cooling, lubrication and ignition systems. Student can understand how auxiliary systems play key role in increasing the performance of an I.C engine.

Student is advised to visit nearby automobile service center/station for getting practical knowledge about various auxiliary systems. Student can find the radiator (air cooling and water cooling) in front of heavy vehicles and stationary engines and air cooling for two wheelers and three wheelers.
The following URLs will be highly useful to the students to understand various aspects of fuel supply systems, filters, cooling, lubrication systems and Ignition systems.
http://www.youtube.com/watch?v=ksG4ypoMEaM;http://www.youtube.com/watch?v=LwrL-Cn9HT8;http://www.youtube.com/watch?v=O_Y3dM8ZApo;
http://www.youtube.com/watch?v=mmmcj53TNic

UNIT III

Fuels and Combustion:

S I engine :Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

Learning Outcome & Suggested Student Activities:
Student can understand the flame propagation inside the cylinder, stages of combustion in S.I and C.I engines. Student can understand the knocking phenomenon. Student can know about Octane number and Cetane number of fuels and properties of fuel. Combustion Process is very typical process practically students can't see but student can understand the combustion process by visiting following URLs. Students are suggested to know various losses occurred through combustion chamber, at least theoretically.
http://www.youtube.com/watch?v=ep1NhANcCL4;
http://www.youtube.com/watch?v=pqa4zCo4erY

UNIT IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

Learning Outcome & Suggested Student Activities:
Student can be familiar with indicated power, brake power and friction power and their methods of measurement. Student can understand the methods to increase the engine performance. Also, student can know calculating specific fuel consumption, A/F ratio and mean effective pressure and estimating heat losses etc. Students are advised to visit heat engines laboratory for analyzing the effect of various parameters on engine performance.
To better understand the above following URLs are useful.

http://web.iitd.ac.in/~ravimr/courses/mel345/ignou-notes.pdf;

UNIT V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors, Working Principle of Rotary Compressors.

Learning Outcome & Suggested Student Activities:

Student can differentiate the working of reciprocating and rotary air compressors. Student can calculate work done by single and multistage reciprocating air compressors. Student can understand how intercooling reduces the work done / kg of air.

To gain further practical knowledge students are advised to visit laboratory/automobile workshop to see different types of compressors. The following URLs will be highly useful to the students to understand the air compressors.

http://www.ustudy.in/node/5106 ; http://www.youtube.com/watch?v=Ue7BkzBARXw
http://www.youtube.com/watch?v=6zYHUXSG3HE;
http://www.youtube.com/watch?v=OuK6nGibFqY

Students are advised to refer the text book of "Internal Combustion Engine Fundamentals" by John B. Heywood.

Text Books:

1. *Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012*
2. *Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013*

Reference Books:

1. *I.C. Engines fundamentals, Heywood, McGrawHIll, 1st Edition,2011*
2. *IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010*
3. *Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009*
4. *Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010*
5. *Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002*
6. *Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012*

WEB Resources:

http://autoclub.rso.siuc.edu/frange.html
http://www.howstuffworks.com/engine1.htm
http://inventors.about.com/library/inventors/blinternalcombustion.htm
http://www.animatedengines.com/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II-II Sem. (ME)

L	T	P	C
3	1	0	3

(15A03404) MANUFACTURING TECHNOLOGY

Course Objective:
By this subject the students will understand how manufacturers use technology to change raw materials into finished products. The students shall also introduce the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications

UNIT I

CASTING: Definition, elements, Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Design of core prints, buoyancy principle. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

Learning Outcome & Suggested Student Activities*:*
Students can understand the elements of casting, construction of patterns and gating systems, moulds, methods of moulding, moulding machines and solidification of castings of various metals. Students are advised to visit URLs http://www.nptel.iitm.ac.in/ and iitr.ac.in, www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT II

SPECIAL CASTING PROCESSES: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting.

RISERS – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks

METHODS OF MELTING: Crucible melting and cupola operation, steel making processes.

Casting inspection and defects

Learning Outcome & Suggested Student Activities:
Students can understand the different types of special casting methods and their applications, design of risers and feeding systems, crucible melting, cupola operation and steel making process. The students may also be able to design a casting process on his own. The students are also advised to visit a Casting Industry nearby to get practical exposure.

UNIT III

A) **WELDING** : Classification of welding processes types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

B) **CUTTING OF METALS**: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals

Learning Outcome & Suggested Student Activities:

Students can understand the different types of welding processes, welds and weld joints, their characteristics, cutting of ferrous and non-ferrous metals by various methods. The students are advised to visit nearby welding shop for better understanding of welding process.

UNIT IV

Mechanics, characteristics, process parameters, applications of Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing and adhesive bonding. Heat affected zones in welding; welding defects – causes and remedies – destructive and nondestructive testing of welds

.

Learning Outcome & Suggested Student Activities:

Students can understand about advanced welding process, heataffected zone(HAZ), Defects and Identification Methods. The students are advised to visit nearby welding shop and MFT Lab in the college.

UNIT V

SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces

Learning Outcome & Suggested Student Activities:

Students can understand the various surface treatment processes. Student is advised to visit the nearby surface coating industry.

Text Books:

1. *Manufacturing Technology, Vol I P.N. Rao, Tata Mc Graw Hill, 4th Edition,2013*
2. *Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition,2002*

Reference Books:

1. *Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition,2013*
2. *Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,*
3. *Principles of Metal Castings, Rosenthal, Tata Mc Graw Hill ,2nd Edition,2001*
4. *Welding Process, Parmar.*
5. *Manufacturing Technology, R.K. Rajput, Laxmi Pub, 1st Edition,2007*
6. *Workshop Technology – B.S.RaghuVamshi – Vol I.*

***WEB References**:*

NPTEL Lectures

http://teacher.buet.ac.bd/shabnam/14250_ch3.pdf

http://me.emu.edu.tr/majid/MENG364/2_casting.pdf

http://en.wikipedia.org/wiki/Metalworking

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II-II Sem. (ME)

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(15A03405) THERMAL ENGINEERING LABORATORY

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines for CI Engines
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Engine Emission Measurement for SI & CI Engines.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II-II Sem. (ME)

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0	0	4	2

(15A03406) MANUFACTURING TECHNOLOGY LABORATORY

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB:

a. Pattern Design and making - for one casting drawing.
b. Sand properties testing - Exercise -for strengths, and permeability – 1
c. Moulding: Melting and Casting - 1 Exercise

II. WELDING LAB:

a. Arc Welding: Lap & Butt Joint - 2 Exercises
b. Spot Welding - 1 Exercise
c. TIG Welding - 1 Exercise
d. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
b. Hydraulic Press: Deep drawing and extrusion operation.
c. Bending and other operations

IV. PROCESSING OF PLASTICS:

a. Injection Moulding
b. Blow Moulding

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (ME)

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3	1	0	3

15A01510 FLUID MECHANICS AND HYDRAULIC MACHINES

UNIT - I

FLUID STATICS : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

FLUID KINEMATICS : stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

Fluid dynamics: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.

UNIT – II

CONDUIT FLOW: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle and Turbine current meter.

UNIT – III

TURBO MACHINERY : hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

HYDROELECTRIC POWER STATIONS: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

UNIT – IV

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design-draft tube- theory- functions and efficiency.

PERFORMANCE OF HYDRAULIC TURBINES : Unit and specific quantities, characteristics, governing of turbines, selection of type of turbine, cavitation and surge tank.

UNIT – V

CENTRIFUGAL PUMPS : Classification- working-work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves and NPSH.

TEXT BOOKS :

1. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
2. A Text of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd., New Delhi.
3. Mechanics of Fluids by Potter, Wiggert, Ramadan, M.M.M.SARCAR, Cengage Publishers.

REFERENCE BOOKS :

1. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.
2. Principles of Fluid Mechanics and Fluid Machines by M.Narayana Pillai, Universities Press.
3. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (ME)

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15A03501 THERMAL ENGINEERING – II

Course Objective:

This subject is designed to provide a sound knowledge in various aspects of thermal equipments. This subject has an increasingly dominant role to play in the vital areas of power generation, Automobiles, R&AC and energy sector. The course contents aims at developing the necessary analytical and technical contents among engineers in these areas. The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.

UNIT I

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

Learning Outcome & Suggested Student Activities:

Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation.

Students are advised to be acquainted with the terms related to steam, steam tables and mollierchart.Also, students are advised to visit the thermal power station to get real expose.

UNIT II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

Learning Outcome & Suggested Student Activities:

Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator. Students are advised to visit the Boilers in the power generation units to get better expose. And visit the following URLs will be highly useful to the students to understand various aspects of thermal power plants and boilers.

https://www.youtube.com/watch?v=Ota2_LUuar0,

https://www.youtube.com/watch?v=8GSUgwombdE

UNIT III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.

Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit.

CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

Learning Outcome & Suggested Student Activities:

Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations. Student can able to understand the effect of meta stable flow/ super saturation flow through nozzle.

Students are advised to visit the thermal power stations to acquire the practical expose and visit URL http://www.youtube.com/watch?v=cdUNmzcu2rA

UNIT IV

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 - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

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.

Learning Outcome & Suggested Student Activities:

At the end of unit, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce.

Students are advised to visit thermal power stations for better understanding the working of turbines. Students are suggested to participate in science exhibitions based on the concept of thermal power plants. Student is advised to visit following URLs http://www.youtube.com/watch?v=y2dOmpZgYW8&list=PLBD7B1EEF7CCB7D9D , https://www.youtube.com/watch?v=1bl1Q3V_79I

UNIT V

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 – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants

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, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

Learning Outcome & Suggested Student Activities:

After the study of the unit, Student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices. Student can aware of using thrust equations in solving problems. Students advised to visit Gas power generation plants.

http://www.youtube.com/watch?v=hnVWpOV5chs,http://www.youtube.com/watch?v=p1TqwAKwMuM , http://www.youtube.com/watch?v=MUxP3PCDRTE

Text Books:

1. *Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013*
2. *Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.*

Reference Books:

1. *Gas Turbines, V. Ganesan, TMH*
2. *Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.*
3. *Thermal Engineering, Mahesh M Rathore, McGrawHill,2010*
4. *Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai*
5. *Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.*
6. *Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.*
7. *Steam Tables SI Units- Dr.B.Umamaheswar Gowd and A. Nagraju, Siri Publ.*

NOTE: Steam tables and Mollier charts to be supplied for exam.

Web References:

http://www.iscid.org/encyclopedia/Tthermodynamics. http://www.transtutors.com/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (ME)

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15A03502 DYNAMICS OF MACHINERY

Course objective:
To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

UNIT I

FRICTION: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the basic concepts of friction in pivots and collars with uniform pressure and uniform wear, and also to solve the numerical problems on brakes, clutches and dynamometers.
Students may go through text books given for more number of problems on friction, brakes and clutches. The following URLs will be highly useful to the students to understand various concepts of friction and its application.
http://nptel.iitm.ac.in/video.php?subjectId=112104121,
http://www.youtube.com/watch?v=FA04XFpJgwE

UNIT II

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

TURNING MOMENT DIAGRAMS AND FLY WHEELS: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

Learning outcome & Suggested Student Activities:
After completion of this unit students can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. Students are able to design a flywheel for IC engine. Students may go through text books given for more number of problems on gyroscopic

effects and flywheels. The following URLs will be highly useful to the students to understand various concepts of gyroscopic couple and turning moment diagrams.
http://www.youtube.com/watch?v=FydJu1A1oeM&list=PL46AAEDA6ABAFCA78&index=7
http://www.youtube.com/watch?v=swgvKwyOnYk&list=PL46AAEDA6ABAFCA78&index=16

UNIT III

GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

Learning outcome & Suggested Student Activities:
The outcome of this unit is to study the basics and definitions related to governors and forces acting on various governors. After completion of this unit students are able to solve numerical problems on different governors.
Students may go through text books given for more number of problems on governors. The following URLs will be highly useful to the students to understand various concepts on governors.
http://nptel.iitm.ac.in/video.php?subjectId=112104121,
http://www.youtube.com/watch?v=OG1AiaNTT6s

UNIT IV

BALANCING: Balancing of rotating masses - single and multiple – single and different planes.

BALANCING OF RECIPROCATING MASSES: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in-line and radial engines for primary and secondary balancing.

Learning outcome & Suggested Student Activities:
After completion of this unit students can solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines.
Students may go through text books given for more number of problems on balancing of rotating masses and balancing of reciprocating masses in locomotives and IC engines. The following URLs will be highly useful to the students to understand various concepts of balancing of masses.
http://www.youtube.com/watch?v=aRulDXMuNDc&list=PL46AAEDA6ABAFCA78&index=8
http://nptel.iitm.ac.in/video.php?subjectId=112104121

UNIT V

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of

beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

Learning outcome & Suggested Student Activities:

Upon completion of this unit, the student will perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. Students may go through text books given for more number of problems on single degree of freedom system, transverse and torsional vibrations. The following URLs will be highly useful to the students to understand various concepts on vibrations.
http://nptel.iitm.ac.in/video.php?subjectId=112104121
http://www.youtube.com/watch?v=irudCaBrij0&list=PL46AAEDA6ABAFCA78&index=30

Text Books:

1. *Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.*
2. *Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.*

Reference Books:

1. *Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.*
2. *The theory of Machines, Ballaney, Kanna Publishers*
3. *Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.*

NOTE: End Exam Should be conducted in Drawing Hall

Suggestions:

Students may visit near by machine tool shops and automobile work shops to know about clutches, bearings, brakes, dynamometers, flywheel, centrifugal governors and balancing equipment like wheel balancing. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

Web References:

Machine Dynamics by Prof. Amitabha Ghosh, IITK, Kanpur - http://nptel.iitm.ac.in/video.php?subjectId=112104114
Machine Dynamics by Prof. C. Amarnath, Prof. K. KurienIssac, Prof. P. Seshu of IITB, Mumbai
http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (ME)

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15A03503 MACHINE TOOLS

Course Objective:

The objectives of this course are to introduce to demonstrate the fundamentals of machining processes and machine tools.

To develop knowledge and importance of metal cutting parameters, tool materials, cutting fluids and tool wear mechanisms.

To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes. The students will have the knowledge and hands-on experience that will enable them to work in a typical machine shop.

UNIT I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the interface in the machining zone between the tool and the work piece and how the physical and mechanical parameters dictate the cutting performance.

UNIT II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic concepts of turning. Student shall be made familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation.

UNIT III

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation.

Shaping, Slotting and Planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the basic principle of drilling, shaping and planning operation, parts of the drilling, shaping and planning machines and tool holding devices, operations performed on drilling, shaping and planning and machining calculations.

UNIT IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation, parts of the milling machine and types of milling and grinding machines.

UNIT V

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and fixtures

Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping. Some examples of jigs and fixtures. The outcome of this unit is to understand the basic principle of unconventional machining methods USM,AJM,EDM,LBM,EBM,CM and ECM and machining of the USM,AJM,EDM,LBM,EBM,CM and ECM.

Text Books:

1. *Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013*
2. *Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012*

Reference Books:

1. *Manufacturing Technology-Kalpakzian- Pearson*
2. *Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012*
3. *Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001*
4. *Production Technology by K.L.Narayana, IK International Pub.*
5. *Machining and machine tools by AB. Chattopadyay, WileyEdn,2013*
6. *Unconventional Machining process by V.K.Jain, Allied Pub.*
7. *Manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013*
8. *Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Press Taylor and Francies .*

Web Resources:

www.hgfarley.com
www.kennametal.com/ - United States
www.mini-lathe.com/links.htm;machinedesign.com/.../designer-s-guide-tometalcutting-machinery-0608 -
www.metalwebnews.com/wc.html
www.britannica.com/EBchecked/topic/463000/planer
www.americanmachinist.com
www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm

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15A03504 DESIGN OF MACHINE MEMBERS – I

Course Objective:

The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied. This subject will help to the students to learn to analyze and design basic machine elements in mechanical systems. By this subject students will become familiar on design principles, materials selection, stresses developed in machine elements under different loads. The students will also get knowledge on design of the permanent and temporary joints, shafts and keys.

UNIT I

INTRODUCTION: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Theories of failure – factor of safety.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are capable to apply design procedures using theories of failure for different elements. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of machine design. http://machinedesign.com/

http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6

UNIT II

DESIGN FOR FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Estimation of Endurance strength – Goodman's line – Soderberg's line. Design of components for finite and infinite life.

Learning Outcome & Suggested Student Activities:

After completion of this chapter students are able to design simple components under cyclic loading using Goodman's and Soderberg's criterions. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of cyclic loading design. http://machinedesign.com/

http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8

UNIT III

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

DESIGN OF BOLTED JOINTS: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints. Further students are able to design bolted joints with direct loading and eccentric loading. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of joints. http://machinedesign.com/ http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16

UNIT IV

DESIGN OF COTTERS AND KNUCKLE JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design cotter joint, knuckle joint and shafts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of shafts, http://machinedesign.com/ http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20

UNIT V

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to design various rigid and flexible shaft couplings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of couplings. http://machinedesign.com/

http://www.youtube.com/watch?v=4nlQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21

Text Books:

1. *MachineDesign, Schaum'sseries, TMH Publishers, NewDelhi, 1st edition, 2011*
2. *MachineDesign, R.S. Kurmi and J.K. Gupta ,S.ChandPublishers, NewDelhi*

Reference Books:

1. *MachineDesign,R.K.Jain, KhannaPublishaers,New Delhi.*
2. *MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi*
3. *MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2011 R*
4. *DesignofMachineElements,M.F.Spotts, PHIPublishers, NewDelhi.*
5. *MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2009*
6. *Machine Design, R.L. Norton, Tata McGrawHillPublishers, 2nd edition, 2002*
7. *Machine Design by Groover – CBS Publications, 5th edition, 2012.*
8. *Machine Design Data Book, V B Bhandari, McGraw Hill,2014*

NOTE: Design data books are not permitted in the examinations.

Web Resources:

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv077-page1.htm
http: // www .f a s t e n a l .c o m / c o n t e n t / f e d s / p d f / A r t i c l e % 2 0 - %20Bolted%20Joint%20Design.pdf
http://people.rit.edu/megite Lec%203%20Fatigue%20Faiure% 20031004_ for_students.ppt
http://engineershandbook.com/Tables/materials.htm
www.nptel.iitm.ac.in/video

Suggestions:

1. Students may visit nearby automobile workshops and machine tool shopsor IC Engine Lab/Automobile Lab to know about different machine elements like shafts, keys, couplings and riveted and bolted joints.
2. In addition to the text books students may also go through the reference books authored by V.B.
Bhandari, by Pandya and Shah for more number of numerical problems.

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15A03505 ENTREPRENEURSHIP
(MOOCS-I)

UNIT 1: Introduction to Entrepreneurship Definition Types of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad.

Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creative problem solving, product planning and development process.

UNIT II: The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

UNIT III: Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

UNIT IV: New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.Choosing location and layout, Issues related to Selection of layout.

UNIT V: Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control.Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Global aspects of Enterprenership.

Text Books:

1Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5th Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

REFERENCES:

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.

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15A03506 NANO TECHNOLOGY
(MOOCS-I)

Course objective

On successful completion of the course, students should be able to: Understand the basic cientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

PROPERTIES OF MATERIALS:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-II

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

UNIT-III

CHARECTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-IV

CARBON NANO TECHNOLOGY:

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, applications of carbon nano tubes.

UNIT-V

APPLICATIONS OF NANO TECHNOLOGY:

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

TEXT BOOK:

1. Nano science and nano technology / M.S Ramachandra Rao, Shubra Singh/Wiley publishers.
2. Introduction to Nanotechnology by Risal Singh, Shipra Mital Gupta, Oxford Higher Education, First Publication 2016.

REFERENCE BOOKS:

1. Introduction to Nano Technology /Charles P. Poole, Jr., Frank J.Owens/Wiley publishers.
2. Nanotechnology /Jermy J Ramsden/Elsevier publishers
3. Nano Materials/A.K.Bandyopadhyay/ New Age
4. Nano The Essentials, T.Pradeep, McGrawHill, 2014
5. Nanotechnology the Science of Small / M.A Shah, K.A Shah/Wiley Publishers.

Course outcomes:

- Upon successful completion of this course the student shall be able to:
- Identify the essential concepts used in nanotechnology. Identify the materials, properties, syntheses and fabrication, characterization and applications in various fields.

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15A03507 MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)
(MOOCS-I)

Course Objectives:

1. To learn basics of Micro Electro Mechanical Systems (MEMS).
2. To learn about various sensors and actuators used in MEMS
3. To learn the principle and various devices of MOEMS, Fluidic, bio and chemical systems

UNIT – I

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.
MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT – II

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT – III

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators

UNIT – IV

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, microfluid dispenser, micro needle, molecular gate, micro pumps.

RADIO FREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT - V

CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluroscence detection, calorimetric spectroscopy.

TEXT BOOK:

1. MEMS/Nitaigour Premchand Mahalik/TMH Publishing co.
2. MEMS and NEMS/Sergey Edwrd Lyshevski/CRC Press, Indian Edition, 2013

REFERENCE BOOKS:

1. Foundation of MEMS/Chang Liu/Prentice Hall Ltd.
2. RF MEMS Theory, Design and Technology Gabriel M. Rebeiz, Wiley-India,2010
3. MEMS and Micro Systems: Design and Manufacture/Tai-Ran Hsu/TMH Publishers.
4. Introductory MEMS/ Thomas M Adams, Richard A Layton/Springer International Publishers.

Course outcomes:

Upon successful completion of this course the student shall be able to know the importance and various devices of MEMS and their applications.

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15A01511 FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

OBJECTIVE: The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

SYLLABUS :

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Varification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

LIST OF EQUIPMENT :

1. Venturimeter Setup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel and Francis turbines.
11. Centrifugal pumps.

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15A03508 MACHINE TOOLS LABORATORY

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

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15A99501 SOCIAL VALUES & ETHICS (AUDIT COURSE)

(Common to all Branches)

UNIT - I

Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

Channels of Youth Moments for National Building: NSS & NCC: History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. Nehru Yuva Kendra (NYK): Activities – Socio Cultural and Sports.

UNIT – II

Activities of NSS, NCC, NYK:

Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III

Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV

Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V

Physical Education : Games & Sports: Health and Recreation – Biolagical basis of Physical activity – benefiets of exercise – Physical, Psychological, Social; Physiology of Musucular Activity, Respiration, Blood Circulation.

Yoga: Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

TEXT BOOKS:

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6th Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on www.yas.nic.in)
10. TOWARS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu
10. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

www.un.org
www.india.gov.in
www.yas.nic.in
http://www.who.int/countries/ind/en/
http://www.ndma.gov.in
http://ayush.gov.in/event/common-yoga-protocol-2016-0

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15A03601 OPERATIONS RESEARCH

Course Objective:

The subject should enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operation research techniques to industrial applications,

To make the student capable of Formulating the various real life decision making problems as Mathematical programming problems. Students to learn the fundamental Techniques of Operations Research and to choose a suitable OR technique to solve problem on hand.

UNIT I

Introduction to OR and Linear Programming-1

OR definition– Classification of Models –Types of Operations Research models;

Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method

Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

Learning Outcome & Suggested Student Activities:

At the end of the Unit, the student will be able to create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method.

(The student must refer to any of the text books and practice solving several problems as it is very common to make mistakes while solving due to lack of practice). The student should take up a real life problem and formulate it as a mathematical programming problem.

Further, the students may visit the following URL for live online tutorial for LPP formulation

http://www.www.mathsdoctor.tv

UNIT II

Linear programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method;

OptimalityTesting.

Special Cases -Unbalanced Transportation Problem, Degenerate Problem;

Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

Learning Outcome &Suggested Student Activities:
At the end of this Unit, the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs, and solve the special cases of LPP such as Transportation and Assignment problems. A large number of problems are to be solved by the student in order to gain much required capability of handling the problems without mistakes.
The following URLs will be useful to the students for in-depth knowledge
http://nptel.iitm.ac.in/video.php?subjectId=112106134,
http://www. Math.harvard.edu/archive/20_spring_05/handouts

UNIT III

Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies– Dominance Principle–Graphical Method, Algebraic methods, sub matrices method.
Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

Learning Outcome & Suggested Student Activities:
At the end of this Unit, the student will have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition. The following web link will direct the students to the video lecture on Game Theory.
http://www.youtube.com/watch?feature=player_detailpage&v=h0bdo06qNVw
The student will be capable of identifying the suitable Queuing Model for real world waiting lines and make estimations like Average Waiting Times, Average Queue Length, Probability of Waiting in the queue etc.
The students may watch the following web video for better understanding of the subject.
http://www.youtube.com/watch?feature=player_detailpage&v=xGkpXk-AnWU#t=104s
The students should refer to any OR text book for more number of practice problems.

UNIT IV

Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models & n jobs – m Machines models.
PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float

CPM- Deterministic Model- Critical Path, Crashing, Optimal Project Duration, Least Possible Project Duration

PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time

Learning Outcome & Suggested Student Activities:

At the end of this Unit, student will be able to represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project, Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability.

The following URL will lead us to a video lecture on this Unit

http://www.youtube.com/watch?feature=player_detailpage&v=H58TPQNr2kM

UNIT V

Dynamic Programming : Introduction – Bellman's Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP

Replacement Models: Introduction –Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

Learning Outcome & Suggested Student Activities:

At the end of this Unit, the student will be aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems. The following URL contains a video lecture on Dynamic Programming and the students are advised to go through

http://www.youtube.com/watch?feature=player_detailpage&v=ug7O1lSZyg0

Further, the student will gain knowledge in different types of maintenance, failure patterns and the economic replacement policies which are very much important for the continuous functioning of machinery in an organization. The students may visit the following websites for better understanding of the subject.

http://www2.ensc.sfu.ca/undergrad/courses/ENSC201/Unit09/lecture9.html

http://pakaccountants.com/what-is-depreciated-replacement-cost/

Text Books:

1. *Operation Research, J.K.Sharma,MacMilan, 5th edition, 2013.*
2. *Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.*

Reference Books:

1. *Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers*
2. *Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.*
3. *Operations Research, Wagner, PHI Publications , 2nd edition.*
4. *Operations Research, S.R.Yadav, A.K.Malik, Oxford, 2015*
5. *Operations Research, A.M.Natarajan,P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.*

Web References:

http://www2.informs.org/Resources/
http://www.mit.edu/~orc/
http://www.ieor.columbia.edu/
http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
http://www.wolfram.com/solutions/OperationsResearch/
http://nptel.iitm.ac.in/video.php?subjectId=112106134

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15A03602 DESIGN OF MACHINE MEMBERS– II

Course Objective:
To aware the student about basic concepts of curved beams with different cross sections, design of power transmission elements, understand the design concepts of various types of springs, various types of bearings and gears.
To know the students how to apply design concepts in designing of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

UNIT I

DESIGN OF CURVED BEAMS: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps.

DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design crane hooks, C-clamps and various belt, rope and chain drives. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of power transmission elements.
http://machinedesign.com/
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
http://www.youtube.com/watch?v=nMsB6Soz4Hc&list=PL3D4EECEFAA99D9BE&index=30

UNIT II

DESIGN OF MECHANICAL SPRINGS: Stress and deflections of helical Springs- Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs.

DESIGN OF POWER SCREWS: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

Learning Outcome & Suggested Student Activities:
After completion of this unit, students are able to design helical sprigs for two wheel vehicle and laminated springs for trucks. Also students can apply design concepts in designing power screws. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of springs and power screws.
http://machinedesign.com/
http://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
http://www.youtube.com/watch?v=46quOD7V- cQ&list=PL3D4EECEFAA99D9BE&index=28

UNIT III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of bearings.
http://machinedesign.com/
http://www.mae.ncsu.edu/klang/courses/mae442/Tranmission/Journal%20Bearing.ppt
http://nhbb.com/files/catalog_pages/HiTech_Catalog.pdf

UNIT IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to design spur and helical gears for different input conditions. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of gears.
http://machinedesign.com/
http://nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_9.pdf
http://www.youtube.com/watch?v=8bml2pK6Ra0

UNIT V

DESIGN OF IC ENGINE PARTS: Pistons– Design of piston. Cylinder, Connecting Rod. Crank shafts- Center and over hung cranks.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to know various forces acting on I C engine parts and failure criteria to be adopted for various parts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of IC Engine parts.

http://machinedesign.com/

http://umpir.ump.edu.my/1778/1/Design_Of_Cooecting_Rod_Of_Internal_Combustion_Engine_A_Topology_Optimization_Approach.pdf

http://www.d-p.com.gr/pistons/piston-designs.html

Text Books:

1. *MechanicalEngineeringDesign,JosephE.Shigely,TMH Publishers,NewDelhi, 9th edition, 2010.*
2. *Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.*

Reference Books:

1. *MachineDesign,Schaum'sseries,TMHPublishers, NewDelhi, 1st edition, 2011*
2. *Design ofMachine Elements, V.B.Bhandari , TMH Publishers,NewDelhi, 2nd edition, 2013.*
3. *MachineDesign,SadhuSingh,KhannaPublishers, NewDelhi*
4. *DesignofMachineElements,M.F.Spotts,PHIPublishers, NewDelhi.*
5. *MachineDesign,PandyaandShah,CharotarPublishers,Anand, 17th edition, 2012.*

NOTE: Design data books are permitted in the examinations.

Web References:

http://www.uni.edu/~rao/Md-17%20Shaft%20Design.pdf

http://www.uni.edu/~rao/Md-15%20Keys%20and%20Couplings.pdf

http://etidweb.tamu.edu/ftp/ENTC463/Notes/ENTC463Key%20and%20Coupling.pdf

http://www.science.howstuffworks.com/transport/engines.../bearing1.html

http://www.fi.edu/time/Journey/Time/Escapements/gearint.html

Suggestions:

1. students may visit nearby automobile workshops and machine tool shops to know about different machine elements like gears, bearings, springs, power screws, flexible drives and I C engine parts.

2. In addition to the text books students may also go through the reference books authored by V.B. Bhandari, by Pandya and Shah for more number of numerical problems.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ME)

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15A03603 HEAT TRANSFER

Course Objective:
The students will gain the ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques , tools and skills required to solve typical thermal related problems, the analysis of energy flows in complicated systems and the design of efficient heat transfer equipments. Enables the student to utilize analogies to solve heat transfer problems. Further students gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

UNIT I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates.

Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

Learning Outcome & Suggested Student Activities:
After the completion of the unit, student can able to grasp the concept of steady state conduction. Student can learn representing conduction equation in various forms. Student can imply concept successfully to problems encounter in day to day life. The following URL's will be highly useful to students.
http://k12videos.mit.edu/content/heat-transfer;
http://www.youtube.com/watch?v=9WwSaIP5pbs
http://www.youtube.com/watch?v=HIYCR7gXXFo;
http://www.youtube.com/watch?v=S57nIs503fA
http://energy.concord.org/ir/experiments-page3.html

UNIT II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student is expected understand the concept of extended surfaces and its applications. Also, student can aware transient heat conduction and how it vary w.r.t time. Student is expected to develop the ability to formulate practical conduction heat transfer problems by transforming the physical system into a Mathematical model and selecting an appropriate solution technique and evaluating the significance of results.

The following URLs will be highly useful to the students
http://www.youtube.com/watch?v=cMmREKOhIV8
http://www.youtube.com/watch?v=HiX7DKUlAOM

UNIT III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Learning outcome & Suggested Student Activities:

At the end of the chapter, Student will have the ability to formulate practical forced and natural convection heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance.

The following URLs will be highly useful to the students
http://www.youtube.com/watch?v=HIYCR7gXXFo
http://www.youtube.com/watch?v=S57nIs503fA;
http://energy.concord.org/ir/experiments-page3.html

UNIT IV

Heat Transfer with Phase Change:

Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Filmwise and Dropwise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor – Concepts of LMTD and NTU Methods – Problems using LMTD And NTU Methods.

Learning outcome & Suggested Student Activities:

After the completion of the chapter, student will be able to calculate heat transfer in condensation and boiling systems, turbulent and laminar film condensation. Student can understand the concepts of critical heat flux and different models of critical heat flux. Student can able to grasp the fundamentals of heat exchangers and its analysis. The following URLs will be highly useful to the students to understand simple heat exchangers.

MIT: Professor Z. S. Spakovszky's Lecture Notes on Thermodynamics & Propulsion: "Section 18.5: Heat Exchangers" (HTML)

Lecture: YouTube: Stanford University: Professor Channing Robertson's Introduction to Chemical Engineering: "Lecture 12: Heat Exchangers"

http://www.youtube.com/watch?v=Gu1ApKpcxQc

UNIT V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Learning outcome & Suggested Student Activitie:

At the end of the unit, student can have knowledge on fundamental laws of radiative heat transfer. Also, student can understand the concept of radiative heat transfer between black bodies and grey bodies. Student can know radiation shields and their applications. Student can determine shape factor for different geometries and can know its importance in determining radiative heat transfer.

The following URLs will be highly useful to the students - http://energy.concord.org/ir/experiments-page5.html

Text Books:

1. *Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.*

Reference Books:

1. *Heat Transfer, P.K.Nag, 3/e, TMH, 2011*
2. *Heat Transfer, S.P.Sukhatme, University Press, 4th edition, 2005*
3. *Heat Transfer, Holman.J.P, 10/e, TMH, 2012*
4. *Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001*
5. *Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.*
6. *Heat and Mass Transfer, D.K.Dixit, McGrawHill,2016*
7. *Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007*

NOTE: Heat transfer Data books are permitted for Exam.

Suggestion:

1. *Student is advised to visit heat transfer laboratory to understand the concept of three modes of heat transfer.*

Web References:

IIT video lecturers (NPTEL)
http://www.wisc-online.com/Objects/ViewObject.aspx?ID=SCE304
http://web.cecs.pdx.edu/~gerry/heatAnimations/sphereTransient/#TOC
http://rpaulsingh.com/animated%20figures/animationlisttopic.htm

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ME)

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15A03604 FINITE ELEMENT METHODS

Course objective:
The subject should enable the students to learn the principles involved in discretization in finite element approach, form stiffness matrices and force vectors for simple elements, find the various approach followed in finite element approach, use the various elements for discretization and learn about shape functions.
To learn the application of FEM to various structural problems incorporating temperature.
and boundary conditions and heat transfer problems.

UNIT I

INTRODUCTION: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions.
Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.
Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems.
Solution methods for solving simultaneous equations.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to know introductory basic principles and approaches for solving FEM problems in different fields. In addition to text books, the following URLs will be highly useful to the students to understand basic approaches to formulate and solving of FEM problems.
http://www.youtube.com/watch?v=NYiZQszx9cQ&list=PLA4CBD0C55B9C3878&index=1
http://www.youtube.com/watch?v=RQBXWF9b-Fs&list=PLA4CBD0C55B9C3878

UNIT II

Problems with One-dimensional geometry:
Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.
Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations.

Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

Learning Outcome & Suggested Student Activities:
After completion of this unit students are able to formulate FEM model for simple problems. In addition to text books, the following URLs will be highly useful to the students to formulate FEM models for simple problems using different elements.
http://web.iitd.ac.in/~achawla/public_html/429/fem/overview.pdf
http://www.cmmacs.ernet.in/cmmacs/Lect_notes/sangeeta1.pdf
http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter4.pdf

UNIT III

INTERPOLATION MODELS: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates for triangular (2D simplex) elements, quadrilateral element.

HIGHER ORDER AND ISOPARAMETRIC ELEMENTS: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

Learning Outcome &Suggested Student Activities:
After completion of this unit students are able to write interpolation functions to higher order isoparametric elements. In addition to text books, the following URLs will be highly useful to the students to understand basic concepts of isoparametric elements.
http://www.kochmann.caltech.edu/ae108a/IsoparametricElements.pdf
http://www.me.mtu.edu/~bettig/MEEM4405/Lecture08.pdf
http://site.iugaza.edu.ps/marafa/files/FEM-Chapter-10.pdf

UNIT IV

FINITE ELEMENT APPLICATION IN SOLID MECHANICS:

Problem modeling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Isoparametric, subparametric and superparametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Axi-symmetric triangular elements: formulation of stiffness and load vectors.

Introduction to 3D stress analysis.

Learning Outcome &Suggested Student Activities:

After completion of this unit students are able to derive element matrices for applying the principles to find stresses in beams and trusses and temperature distribution in composite walls and fins. In addition to text books, the following URLs will be highly useful to the students to develop and solve FEM models using beam and truss elements.

http://www.youtube.com/watch?v=UeatU9OpDNA&list=PLA4CBD0C55B9C3878

http://uqu.edu.sa/files2/tiny_mce/plugins/filemanager/files/4041296/ComputerApplicationsInStructures/LeturesTutorialsDowloadedFromWeb/Lecture%202%20Truss%20and%20Beam%20FEM.pdf

http://www.engineering.uiowa.edu/~sxiao/class/058-153/lecture-24.pdf

www.rpi.edu/~des/CST.ppt

UNIT V

HEAT TRANSFER AND FLUID MECHANICS PROBLEMS:

Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems. Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces.

Two dimensional potential flow problems: Potential function formulation and stream function formulation.

Learning Outcome & Suggested Student Activities:

After completion of this unit students are able to solve bars, trusses, beams and heat transfer problems using FEM and also to apply boundary conditions in realistic problems. In addition to text books, the following URLs will be highly useful to the students to develop and solve FEM models using different elements. The students are also advised to use FEM software to solve all application problems.

http://www.mecheng.iisc.ernet.in/~suresh/me237/fea/Chapter6.pdf

http://www.colorado.edu/engineering/cas/courses.d/IFEM.d/IFEM.Ch22.d/IFEM.Ch22.pdf

Text Books:

1. *Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu , Pearson Education, New Delhi.*
2. *Finite Element Methods, S. S. Rao , Pergamom Press, New York*

Reference Books:

1. *Finite Element Method by R. Dhanaraj, K. Prabhakaran Nair Oxford University Press*
2. *Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.*
3. *Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.*
4. *Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.*
5. *Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.*
6. *Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers, New Delhi.*
7. *Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995*.

WEB REFERENCES

1. *Finite Element Method IIT Kanpur Course, Prof. C.S. Upadhyay* http://nptel.iitm.ac.in/video.php?subjectId=112104115

2. *Computational Methods in Design and Manufacturing by Dr. R. Krishnakumar, Department of Mechanical Engineering, IIT Madras http://nptel.iitm.ac.in/video.php?subjectId=112106135*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ME)

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15A03605 METAL FORMING PROCESSES

Course Objective:
Metal forming processes are highly non linear because they involve geometric, material and contact non linearity. And so this subject introduce the concepts of one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students also will get the awareness on various types of rolling mills, forgings, extrusions, wire drawing processes, sheet metal operations, concepts on plastic manufacturing processes and rapid manufacturing process and its applications.

UNIT 1

Stress, strain, Two dimensional stress analysis and three dimensional stress analysis, relation between engineering stress and true stress, relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts

Learning Outcome & Suggested Student Activities:
Students can understand the basic concept on one, two and three dimensional stress analysis, theory of plasticity, strain hardening, hot and cold working process. The students are advised to visit the URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT II

ROLLING: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, applications and, limitations, defects in rolled products – machinery and Equipment.

FORGING PROCESSES: Principles of forging –Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects, Forces in forging of strip, disc and power requirements, applications, Equipment and their selection.

Learning Outcome & Suggested Student Activities:
Students can understand the principles of rolling and forging processes, their applications and defects. The students are advised to visit URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm

UNIT III

EXTRUSION PROCESSES: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion, forces in extrusion of cylindrical and non cylindrical components – characteristics and defects in extruded parts.

Wire Drawing: Process Mechanics and its characteristics, determination of degree of drawing, drawing force, power, and number of stages-defects in products.

Learning Outcome & Suggested Student Activities:

Students can understand the fundamentals of extrusion process and wire drawing processes and their industrial applications. The students are advised to visit the URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT IV

Sheet Metal Working – Economical Considerations - Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – Cup drawing and Tube drawing – coining – Hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products – Equipment, tooling and their characteristics.

Learning Outcome &Suggested Student Activities:

Students can understand the various press working processes, their advantages and disadvantages. The students are advised to refer the text book Workshop Technology by H*ajra Choudhary. Students are advised to visit nearby sheet metal works industries.*

UNIT V

Processing of plastics, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction – concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, sterer holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process

Learning Outcome &Suggested Student Activities:

Students can understand the concept of plastic manufacturing process, rapid manufacturing process and its applications. Students are advised to visit the following URLs http://www.nptel.iitm.ac.in/iitkgp.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

Text Books:

1. *Manufacturing Technology, Schmid and kalpakjin, Pearson Education.*
2. *Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH*

Reference Books:

1. *Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012*
2. *Process and materials of manufacturing –Lindberg, PE*
3. *Principles of Metal Castings, Rosenthal.*
4. *Welding Process, Parmar*
5. *Manufacturing Technology, R.K. Rajput, Laxmi Pub*
6. *Rapid Prototyping Principles and Applications, RafiqNoorani, Wiely Pub.*

Web Resources:

www.casde.iitb.ac.in/store/events/2003/IAT-Pune.../DFMA.ppt
www.rose-hulman.edu/~stienstr/ME470/DFA.ppt
www.design4manufacturability.com/DFM_article.htm

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15A03606 NONCONVENTIONAL SOURCES OF ENERGY
(CBCC- I)

Course Objective:
To create awareness to the student about basic concepts of non-conventional source of energy, to understand the process of collection, storage, conversion and applications of Solar Energy, Wind Energy, Bio Mass, OTEC. To learn about direct conversion methods.

UNIT – I
PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solarenergy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrialand terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-III
SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat andstratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-IV
BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.
GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential inIndia.

UNIT-V
OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidaland wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, and principles of DEC.
Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications,
MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator,
MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

Outcomes:

- *Understanding various Non-conventional sources of Energy.*
- *Able to learn how to use renewable energies instead of conventional fuels.*

TEXT BOOKS:

1. *Non-Conventional Energy Sources /G.D. Rai*
2. *Energy Resources Utilization and Technologies, Anjaneyulu Yerramilli, Francis Tuluri, BS Publications, 2012*

REFERENCES :

1. *Renewable Energy Sources/ Twidell & Weir*
2. *Non Conventional Energy Resources, B.H.Khan, McGrawHIll, 2015*
3. *Solar Power Engineering/B.S.Magal Frank Kreith & J.F.Kreith.*
4. *Principles of Solar Energy/ Frank Krieth & John F Kreider.*
5. *Non-Conventional Energy/ Ashok V Desai/ Wiley Eastern*

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15A03607 TOTAL QUALITY MANAGEMENT
(CBCC-I)

Course Objective:
To understand the concept of quality, cost of quality, international quality standards.
To learn the principles of Total quality management, techniques for problem solving.
To learn about various tools of quality management used in various industrial applications.

UNIT – I
TQM – overview , concepts, elements – History-Quality management philosophies-Juran, Deming, Crosby , Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement
– objectives – internal and external customers.
Quality standards – Need of standardization - Institutions – bodies of standardization, ISO 9000 series – ISO 14000 series – other contemporary standards – ISO certification process-Third party audit.

UNIT – II
Process management- Quality measurement systems (QMS) – developing and implementing QMS – nonconformance database- TQM tools & techniques- 7 QC tools-7 New QC tools.
Problem Solving techniques - Problem Solving process – corrective action – order of precedence

UNIT – III
System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis.
Quality circles – organization – focus team approach – statistical process control – process chart – Ishikawa diagram – preparing and using control charts.

UNIT IV
Quality Function Development (QFD) – elements of QFD – benchmarking-Types-Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

UNIT – V

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management.

Six sigma approach – application of six sigma approach to various industrial situations.

Outcomes:

- *Understanding the concepts of TQM.*
- *Able to use tools and techniques for problem solving.*
- *To formulate quality circles to find solutions to problems in industry.*
- *Analyze various quality problems and contribute towards continuous improvement in the system.*

TEXT BOOKS:

1. Total Quality Management, D.R.Kiran, BS Publications, 2016
2. Total Quality Management by Besterfield, Pearson.

REFERENCE BOOKS:

1. Quality management by Howard Giltow-TMH
2. Quality management by Evans.
3. Quality management by Bedi
4. Total Quality Management by Joseph & Susan Berg
5. Total Quality Management-Toward the Emerging Paradigm, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

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15A03608 MECHATRONICS
(CBCC- I)

Course Objective:

To make the students to learn about the Basic electronics, electrical and mechanical components used to control the machines and industries. Various types of sensors, signal conditioning systems and various pneumatic and hydraulic components used in control systems. Micro controllers, PLCS and PLC program and programmable motion control systems.

UNIT I

INTRODUCTION: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Learning outcome &Suggested Student Activities:

This unit helps the students to understand the importance of mechatronicssubject and controlling the various machines, robots etc. Students may observe CNC machines in CAD/CAM lab to understand the mechatronics concepts.
Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 1, by the authors - W .Bolton, publishers - Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.nptel.iitm.ac.in/ECE/mechatronicswww.ustudy.in/mech/mechs en.wikipedia.org /wiki/mechatronics for better understanding of this topic.

UNIT II

SIGNAL CONDITIONING: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering.

Learning outcomes & Suggested Student Activities:

This unit helps the students to understand how to convert the analog signals into useful required form. These signal condition systems may be observed in electronics and communication engineering department labs.
Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter – 3, by the authors - W Bolton, publishers- Pearson Education Press, 3rd edition, 2005.
Students may refer the following website www.nptel.iitm.ac.in/ECE/mechatronicswww.saylor.org/corses/me302 for better understanding of this topic.

UNIT III

PRECISION MECHANICAL SYSTEMS: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Bearings- Motor / Drive Selection.

Learning outcome & Suggested Student Activities:
In this unit the students learn about the pneumatic and hydraulic systems and about some precisions mechanical component which are useful in the field of automation. This automation system can be observed in many processing industries and manufacturing industries to handle the materials and control the machines (or) process. Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter-5, 6 & 7 by the authors - W .Bolton, publishers - Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.pic-design.com, www.sdp-si.com, www.csio.res.in,

UNIT IV

ELECTRONIC INTERFACE SUBSYSTEMS: Motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ mosfets.
ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - PWM's - Pulse Width Modulation – Variable Frequency Drives.

Learning outcome & Suggested Student Activities:

The objective of this unit is to make the student aware of electronic systems, electromechanical drives used in automation. Some of the systems may be observed electrical and electronics labs for better understanding. Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 7 by the authors – W. Bolton, publishers- Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.pic-design.com, www.sdp-si.com, www.csio.res.info better understanding of this topic.

UNIT V

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors – Applications, Programming –Assembly.

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection, interface – R232 etc.,- Applications.

Learning outcome & Suggested Student Activities:

This unit helps the student to know about microcontrollers and to programming of programmable logic controls. Students may visit pharmaceutical industries, thermal power plants etc. To observe the PLC based control systems. to know about the interface between processing equipment and central system.

Student may refer text book - Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, Chapter- 15, 14 & 19 by the authors - W .Bolton, publishers- Pearson Education Press, 3rd edition, 2005.Students may refer the following website www.authorstream.com, www.atmel.in, www.lifehacker.com

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , W Bolton, Pearson Education Press, 3rd edition, 2005.

2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

Reference Books:

1.Mechatronics Principles, concepts and applications. Nitaigour premchand mahalik, MC Graw Hill Edu.

2. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.

3. Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.

4. Mechatronics System Design, Devdas shetty,Richard,Thomson.

5. Mechatronics Er. R.K. Rajput. S. Chand Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ME)

L	T	P	C
3	1	0	3

15A01608 INTELLECTUAL PROPERTY RIGHTS
(CBCC – I)

COURSE OBJECTIVE:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.
Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.
Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Developments Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.
International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
2. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,

Course Outcomes:

On completion of this course, the student will have an understanding of the following:

a) *Intellectual Property Rights and what they mean*
b) *Trade Marks and Patents and how to register them*
c) *Laws Protecting the Trade Marks and Patents*
d) *Copy Right and laws related to it.*

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-II Sem. (ME)

L	T	P	C
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15A03609 HEAT TRANSFER LABORATORY

NOTE: Thermal Engineering data books are permitted in the examinations

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

Note: Any 10 of the above 15 experiments are to be conducted.

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L	T	P	C
0	0	4	2

15A03610 COMPUTER AIDED ENGINEERING LAB (CAE LAB)

I. Introduction to Analysis Software Package

II. Structural analysis: (Any Six exercises)

1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)

1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any four exercises)

1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated fin within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem (in an infinitely long concentric cylinders).
7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

Software can be used: ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

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B. Tech III-II Sem. (ME)

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15A52602 ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS (AELCS) LAB (Audit Course)

1. INTRODUCTION

With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

UNIT-I: COMMUNICATION SKILLS

1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS

1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB

1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:

- Accomplishment of sound vocabulary and its proper use contextually
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

5. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system

- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

6. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and G

1. Walden Infotech: Advanced English Communication Skills Lab
2. K-VAN SOLUTIONS-Advanced English Language Communication Skills lab
3. DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
4. TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. Train2success.com

7. BOOKS RECOMMENDED:

1. Objective English for Competitive Exams, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, O U Press 3rd Edn. 2015.
3. Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience,OUP, 2016
4. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Campus to Corporate, Gangadhar Joshi, Sage Publications, 2015
7. Communicative English,E Suresh Kumar & P.Sreehari, Orient Blackswan, 2009.
8. English for Success in Competitive Exams, Philip Sunil Solomon OUP, 2015

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B. Tech IV-I Sem. (ME)

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15A52601 MANAGEMENT SCIENCE

Course Objective: The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.

UNIT –I

Introduction to Management: Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management-Motivation Theories-Leadership Styles-Decision MakingProcess-Designing Organization Structure-Principles and Types of Organization.

UNIT- II

Operations Management: Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis(Simple Problems)Marketing Management:

Meaning,Nature, Functions of Marketing, Marketing Mix, Channels of distribution-Advertisement and sales promotion-Marketing strategies-Product Life Cycle.

UNIT –III

Human Resource Management(HRM): Significant and Basic functions of HRM-Human Resource Planning(HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances.

UNIT –IV

Strategic Management: Vision, Mission, Goals and Strategy- Corporate Planning Process-Environmental Scanning-SWOT analysis-Different Steps in Strateg Formulation, Implementation and Evaluation. Project Management: Network Analysis-PERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

UNIT-V

Contemporary Management Practices: Basic concepts of MIS-Materials Requirement Planning(MRP),Just-In-Time(JIT)System, Total Quality Management(TQM)-Six Sigma

and Capability Maturity Models(CMM) evies, Supply Chain Management, Enterprise Resource Planning(ERP),Performance Management, Business Process Outsourcing(BPO), Business Process Re-Engineering and Bench Marking, Balance Score Card.

Learning Outcome: This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

TEXT BOOKS:

1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill 'Introduction to Management Science' Cengage, Delhi, 2012.

REFERENCE BOOKS:

1. A.K.Gupta "Engineering Management",S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
5. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
6. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
7. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
8. Parnell: Strategic Management, Biztantra, 2003.
9. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

L	T	P	C
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15A03701 AUTOMOBILE ENGINEERING

Course Objective:

The students acquires sufficient knowledge to classify Engines, Chassis, Fuel Supply Systems, Cooling Methods, Lubrication Methods, Ignition Systems, Generating Systems, Suspension Systems, transmission system, steering mechanism and braking methods.

The students get the working knowledge of assembly of various components of layout and of various electrical equipment of an automobile.

UNIT I

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit –Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

Learning outcome & Suggested Student Activities:

Student can understand the function of each and every component of an automobile. Student can understand the use of turbo charging and super charging. Students may refer the following website auto.howstuffworks.com, www.em.gov.au for better understanding of this topic.

UNIT II

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.

Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles.

Learning outcome & Suggested Activities:

Student can be able to grasp the knowledge on emission standards, emission control techniques and electrical systems. Student can identify thrust areas for carrying their dissertation in future. Students may refer the following website www.dec.ny.gov,www.studymode.com,www.ehow.com, www.automotiveservices.blogspot.com for better understanding of this topic.

UNIT III

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

Learning outcome &Suggested Student Activities:
At the end of the unit, student can have broad knowledge on each and every component of transmission system of a automobile. Students may refer the following websites en-wikipedia.org/wiki/transmission, www.youtube.com, www.youtube.com, jalopink.com, www.geansandstuff.com for better understanding of this topic.

UNIT IV

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.
Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

Learning outcome & Suggested Student Activities:
After the completion of the chapter, student can able to understand purpose and methods of steering systems and their applications. Students may refer the following website www.scribd.com, www.youtube.com,leemyles.com www.howcanworks.com, www.forza.se/sider/of/listton/bi/stein1.pdf for better understanding of this topic.

UNIT V

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Techniques – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.
Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Température Indicator.

Learning outcome & Suggested Student Activities:
At the end of the unit. Student can have ample knowledge on suspension system and braking system of an automobile.
Students may refer the following website www.youtube.com, www.howcanworks.com, www.forza.se/sider/of/listton/bi/stein1.pdf for better understanding of this topic.

Text Books:

1. *Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers Distributors, 13th edition, 2013.*
2. *Automobile Engineering , William Crouse, TMH, 10th edition, 2006.*

Reference Books:

1. *Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.*
2. *Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.*
3. *Automotive engines , Newton, Steeds & Garret.*

Books in Digital Libraray:

www.nptel.iitm.ac.in

Suggestions:

Student is requested to visit the research and development cell of Automobile manufacturing companies and A.R.A.I emission testing centers.

For better understanding of these systems students may visit the Automobile service centre and APSRTC workshop.

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B. Tech IV-I Sem. (ME)

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15A03702 CAD/CAM

Course objective:
The objective of the this subject is to enable the students to understand and handle design problems in symmetric manner, gain practical experience in handling 2-D drafting and 3-D modeling software systems, apply CAD in real life applications, understand the concepts G and M codes and manual part programming and know the applications of CNC machines. Further the students will become familiar on principles of computer graphics, geometric modeling, NC and CNC machines, group technology and FMS.

UNIT I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, homogeneous transformations, clipping, hidden line / surface removal colour, shading.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the basic concepts Automation, components of CAD/CAM, input and output components of CAD, Steps involved in computer aided design.

UNIT II

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.

Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the geometric model of the component in CAD technology of computer graphics. The techniques of raster technology, scan conversion, clipping, removal of hidden lines and hidden surfaces, color, shading and texture.

UNIT III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Codes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

Learning outcomes & Suggested Student Activities:

Geometric Modelling constitutes the most important and complex part in most of CDA software packages. Hence the students should focus on various requirements of information that are generated during geometric modeling stage, various types and its applications. Mathematical representations of curves used in geometric construction.

UNIT IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM

Learning outcome & Suggested Student Activities:

CNC has revolutionized the manufacturing automation. The flexibility of manufacturing achvied with the use of CNC and associated Technology. The students should aimed to understand the principle of NC, CNC , Machining Centre and various methods of part programming. The student is advised to visit manufacturing industry where the CNC machines are using and also interact with CNC programmer in industry.

UNIT V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits, Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits. Trends in Manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Learning outcomes & Suggested Student Activities:

Understanding the need of GT as a means of bringing the benefits of mass production to relatively smaller production. Understanding the need of computers in process planning and QC .Understanding the definition and concept of FMS, and its elements etc.

Text Books:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI
2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010

Reference Books:

1.Computer Aided Design & Manufacturing, Lalit Narayan/Mallikarjuna Rao/M.M.M.Sarcar.PHI(2015)
2.Automation, Production systems & Computer integrated Manufacturing ,Groover, P.E
3. CAD/CAM/CIM, Radhakrishnan and Subramaniah, New Age, 3rd edition, 2008
4. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson
5. CAD/CAM Theory and Practice, R. Sivasubramaniam, TMH
6. Computer Aided Design and Manufacturing, K.Lalit Narayan , PHI, 2008.
7. Computer Aided Manufacturing, T.C. Chang, Pearson, 3rd edition, 2008
8. A text book of CAD/CAM, CSP Rao, Hitech Publ.

Web References:

http://www.cadcamfunda.com/cam_computer_aided_manufacturing
http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03703 METROLOGY AND MEASUREMENTS

Course objective:

Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods, Alignment tests on machine tools.

Students will be able to understand various transducers to measure displacement like Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers and also learn about Calibration procedure, temperature and pressure calibration methods, the measurement of flow stress, strain measurements acceleration and vibration.

UNIT I

LIMITS, FITS and TOLERNCES : Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard system – International Standard organization system for plain work.

LIMIT GAUGES and GAUGE DESIGN: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

COMPARATORS: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the Limits, Fits and Tolerance. Indian standard system – International Standard organization system. He will know the principles of working of the most commonly used instruments for measuring linear and angular distances.

http://www.nptel.iitm.ac.in

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

UNIT II

LINEAR MEASUREMENT: Length standard, line and end & wavelength standards, slip gauges – calibration of the slip gauges, Dial indicator, micrometers, vernier height gauges.

MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

FLATNESS MEASUREMENT: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimators, interferometer and their uses.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to study the different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness. http://www.nptel.iitm.ac.in/and for notes, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv113-Page1.htm

UNIT III

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surfacewaviness- Numerical assessment of surface finish – CLA, R.M.S Values – R_a , R_z values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

GEAR MEASUREMENT: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand, Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools.

UNIT IV

MEASUREMENT OF DISPLACEMENT: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

MEASUREMENT OF SPEED: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer .

STRESS & STRAIN MEASUREMENTS: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

MEASUREMENT OF ACCELERATION AND VIBRATION: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand working of various instruments used for measuring for displacement, temperature and pressure.

UNIT V

MEASURMENT OF TEMPERATURE: Standards and calibration, thermal expansion methods, thermo electric sensors(thermocouples), Electrical Resistance sensors, Junction semiconductor sensors, Digital thermometers, Radiation methods.

MEASUREMENT OF PRESSURE AND SOUND: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.

MEASUREMENT OF FORCE, TORQUE,POWER: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power measurement(dynamometers), Vibrating wire force transducers.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand working of various instruments used for measuring for flow, speed,stress,strain and Vibration.

Text Books:

(1) *Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE*
(2) *Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.*
(3) *Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.*

Reference Books:

(1) *Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.*
(2) *BIS standards on Limits & Fits*
(3) *Fundamentals of Dimensional Metrology,Connie Dn ,CENGAGE LEARNERS*
(4) *Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc GrawHill, 2013.*
(5) *Instrumentation, measurement &analysis ,B.C.Nakra&KKChoudhary, TMH, 6th edition, 2011.*

Web References:

http://emtool box.nist.gov
CambridgeViscosity.com/Viscometer
www.e.FlukeCal.com/Calibration
www.inscotemperature.com/
www.solartronmetrology.com/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03704 REFRIGERATION AND AIR CONDITIONING
(CBCC- II)

Course Objective:
This subject provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry. It gives details on how different components work and influence each other. Students will learn how real systems used in commercial , industrial refrigeration and air conditioning industries are built-up.
The objective this subject is to make the student to have complete knowledge on various refrigeration methods like VCR, VAR and latest developments, knowledge on various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

UNIT I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems -Numerical Problems – Refrigeration Needs of Air Crafts.

Learning Outcome & Suggested Student Activities:
At the end of the chapter, student can able to understand the terminologies associated with refrigeration and also understand the basic principles of Refrigeration and applications. Student can also know the aspects of various natural refrigeration methods; understand the components of Air refrigeration system and the necessity of air craft refrigeration.
The following URLs are very useful to the students
http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20%20 Lecture%201.pdf
http://www.ignou.ac.in/upload/Unit%201-32.pdf ,
http:/nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20 Cond/pdf/RAC%20 Lecture%209.pdf

UNIT II

Vapour Compression Refrigeration (VCR) System – Basic Cycle - Working Principle and Essential Components of The Plant – COP – Representation of Cycle On T-S and P-h Charts – Expander Vs. Throttling, Effect of Sub Cooling and Super Heating – Cycle

Analysis – Actual Cycle- Influence of Various Parameters on System Performance – Construction and Use of P-h Charts – Numerical Problems.

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the components in the domestic refrigerator, analyzing the concepts of sub-cooling and super heating to improve the COP and also necessity of replacements for CFCs and HCFCs with new refrigerants.Following URLs are highly useful to the students

http://www.nptel.iitm.ac.in/courses/IITMADRAS/Applied_Thermodynamics/Module_6/6_Simple_Vapor_Compression_RS.pdf

http://www.mcquay.com/mcquaybiz/literature/lit_ch_wc/AppGuide/AG31-007.pdf

UNIT III

Vapor Absorption Refrigeration (VAR) System – Description and Working of NH_3 – Water System and Li Br –Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required, Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

Learning Outcome & Suggested Student Activities:

After the completion of the chapter, student can know the purpose and function of each of the basic components of the absorption refrigeration system. Student can have knowledge on latest developments of Electrolux, thermo electric vortex tube methods. Following URLs are highly useful to the students

http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/RAC%20Lecture%2014.pdf

http://en.wikipedia.org/wiki/Thermoelectric_cooling

UNIT IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts.

Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

Learning Outcome & Suggested Student Activities:

After the end of the chapter, student can have knowledge on the use of psychrometric terms in Air conditioning. Student can learn the use of psychrometric chart to know psychrometric properties of air. Student can able to understand the terms sensible heat load and latent heat load. This technical information is fundamental to all types of

domestic, commercial and industrial systems for the calculations of heat loads.
Student is advised to conduct experiment on A.C tutor in the laboratory. Following URLs are highly useful to the students
http://server.fst.uga.edu/kerr/FDST%204060/pdf%20files/7%20Psychrometrics.pdf
http://people.eng.unimelb.edu.au/mjbrear/436-432/chapter%208%20-%20psychrometry.pdf
http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2031.pdf

UNIT V

Air Conditioning Equipment - Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart.Heat Pump – Heat Sources – Different Heat Pump Circuits.

Learning Outcome & Suggested Student Activities:
After the completion of the chapter, student can understand the components of A/C system and describe the cooling equipment combinations. Student can describe the concept of human comfort chart and the processes by which the body produces and rejects heat. Student can be familiar with the Heat pump circuit analysis. Following URLs are highly useful to the students
Effective temp- http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2029.pdf
http://courses.washington.edu/me333afe/Comfort_Health.pdf
http://web.me.unr.edu/me372/Spring2001/Heat%20Pumps.pdf

Text Books:

1. *Refrigeration and Air Conditioning ,CP Arora,TMH, 15th edition, 2013.*
2. *A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai*

Reference Books:

1. *Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013*
2. *Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.*
3. *Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.*
4. *Basic Refrigeration and Air-Conditioning – P.N.Ananthanarayanan / TMH, 4th edition, 2013.*

NOTE: Tables/Codes: Thermal Engineering Data Book containingRéfrigérant and Psychrometric property Tables and charts are permitted in Exam

Suggestions:

The entire syllabus is covered in the text book –" A Course in Refrigeration and Air conditioning " by Domkundwar, Arora, Dhanpatrai Publications (Highly useful book for GATE exam and other Government /Private sector competitive examinations)

Students can visit the nearby small scale Industries like Ice Plants to understand the principles of production of Ice and to observe the other simple components for practical understanding. Student is also advised to visit domestic refrigerator manufacturing industries/ Centralized and Split A/C system units.

Students are advised to watch the video lectures in the website - http://nptel.iitm.ac.in

The fundamental concepts of Thermodynamics, Psychrometrics etc., are required for better understanding of this subject.

Web Resources:

http://www.refrigerationbasics.com/index.htm http://www.howstuffworks.com/ac.htm
http://www.ashrae.org
http://www.taftan.com/thermodynamics/AIRCOND.HTM
http://www.wisegeek.com/how-does-air-conditioning-work.htm

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03705 TOOL DESIGN
(CBCC- II)

Course Objective:
To make the students to understand the design of single point cutting tool.
To learn about the design of drilling tool, tool wear Machinability index and tool life.
To make the students to understand jigs and fixtures, design principle of jigs and fixtures, locating and clamping principles.
To learn about the sheet metal operations, Design forming ,drawings ,Bending and drawing dies, forming dies.
To make the students to understand plastics commonly used as tooling material.

UNIT I

Tool materials: Ferrous, non ferrous, materials, heat treatment, plastics Classification of moulds used in processing of plastics, Design of injection, blow, and compression moulds.

Learning outcome &Suggested Student Activities:
After completion of this unit, students are able to understand the fundamentals of plastics as tooling materials, processing of plastics for tooling materials, heat treatment of materials, ferrous, nonferrous, non metallic, tooling materials.

UNIT II

Design of single point cutting tools: Single point, cutting tools-various systems of specifications, geometry and their interrelation, theories of formation of chip and their effect.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand single point cutting tool geometry and its design theory of chip formation.

UNIT III

Design of multipoint cutting tools: Drill geometry, Design of Drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speeds and feed-machining times-design-form cutters, combination tools, reamers etc.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the drilling tool geometry and its design. Tool life, machinability and tool wear.

UNIT IV

Design of jigs and fixtures: Basic principles of location and clamping, locating, methods and devices, jigs, definitions, types, general consideration in the design of jigs, drills bushing, methods of construction, fixtures-vice fixtures milling, boring, and lathe grinding fixtures.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the design of Jigs and fixtures and advantages and disadvantages of Jigs and fixtures, types of Jigs & Fixtures – Principles of location and clamping. Some examples of jigs and fixtures.

UNIT V

Design of sheet metal blanking and piercing: Fundamentals of die cutting operating, power press- types, General press information, Material handling equipment, cutting action in punch and die operation. Die clearance, and types of Die construction. Die design fundamentals-blanking and piercing die construction, pilots, striper and pressure pads presswork material, strip layout.

Design of sheet metal bending, forming and drawings die: Bending dies, drawing dies, forming dies, drawing operations, variables that effect metal flow during drawing. Determination of blank size, drawing force, single and double action draw dies.

Learning outcome &Suggested Student Activities:

After completion of this unit students are able to understand the press working operations like punching, blanking, bending, drawing and forming, types of power presses, design of die, strip layout

Text Books:

1. Tool Design, Donaldson, Lecain and Goold, Tata McGraw Hill, 4th edition, 2012.
2. Principles of Metal cutting, A Bhattacharya, New Central Book Agency, Calcutta
3. ASTME Hand book on Tool Design.

Reference Books:

1. *Production Engineering Design (Tool Design) , SurendraKenav and Umesh 'Chandra,*
   Satyaprakashan, New Delhi 1994..
2. *Design of cutting Tools. Use of Metal Cutting Theory. ASTME publication Michigan USA, 1969.Amitabha Battacharya*

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15A03706 MODERN MANUFACTURING METHODS
(CBCC- II)

UNIT I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping
methods - their relevance for precision and lean manufacturing.
Classification of non-traditional processes - their selection for processing of different materials and the range of applications.
Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters,
applications and limitations.
Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal,
descriptive of equipment, process variables, applications and limitations.

UNIT III

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.
Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy -
Applications of different processes and their limitations.
Plasma Machining: Principle of material removal, description of process and equipment, process
variables, scope of applications and the process limitations.

UNIT V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations. Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Text Books:

1. Advanced machining processes, VK Jain, Allied publishers.
2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid,
5edn, Pearson Pub.

Reference Books:

1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984
2. Manufacturing Technology, Kalpakzian,Pearson
3. Modern Machining Process , Pandey P.C. and Shah H.S., TMH.

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15A03707 COMPUTATIONAL FLUID DYNAMICS
(CBCC- III)

Course Objective:
This course covers topics related to Computational Fluid Dynamics (CFD). CFD is an important tool in engineering analysis and design of fluid systems. In this course Students will develop the equations describing fluid flow and numerical solutions to these equations. Emphasis will be placed on understanding different approaches employed for both time and spatial discretization and how to evaluate these approaches. Students will look at time accurate and steady-state methods, explicit and implicit techniques, laminar and turbulent flow, compressible and incompressible approaches, stability considerations, etc. These techniques will be applied to applications of mixing and heat transfer.

UNIT I

INTRODUCTION: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

Learning outcome &Suggested Student Activities:
This chapter gives the overall view of the various kinds of numerical methods adopted. It also discusses about various solutions for the numerical methods adopted in CFD. The applications of finite difference methods with examples in conduction and convective heat transfer are introduced.

UNIT II

FINITE DIFFERENCES: Discretization, consistency, stability, and fundamentals of fluid flow modeling. Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

Learning outcome &Suggested Student Activities:
This chapter gives how to descretize partial differential equations, including the governing flow equations which is the foundation for the finite difference method. Explicit and implicit approaches represent the fundamental distinction between various numerical techniques.

UNIT III

ERRORS AND STABILITY ANALYSIS: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, Conservation of mass Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

Learning outcome &Suggested Student Activities:

This chapter focuses on numerical errors that are generated and how the numerical calculations become unstable and also entails the conservations of mass, momentum and energy equations to the fluid flow along with Navier stokes equation.

UNIT IV

STEADY FLOW: Dimensions form of momentum and energy equations, navier stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

Learning outcome &Suggested Student Activities:

This unit gives the fundamental principles of fluid mechanics, its governing differential equations and boundary conditions.

UNIT V

SIMPLE CFD TECHNIQUES: Viscous flows conservation form space marching, relovation techniques, viscous flows, conservation from space marching relovation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high reynolds number models and their applications.

Learning outcome & Suggested Student Activities:

This unit gives the information about some techniques for numerical solutions for flow problems. These equations are applicable to time and space marching solutions especially parabolic hyperbolic and elliptic equations.

Text Books:

1. *Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge University Press, India.*
2. *Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.*

Reference Books:

1. *Computational Fluid Mechanics and Heat Transfer, Ronnie Anderson, 3rd edition, CRC Press, Special Indian Edition.*
2. *Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot (2010),3rd edition, Springer, Germany.*
3. *Essential computational fluid Dynamics – olegzikanov, wiley India.*
4. *Introduction to computational fluid dynamics – pradip, Niyogi S.K. Chakrabary, M.K. Laha – pearson.*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03708 AUTOMATION AND ROBOTICS
(CBCC- III)

Course Objective:
The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types.
To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

UNIT I

Introduction to Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation.

Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation. Student is advised to visit URLs http://www.nptel.iitm.ac.in/and iitb.ac.in , http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm for video lectures.

UNIT II

Automated flow lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage.

Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Learning outcome & Suggested Student Activities:
After completion of this unit students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines. Student is advised to visit URLs
http://www.nptel.iitm.ac.in/and iitb.ac.in,
http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm for video lectures.

UNIT III

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning outcome & Suggested Student Activities:

Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure. Student is advised to visit URLs

http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

UNIT IV

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot. Student is advised to visit URLs http://www.nptel.iitm.ac.in , http://www .iitb.ac.in , http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

UNIT V

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Learning outcome & Suggested Student Activities:

After completion of this unit students are able to understand robot programming languages which may adopt in different applications of robot. Student also knows the control motion mechanism in all devices of robot and application of robots in manufacturing sector. Student is advised to visit URLs http://www.nptel.iitm.ac.in/and iitb.ac.in, http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm

Text Books:

1. *Automation , Production systems and CIM,M.P. Groover/Pearson Edu.*
2. *Industrial Robotics - M.P. Groover, TMH.*

Reference Books:

1. *Robotics , Fu K S, McGraw Hill, 4th edition, 2010.*
2. *An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.*
3. *Robotic Engineering , Richard D. Klafter, Prentice Hall*
4. *Robotics, Fundamental Concepts and analysis – AshitaveGhosal,Oxford Press, 1/e, 2006*
5. *Robotics and Control , Mittal R K &Nagrath I J , TMH.*
6. *Introduction to Robotics – John J. Craig,PearsonEdu*

Web References:

http://www.cadcamfunda.com/cam_computer_aided_manufacturing
http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf
http://nptel.iitm.ac.in/courses.php?branch=Mechanical
http://academicearth.org/courses/introduction-to-roboticsVideo references:-http://nptel.iitm.ac.in/video.php?courseId=1052

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03709 PRODUCTION AND OPERATIONS MANAGEMENT
(CBCC- III)

Course Objective:
To make the students understand the functions of production planning & controls, generating of new products, issues in product design and strategies of aggregate planning. To provide the knowledge on principles of forecasting, forecasting methods, types and its accuracy. To provide the knowledge on facilities location, various types layouts and assembly line balancing. To provide the knowledge on lean management, concepts of JIT, six sigma, quality control, MRP,ERP and LOB.
To make the students understand the inventory management and scheduling techniques.

UNIT I

Functions of Production Planning & Controls operations & productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design.
Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

Learning Outcome & Suggested Student Activities:
At the end of this unit students can get the concepts on Production planning & controls operations and its functions, productivity and productivity measurements, design of goods and services and aggregate planning. Students are advised to visit following URLs http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Management_Science_II/Pdf/3_5.pdf. And also well documented note is available in pdf form at the following links.
www.processprotocol.com/extranet/doucuments/pdf/.../production1.pdf
elearning.dbhosting.net/.../Production%20Planning%20And%20Control
http://www.academicearth.org/lectures/product-development-process-observation

UNIT II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods – accuracy of forecasting methods. Scheduling Policies – Techniques, flow shop and job shop Scheduling techniques.

Learning Outcome & Suggested Student Activities:
Students can understand the importance of forecasting, uses of long term and short term forecasting and application of qualitative and quantitative methods for finding the future demands. Students are advised to refer the text book Forecasting: Methods and Applications Spyros G. Makridakis, Steven C. Wheelwright , Rob J Hyndman. For video lectures advised to visit following URLs http://www.learnerstv.com/video/Free-video-Lecture-2496-Management.htm; http://www.slideshare.net/jrdn_27/qualitative-and-quantitative-methods-of-research

UNIT III

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, CORELAP.

Learning Outcome & Suggested Student Activities:
At the end of the unit the student will be able to understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. Can compare the rural & urban sites, methods of selection. The following URLs are useful to the students
http://www.slideshare.net/satya4/plant-layout-16143741
http://freevideolectures.com/Course/2371/Project-and-Production-Management/32
http://www.tcyonline.com/video-tutorials-computerised-layout-planning/101568

UNIT IV

Lean Management, philosophy and creation of lean enterprise, JIT concepts-Kanban System-Elements of total quality management, Six Sigma Quality Control.
MRP, –lot sizing techniques in MRP, introduction to ERP, LOB (Line of Balance).

Learning Outcome & Suggested Student Activities:
Students can understand the how philosophy of lean management applied to develop lean enterprise and basic concepts JIT, Six sigma control etc., Students are advised to visit the following URLs .http://www.learnerstv.com/video/Free-video-Lecture-6944-Management.htm; http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-852j-integrating-the-lean-enterprise-fall-2005/lecture-notes/
http://freevideolectures.com/Course/2688/Human-Resource-Management/13

UNIT V

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – various models Simple Problems.

Learning Outcome & Suggested Student Activities:

At the end of the unit the student will be able to understand the scheduling policies, flow shop and job shop scheduling techniques and concepts of Inventory, Classification, Functions, it's associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up. The following URLs are useful to the students.

http://www.technologyevaluation.com/search/for/inventory-management-pdf.html
http://freevideolectures.com/Course/3096/Operations-and-Supply-Chain-Management/10

Text Books:

1. *Production and Operations Management, Ajay K Garg, McGrawHill, 2015*
2. *Operation Management by B. Mahadevan,PearsonEdu.*
3. *Operation and O.M by Adam & Ebert- PHI Pub.,*

Reference Books:

1. *Operations Management – S.N. Chary.*
2. *Modern Production , Operations Management , Baffa&Rakesh Sarin.*
3. *Production Control A Quantitative Approach , John E. Biegel.*
4. *Production Control , Moore.*
5. *Operations Management , Joseph Monks.*
6. *Operation Management by Jay Heizar& Read new Pearson*
7. *Elements of Production Planning and Control, Samuel Eilon.*

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech IV-I Sem. (ME)

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15A03710 CAD/CAM LABORATORY

LIST OF EXPERIMENTS:

I. 2D Drafting using Auto CAD or any drafting package

II. 3D Modeling :

1. Modeling of Component in 3D – V block
2. Modeling of Component in 3D – Open Bearing
3. Modeling of Component in 3D – Angular block
4. Modeling of Component in 3D – Dovetail Guide
5. Modeling of Component in 3D – Dovetail Bracket
6. Modeling of Component in 3D – Tool post

Geometric Modeling may be done Using Auto CAD or Pro-E or CATIA or Solid Works or Iron CAD

III. Assembly Modeling:

1. Assembly of a screw jack parts
2. Assembly of a knuckle joint
3. Assembly of a Oldham's coupling
4. Assembly of a footstep bearing
5. Assembly of a stuffing box
6. Assembly of a square tool post

IV. Machining of Simple Components on CNC Lathe and CNC Milling Machine.

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15A03711 METROLOGY & MEASUREMENTS LABORATORY

Any 6 experiments from each section

Section A:

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/ Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

Section B:

1. Calibration of Pressure Gauges
2. Calibration of transducer or thermocouple for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Study and calibration of capacitive transducer for angular measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotometer for flow measurement.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
8. Study and calibration of Mcleod gauge for low pressure.

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15A03801 INDUSTRIAL ENGINEERING
(MOOCS-II)

UNIT I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg's Two factor Theory of Motivation, Maslow's Hierarchy of Human needs – Systems Approach to Management.Organizational Structures-Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

UNIT II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Selection of Plant Location – Types of Production; Plant Layout: Definition, Objectives, Types of Plant Layout - Materials Handling: Functions-Objectives – Types, Selection Criteria of Material Handling Equipment.

UNIT III

Work Study – Definition, Objectives, Method Study – Steps Involved – Various Types of Process Charts –Micro motion and Memo motion Studies. Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations - Applications.

UNIT IV

Inventory Models- Deterministic models- EOQ Models – With and Without Shortages Models; Inventory Models with Price Breaks -Probabilistic Models –Discrete Variable, Continuous Variable. Inventory Control Systems

UNIT V

Inspection & Quality Control: Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance .

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.
3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

Reference Books:

1. *Industrial Engineering and production management, MartindTelsang S.Chand..*
2. *Work Study by ILO(International Labour Organization)*
3. *Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005*
4. *Production and Operations management, PanneerSelvam, PHI,2004.*
5. *Statistical Quality Control by EL Grantt, McGrawhil*
6. *Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004*

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15A03802 PRODUCT DESIGN
(MOOCS-II)

Course Objective:
To make the students understand the product development process, requirements setting, conception design,, embodiment design principles, to understand the basics of mechatronics and adaptronics.

UNIT I
PRODUCT DEVELOPMENT PROCESS
General problem solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behavior.

UNIT II
TASK CLARIFICATION
Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and Extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

UNIT III
CONCEPTUAL DESIGN
Steps in Conceptual Design.
Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, Establishing functions structures, Overall function, Breaking a function down into sub-functions.
Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures.
Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures.
Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

UNIT IV

EMBODIMENT DESIGN - Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design

Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards.
Evaluation of Embodiment Designs.

UNIT V

MECHANICAL CONNECTIONS, MECHATRONICS AND ADAPTRONICS
Mechanical Connections - General functions and General Behavior, Material connections, From Connections, Force connections, Applications.
Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples.
Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Text Books:

1. Engineering Design: G.Paul; W. Beitzetal, Springer International Education 2010.
2. Product Design And Developement: Kevin Otto: K. Wood Pearson Education 2016.

Reference Books:

1. Product Planning Essentials: Kenith B. Kahu, Yes dee Publishing 2011.
2. Product Design and Development: K.T. Ulrich TMH Publishers 2011.

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15A03803 COMPOSITE MATERIALS
(MOOCS-II)

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: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide. fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

Unit-II

Manufacturing methods: Autoclave curing, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM. Compression moulding, tape winding.

Macromechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit-III

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-IV

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT-V

Failure Analysis and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate.

Text Books:

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

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman Wiley- Interscience, New York, 1980.
2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering)- Autar K. Kaw, Publisher: CRC
3. Finite Element Analysis of Composite Materials, Ever J. Barbero , CRC Press, 2007.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, University Press, 2009.
6. Composite Materials Science and Engineering, Krishan K. Chawla, Springer, 2009

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15A03804 POWER PLANT ENGINEERING
(MOOCS-III)

UNIT I

Introduction To The Sources Of Energy – Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection,

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment – Pollutants and Pollution Standards – Methods of Pollution Control. Inspection And Safety Regulations.

UNIT II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal – Overfeed and Under Feed Fuel Beds, Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

UNIT III

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow Measurement – Drainage Area Characteristics – Hydrographs – Storage and Pondage – Classification of Dams and Spill Ways.

Hydro Projects and Plant: Classification – Typical Layouts – Plant Auxiliaries – Plant Operation Pumped Storage Plants. .

UNIT V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle Of its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel – Nuclear Fission, Chain Reaction, Breeding and Fertile Materials – Nuclear Reactor –Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast

breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding –

Radioactive Waste Disposal.

Text Books:

1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.
2. A course in power plant Engineering, Arora and S. Domkundwar.

Reference Books:

1. A Text Book of Power Plant Engineering , Rajput , Laxmi Publications, 4th edition, 2012.
2. Power plant Engineering, Ramalingam, Scietech Publishers
3. power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.

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15A03805 GAS TURBINES AND JET PROPULSION
(MOOCS- III)

UNIT-I

Gas Turbine Operating Cycles: Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or maximum cycle thermal efficiency, means of improving the efficiency and the specific out put of simple cycle.

UNIT-II

Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, inter-cooling & reheating, turbojet engine, turbofan engine, turboprop engine.

UNIT-III

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency- need for thermal jet engines and applications.

Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

UNIT-IV

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serqujet and pulse jet, elementary treatment.

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

UNIT-V

Rocket Technology: Flight mechanics, application thrust profiles, acceleration-staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling.

Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

TEXT BOOKS:

1. Gas Turbines , V. Ganesan TMGH
2. Gas turbines , cohen , Rogers & Sarvana Muttoo , Addision Wiley & longman

REFERENCES BOOK:

1. Thermodynamics of propulsion, Hill & Paterson.
2. Rocket Propulsion , Sutton.
3. Element of Gas Turbines propulsion , Jack D Matingly, MGH

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15A03806 ENERGY MANAGEMENT
(MOOCS-III)

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation-Morality curves. Break even analysis and break even chart- Minimum cost analysis-Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

ENERGY MANAGEMENT PROGRAMS:

Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV

ENERGY AUDITING:

A definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

TEXT BOOKS:

1. Energy Management, Murphy W.R and Mckay G, , Elsevier, 2007
2. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.

REFERENCES BOOKS:

1. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.
2. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
3. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
4. The role of Energy Manager, E.E.O., U.K.
5. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
6. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.